Moving Toward 2050

Charlottesville/Albemarle MPO
Long-Range Transportation Plan

DRAFT April 18, 2024

Preface

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List of Acronyms

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ACS	American Community Survey
ADA	Americans with Disabilities Act
BMP	Best Management Practice
BRT	Bus Rapid Transit
CAT	Charlottesville Area Transit
CLRP	Constrained Long-Range Plan
CMAQ	Congestion Mitigation and Air Quality
CSR	Center for Survey Research
CTAC	Citizens Transportation Advisory Committee
CTF	Commonwealth Transportation Fund
DDI	Diverging Diamond Interchange
DEQ	Department of Environmental Quality, Virginia
DMV	Department of Motor Vehicles
E+C	Existing and Committed
EJ	Environmental Justice
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FY	Fiscal Year (refers to the state fiscal year July 1 - June 30)
GA	General Aviation
GSI	Grade Separated Interchange
HSIP	Highway Safety Improvement Program
HUD	Housing and Urban Development, U.S. Department of
ISTEA	Intermodal Surface Transportation Efficiency Act

LAB	League of American Bicyclists
LOS	Level of Service
LRTP	Long-Range Transportation Plan, also referred to as Moving Toward 2050
LRT	Light Rail Transit
MAP-21	Moving Ahead for Progress in the 21st Century
MOVES	Motor Vehicle Emission Simulator
MPO	Metropolitan Planning Organization
NGIC	National Ground Intelligence Center
NHPP	National Highway Performance Program
NHS	National Highway System
OTAQ	Office of Transportation and Air Quality
PDC	Planning District Commission
PE	Preliminary Engineering
REF	Regional Ecological Framework
RTA	Regional Transit Authority
SAFETEA-LU	Safe, Accountable, Flexible, Efficient, Transportation Equity Act
SHRP2	Second Strategic Highway Research Program
SHSP	State Strategic Highway Safety Plan
SPR	State Planning and Research Funding (used by VDOT to support MPO)
STP	Surface Transportation Program
SYIP	Six-Year Improvement Program
TA	Transportation Alternatives
TCAPP	Transportation for Communities - Advancing Projects through Partnerships
TDM	Travel Demand Management
TDP	Transit Development Plan (for CAT and Jaunt)
TEA-21	Transportation Efficiency Act for the 21st Century

TIP	Transportation Improvement Program
TJPDC	Thomas Jefferson Planning District Commission
TMPD	VDOT Transportation and Mobility Planning Division
TRB	Transportation Research Board
UPWP	Unified Planning and Work Program (also referred to as Work Program)
UnJAM	United Jefferson Area Mobility Plan
UTS	University Transit Service
UVA	University of Virginia
SOV	Single Occupant Vehicle
V-C	Volume-to-Capacity Ratio
VCTIR	Virginia Center for Transportation Innovation and Research
VDOT	Virginia Department of Transportation
VDRPT	Virginia Department of Rail and Public Transportation
VMT	Vehicle Miles Traveled

Executive Summary

The Charlottesville-Albemarle Metropolitan Planning Organization (CA-MPO) is a regional planning commission house within central Virginia's Thomas Jefferson Planning District Commission (TJPDC). Composed of the City of Charlottesville and a portion of Albemarle County, the CA-MPO is the forum for continuing, cooperative, and comprehensive transportation planning and decision-making among Charlottesville, Albemarle, state, and federal officials. The MPO collaborates with various agencies, facilitates public input, and conducts research and analysis to develop forward-thinking solutions for the region's transportation system.

One of the recurrent responsibilities of the CA-MPO is the creation of a Long-Range Transportation Plan (LRTP). This federally-mandated plan outlines the region's priority transportation improvements over the coming decades. The Long-Range Transportation Plan is a fundamental document for our community. It states our region's collective vision for the future of our transportation system, and it identifies projects that we anticipate our region will implement in the foreseeable future. The LRTP considers all modes of transportation, including private vehicles, public transit, bicycles, pedestrians, and air, and covers other transportation issues such as bridge maintenance and safety improvements. The Charlottesville-Albemarle MPO's LRTP must be updated every five years per federal mandate. The preceding version, approved by the MPO Policy Board in May 2019, was named the 2045 Long-Range Transportation Plan (2045 LRTP). The updated plan presented in this document has been named ***Moving Toward 2050***.

With the development of Moving Toward 2050, the Charlottesville-Albemarle MPO continues and enhances a process for identifying and evaluating transportation projects that began with the 2045 LRTP. Public input was essential in all process aspects, especially in identifying transportation deficiencies and potential projects. The evaluation process leverages the interconnectedness of our transportation system. Rather than assessing the benefits of individual projects in an isolated manner, proposed projects were combined into scenarios, tested as a system, and compared with other project groupings through a method of performance measure analysis. A set of performance measures, created using federal resources, public comment, and committee input, produced quantitative values for project scenarios. With these tools, the MPO could determine how various transportation improvements accomplished the region's vision, goals, and objectives and select the most optimal project combination for achieving them.

Moving Toward 2050 describes the region's characteristics, transportation deficiencies, vision, goals, and objectives, as well as the analysis method's findings and conclusions. It is designed to improve the safety, efficiency, and interconnectedness of our facilities and services and strives to plan for and develop a continuing, cooperative, and comprehensive regional transportation system.

Chapter 1: Introduction

Overview

Moving Toward 2050 is the federally-mandated Long-Range Transportation Plan (LRTP) for the Charlottesville-Albemarle Metropolitan Planning Organization (CA-MPO). It updates the 2045 Long-Range Transportation Plan approved by the CA-MPO Policy Board in May 2019. The plan considers projected growth rates throughout the study area through the year 2050 and uses existing and future projected system conditions to identify priority projects for the region.

This chapter describes the federal requirements fulfilled by the LRTP and the regional goals identified as part of the LRTP.

Purpose

Moving Toward 2050 is an essential document for improving the regional transportation system. The development of this plan is an opportunity for the region to determine its priorities for identifying the most critical transportation projects. While the plan provides a valuable framework to inform future planning initiatives based on the identified regional priorities, its ultimate purpose is to support the implementation of critical transportation improvements.

Moving Toward 2050 facilitates the implementation of these transportation improvements in the following ways:

1. To be eligible for federal funding, **surface transportation projects must be identified in the MPO's adopted long-range transportation plan**. This funding is critical for implementing necessary transportation solutions in the region.
2. Funding for transportation system improvements is limited. Therefore, **the region must identify the highest priority projects** that could be implemented based on the public and private resources that can be reasonably expected over the plan's lifetime. These projects are included on a "constrained list," referring to the consideration of the fiscal constraints that will limit the number of projects that could be implemented. The development of this plan allows the region to define what is important when considering transportation infrastructure investments.
3. Funding for transportation projects is based on competitive, performance-based application processes. To successfully implement projects that will improve the transportation system for our region, we need to identify not just the projects that will meet the highest priority needs, but also the projects that have the best overall opportunity to meet critical system needs compared to their costs. **This plan facilitates a conversation about the best opportunities to leverage existing or potential funding sources to implement projects with the most value for the region**.
4. Transportation planning is an ongoing process. The process of **identifying transportation system projects** for consideration occurs in two steps. The first step is to identify where existing system needs are. The second step is determining the most appropriate solutions to address that need. Not every need identified in Moving Toward 2050 will have an

identified solution. Those needs will indicate where additional planning studies are necessary to develop solutions, establishing an ongoing pipeline for developing implementable projects.

Moving Toward 2050 Process

1. **Establish goals and objectives for the regional transportation system.**
   a. Goals were established by reviewing the goals in the 2045 Long-Range Plan, benchmarking against goals identified in other regions' plans, and getting feedback on draft goals and objectives through stakeholder discussion groups.
2. **Assess system performance using data and public feedback.**
   a. Public feedback was received through surveys, open houses, stakeholder meetings, and community outreach.
3. **Identify areas of high-priority system needs.**
   a. Staff identified the highest priority locations for system improvements based on safety, congestion, or lack of access.
4. **Develop a comprehensive list of previously identified projects.**
   a. These are the candidate projects considered when identifying the highest priority projects for implementation. Candidate projects that resolve high-priority system needs were evaluated and prioritized.
5. **Prioritize projects based on:**
   a. The MPO's project prioritization process
   b. Previous statewide/regional initiatives
   c. Locality-developed project prioritization processes
   d. Public and stakeholder feedback
6. **Identify gaps between high-priority needs and previously identified projects.**

Moving Toward 2050 Engagement Efforts

Throughout 2023, MPO staff undertook a robust public engagement campaign to collect stakeholder and public comments to help shape the Goals and Needs Identification phase of the Moving Toward 2050 planning effort. The objectives of this engagement process were to:

- Set and prioritize goals;
- Identify travel needs; and
- Inform the travel need and project selection prioritization process

During this phase of the engagement process, MPO staff reached nearly 600 individuals, attended sixteen community events, and reviewed over 2,300 comments. Efforts included:

- Stakeholder Meetings (February 2023)
- Virtual Public Meeting (June 2023)
- Open House Event (June 2023)
- MetroQuest Community Survey (June 2023)
- Public Intercepts (July - August 2023)
- Community Advisory Committee (CAC) Meetings (July - August 2023)

- Cville Plans Together Survey (past effort)
- Albemarle County 2044 Survey (past effort)
- Charlottesville Area Regional Transit Vision Plan Survey (past effort)

Overarching themes from this phase of the public engagement effort include a need for safer roadways and intersections, dedicated and protected bicycle and pedestrian infrastructure, and an enhanced public transit system. The community appears eager for solutions prioritizing safety and accessibility over traditional car-centric designs.

More detailed information about these efforts can be found in the MPO's October 2023 Public Engagement Report.

Moving Toward 2050 Goals

At the beginning of the planning process, MPO staff established goals and objectives to identify regional transportation system priorities. Regionally identified goals were informed by national goals but based on regionally developed values.

Establishing goals and objectives for Moving Toward 2050 began with a review of goals identified in the 2045 Long-Range Transportation Plan and a benchmarking exercise reviewing goals identified by other MPOs in Virginia. Related local and regional planning documents were further examined to identify emerging local priorities. The final language for the goals was developed through an iterative process involving staff, the MPO committees, and identified stakeholder groups of organizations representing many community perspectives.

Framework

MPO staff began the process of establishing the plan's framework by considering the regional transportation system's goals and objectives. Goals are intended to be broad value statements, demonstrating the community's desired characteristics for its regional transportation system. Objectives are then developed that are more specific, identifying measurable outcomes that support the achievement of those stated goals. The final step was to establish metrics for evaluating the transportation system.

Lenses

As goals were being discussed, themes emerged that were important enough to be integrated throughout the evaluation of individual goals and objectives. These themes have been identified in the system evaluation framework as lenses, indicating that the entire process needs to start with these considerations first and foremost:

- **Equity:** While the importance of addressing equity in the planning processes is not new, it is an area of emphasis that has continued to grow since the adoption of the previous LRTP. In January 2019, Albemarle County passed the Resolution in Support of an Equitable and Inclusive Community, reinforcing a public commitment to enhance all its citizens' well-being and quality of life. Similarly, the City of Charlottesville formed an Advisory Committee on Organizational Equity in 2019. Planning, infrastructure, and neighborhood outreach & engagement were identified as focus areas for the City's racial equity and diversity &

inclusion efforts. National priorities further bolster the identification of equity as an essential local priority. One of President Biden's early acts of his presidency was to sign Executive Order 14008, establishing the Justice40 Initiative. The initiative commits to direct 40 percent of new Federal program investments to disadvantaged communities. In late 2021, the Federal Transit Administration and Federal Highway Administration provided a notice of updated Planning Emphasis Areas identifying joint agency priorities emphasizing the vital role of MPOs in supporting these federal investment goals.

- **Quality of Life:** Ultimately, the transportation system's purpose is to facilitate the movement of people and goods for their benefit. It connects people to the people, places, and things they need, love, and care about. Therefore, any evaluation of the transportation system needs to focus on improving the quality of life for those who rely on it as a primary consideration.
- **Climate Action:** Climate action and environmental justice have become increasingly high priority for the Charlottesville-Albemarle region. Since the 2019 Long-Range Transportation Plan was completed, Albemarle County and the City of Charlottesville completed Climate Action Plans. Both plans independently identified a goal of reducing greenhouse gas (GHG) emissions by 45% from their identified base year by the year 2030 and achieving net zero emissions by 2050. Albemarle County used the base year of 2008 and determined that the transportation sector was responsible for 48% of the total GHG emissions within the county; the City of Charlottesville determined that the transportation sector was responsible for 39% of the GHG emissions in the city in 2019. As part of the MPO's commitment to environmental justice, staff referred to the EPA's most recent EJScreen community reports for Charlottesville and Albemarle County (included in Appendix C) when considering priority projects.

Goals

The plan's identified goals direct the process of evaluating the transportation system and developing infrastructure priorities. While the lenses indicate overarching community values that need to be considered, the goals address the transportation system directly. The goals define values necessary for the region to consider when determining how to improve the transportation system while incorporating and considering national goals, established performance targets, and state funding programs.

Objectives

The plan's objectives are specific and measurable, describing observable outcomes. They can determine whether the region is successfully achieving its established goals.

- **Goal 1: Safety -** Improve the safety of the transportation system for all users.
  - ***Objective 1:*** *Reduce the frequency of serious injury and fatal crashes.*
  - ***Objective 2:*** *Improve comfort and safety for users of the multimodal system.*

- **Goal 2: Multi-Modal Accessibility -** Improve access through greater availability of mode choices that are affordable and efficient.
  - ***Objective 1:*** *Increase mode choice for all users.*

- **Goal 3: Land Use -** Connect community destinations in a manner that aligns with growth management priorities.
  - ***Objective 1:*** *Provide multimodal infrastructure in designated growth areas, mixed-use areas, and near community resources*.
  - ***Objective 2:*** *Fill connectivity gaps in the multimodal network*.

- **Goal 4: Environment -** Reduce the negative environmental impacts of the transportation system.
  - ***Objective 1:*** *Minimize impacts of the transportation system on the natural and built environment*.
  - ***Objective 2:*** *Integrate sustainable infrastructure practices into project design*.

- **Goal 5: Efficiency and Economic Development -** Efficiently and reliably move people and goods through the multimodal transportation system.
  - ***Objective 1:*** *Improve roadway and transit system efficiency through operational improvements*.
  - ***Objective 2:*** *Increase system capacity at identified bottlenecks*.
  - ***Objective 3:*** *Maintain the existing system in a state of good repair*.

While objectives are grouped under the primary goal they are meant to support, many objectives support more than one goal. Figure 1 illustrates the complex interconnection between lenses, goals, and objectives. In developing this framework, MPO staff intentionally worked to minimize redundancy in objectives, meaning that specific desired outcomes will not be reflected directly in the goals and objectives language. For example, emissions reduction is not listed as a goal. Still, full consideration is given to other objectives contributing to decreased emissions, such as improving the multimodal network and system efficiency.

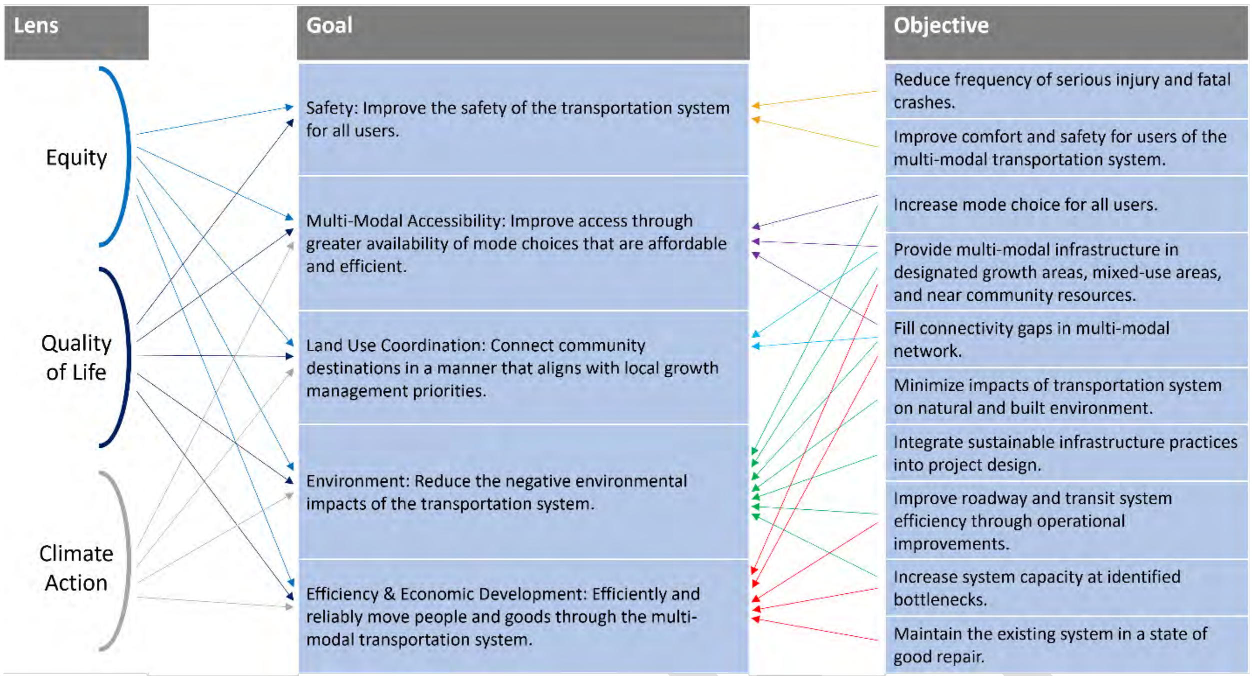


Figure 1: Relationship of Lenses, Goals, Objectives

Chapter 2: Transportation Assessment

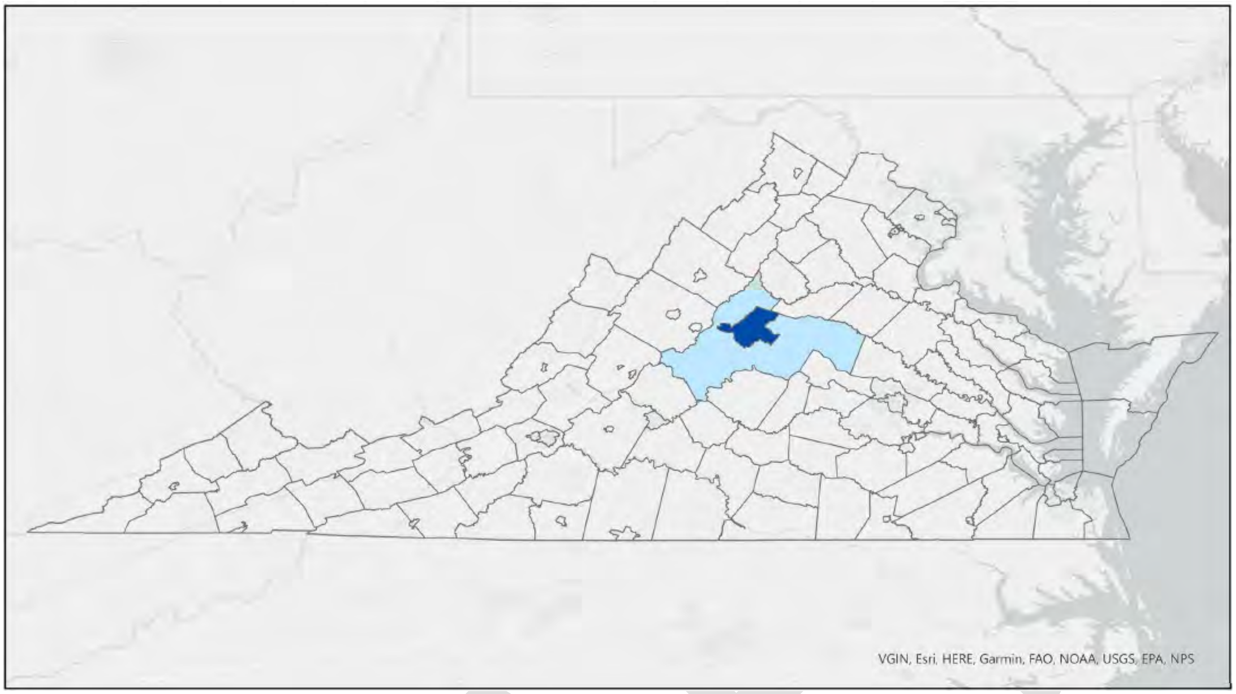
Overview

This section overviews the regional transportation network, focusing on roadways, bridges, freight, public transit, passenger rail, bicycle & pedestrian facilities, and travel demand management. The MPO's physical infrastructure and transportation programming influence how the existing transportation system is used and inform opportunities for future improvements.

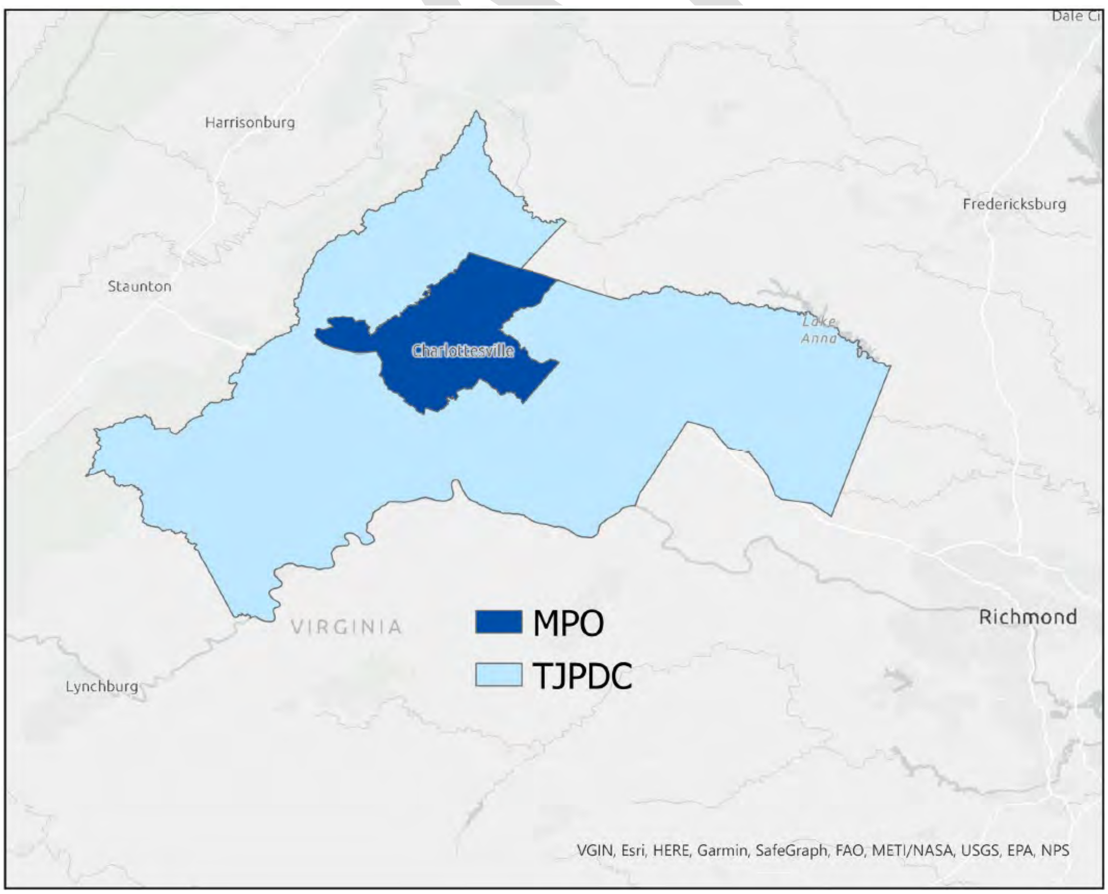
MPO Location

The MPO area (MPA) is in the scenic shadow of the Blue Ridge Mountains to the West. CA-MPO is in Central Virginia, with Richmond approximately 75 miles Southeast of Charlottesville and Washington D.C. approximately 100 miles to the Northeast. The University of Virginia calls this area home and serves as a primary employer in the region.

The maps below highlight the location of the TJPDC (light blue) and the CA-MPO (dark blue).



Map 1:TJPDC/MPO Location (state)



Map 2: TJPDC/MPO Location (region)

National Goals and Performance Measures

The Moving Ahead for Progress in the 21st Century Act (MAP-21) established a requirement for states and MPOs to participate in performance-based planning and programming processes. Performance-based planning and programming practices are intended to identify system performance goals and support transportation investment decisions based on meeting the established goals.

National Goals

Goal Area	National Goal
Safety	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
Infrastructure Condition	To maintain the highway infrastructure asset system in a state of good repair.
Congestion Reduction	To achieve a significant reduction in congestion on the National Highway System.
System Reliability	To improve the efficiency of the surface transportation system.
Freight Movement and Economic Vitality	To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
Environmental Sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment.
Reduce Project Delivery Delays	To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

Table 1: MAP-21 National Goals. Source: Federal Highway Administration

National Performance Measures

To measure progress in achieving these national goals, the following performance measures were established in 2017:

Highway Safety (crashes)

- Number and rate of fatalities (per 100 million Vehicle Miles Traveled)
- Number and rate of serious injuries (per 100 million Vehicle Miles Traveled)
- Number of non-motorized fatalities and serious injuries

Highway Infrastructure Condition

- Percent of pavement on the interstate system in good condition
- Percent of pavement on the interstate system in poor condition
- Percent of pavement on the non-interstate national highway system in good condition
- Percent of pavement on the non-interstate national highway system in poor condition
- Percent of national highway system bridges classified in good condition
- Percent of national highway system bridges classified in poor condition

Highway System Performance

- Percent of person miles traveled on the interstate system that is reliable
- Percent of person miles traveled on the non-interstate national highway system that are reliable (Vehicle Reliability Index)
- Percent of interstate system mileage providing for reliable truck travel times (Truck Travel Time Reliability Index)
- Annual hours of peak-hour excessive delay per capita (not applicable to the MPO)

Transit Asset Management

- Percent of revenue vehicles that have met or exceeded their useful life benchmark
- Percent of non-revenue vehicles that have met or exceeded their useful life benchmark
- Percentage of track segments with performance restrictions
- Percentage of facilities rated in poor condition

Public Transportation Agency Safety

- Fatalities, total
- Fatalities per total vehicle revenue miles
- Injuries, total
- Injuries per total vehicle revenue miles
- Safety events, total
- Safety events per total vehicle revenue miles
- Distance between major failures
- Distance between minor failures

Performance Targets

States, MPOs, and public transportation providers are required to establish performance targets for each performance measure to support the achievement of the national goals. States will set their performance targets, and then MPOs set performance targets to support the achievement of the state's targets. With the establishment of performance targets, states, MPOs, and transit providers are committing to pursuing projects and activities that support the achievement of those targets.

Once the state has adopted its targets, MPOs can either adopt the state's targets or establish their own targets. Overall progress towards achieving the performance targets is evaluated at the state level, not the MPO level. There are no penalties if an MPO does not achieve its performance targets. MPOs must identify and report these performance targets to the state agencies at specified intervals.

Highway Safety (Crashes)

Virginia uses a data-driven predictive model to establish statewide safety targets. This model is based on developing a baseline for the safety data using a statistical analysis and then determining the expected safety benefits from implementing planned infrastructure improvement projects.

Virginia's 2022-2026 Strategic Highway Safety Plan, *Arrive Alive*, aimed to reduce fatalities and serious injuries by 50 percent over the next 25 years, equating to a two percent yearly reduction. The modeled predictions did not indicate that this annual target reduction would be met when the Commonwealth Transportation Board adopted its safety targets in 2022, so they adopted predicted safety targets while committing to pursue an aspirational safety target that meets the two percent annual reduction goal. State agencies were directed to identify actionable strategies to improve safety performance to support these aspirational goals.

Figure 2 and Figure 3 were provided by VDOT to aid in developing highway safety performance targets and show regionally specific trends. As the graphs show, the general trendline points downward for the injury rate five-year average but upward for the fatality five-year average. However, both graphs indicate a recent increase in fatalities and serious injuries. If this trend continues, projections will likely demonstrate an increasing number of fatalities and serious injuries.

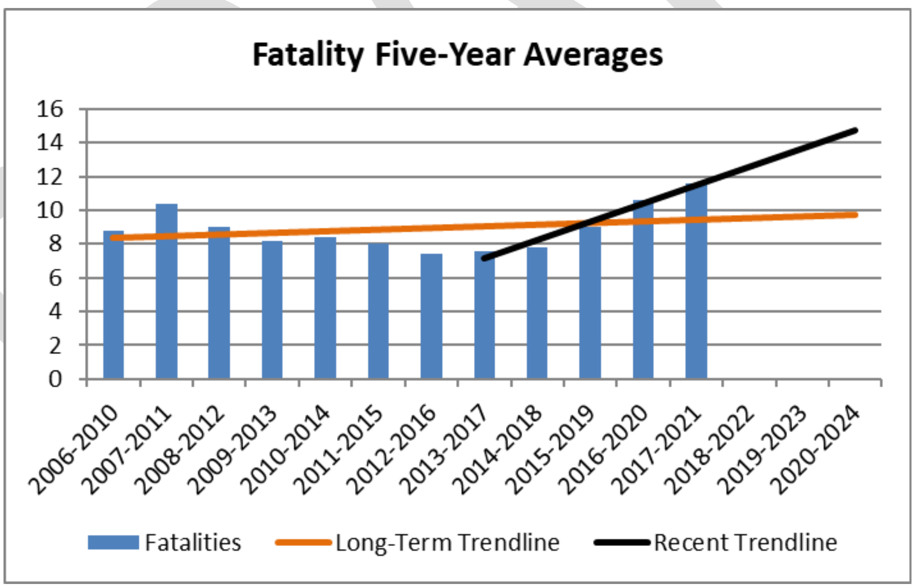


Figure 2: Fatality Five-Year Averages. Source: VDOT

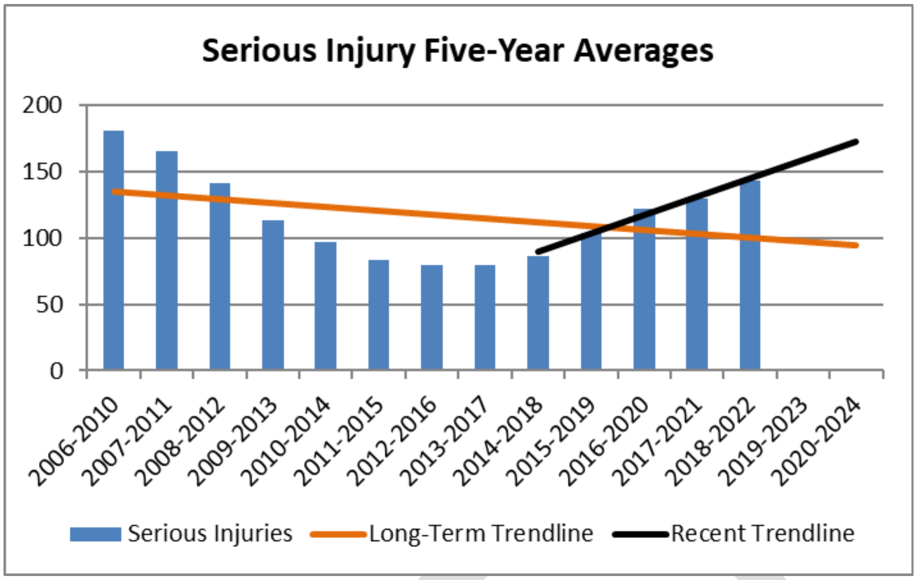


Figure 3: Serious Injury Five-Year Averages. Source: VDOT

The MPO's 2024 safety performance targets are based on goals established as part of the development of a multi-jurisdictional Comprehensive Safety Action Plan funded through a U.S. Department of Transportation Safe Streets and Roads for All Grant. Approval of more aspirational targets to reduce the number of fatalities and serious injuries by an average annual percentage change of 2% is consistent with the goals established in the statewide Strategic Highway Safety Plan. It supports reaching a 50% reduction in deaths and serious injuries by 2050.

CA-MPO 2024 Safety Performance Targets:

- Five-year average annual percentage change in fatalities: 2% reduction or more
- Number of fatalities: 11 or fewer
- Fatality rate per 100 million Vehicle Miles Traveled (VMT): 0.962 or lower
- Five-year average annual percentage change in serious injuries: 2% reduction or more
- Number of serious injuries: 137 or fewer
- Serious injury rate per 100 million Vehicle Miles Traveled (VMT): 12.106 or lower
- Five-year average annual percentage change in non-motorized fatalities and serious injuries: 2.00% reduction or more
- Number of non-motorized fatalities and serious injuries: 15 or fewer

Adopting these more aggressive safety goals reflects a commitment from the CA-MPO region to pursue projects and initiatives that will improve the safety of the regional transportation system.

Highway Infrastructure Condition

VDOT operates and maintains nearly 58,000 miles of road network throughout the state, the country's third highest state-maintained roadway systems. Highway infrastructure condition performance targets are based on pavement conditions on Interstate and National Highway System (NHS) facilities. In contrast, bridge conditions are based on bridges in the National Bridge

Inventory (NBI) on the NHS, which are predominately part of a state-maintained system, as shown in Figure 4.

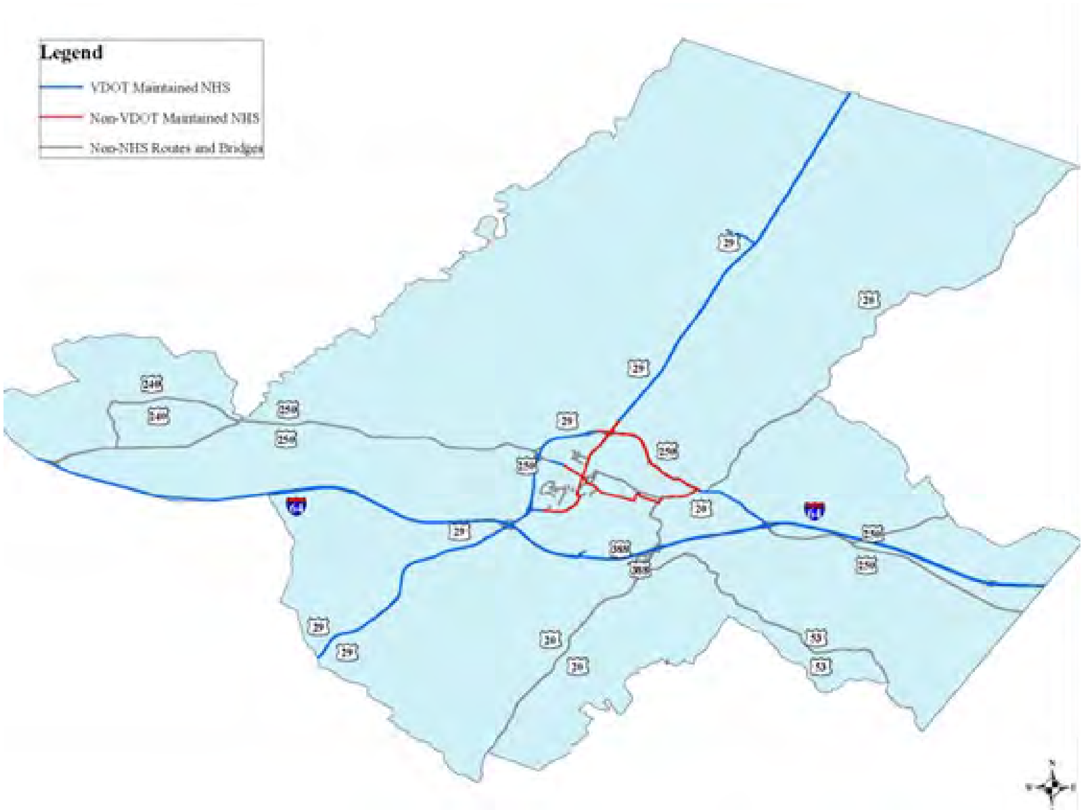


Figure 4: National Highway System (NHS) Maintenance. Source: VDOT

The state established performance targets for the condition of pavement and bridges in 2022, which the CA-MPO also adopted, as indicated in Table 2.

Highway Infrastructure Condition	CA-MPO 2017 Baseline	2018 Adopted Targets	CA-MPO 2021 Baseline	2023 Adopted Targets
Percentage of deck area of bridges in good condition (NBI on NHS)	12.8	23.0	10.8	25.1*
Percentage of deck area of bridges in poor condition (NBI on NHS)	12.1	2.0	7.8	3.6*
Percentage of pavement in good condition (Interstate)	Data Not Available	45*	73.5	45*
Percentage of pavement in poor condition (Interstate)	Data Not Available	3*	0	3*
Percentage of pavement in good condition (NHS)	Data Not Available	25*	28.7	25*

Percentage of pavement in poor condition (NHS)	Data Not Available	5*	0.1	5*
*CA-MPO adopted state-wide target.				

Table 2: Highway Infrastructure Performance Targets. Source: CA-MPO

When the CA-MPO adopted the first set of highway infrastructure conditions performance targets in 2018, regionally-specific data for pavement conditions was unavailable, so the MPO adopted the state's targets. Regionally-specific data was provided to CA-MPO by the Office of Intermodal Planning and Investment (OIPI) for consideration in adopting its targets in early 2023. The existing pavement conditions of the CA-MPO system already exceed the statewide performance targets.

Regarding the percentage of deck area of bridges in good condition, the actual condition for the CA-MPO region is below state-adopted targets. The data also shows that the percentage of deck area of bridges in good condition has actually decreased between 2017 and 2021. The percentage of deck area of bridges in poor condition is higher than the state-adopted goal. Still, the percentage of deck area of bridges in poor condition decreased between 2017 and 2021, demonstrating that the CA-MPO region is progressing in prioritizing improvements of the bridge infrastructure most in need of maintenance and repair.

Highway System Performance

Highway system performance is intended to assess how predictably the transportation system can move vehicles by measuring the variability in travel times between peak traffic conditions and free-flow traffic conditions. For example, a truck travel time reliability index value close to 1 indicates little variation in travel time between peak and free-flow conditions, meaning the system is very reliable.

For all highway system performance measures, existing conditions for the CA-MPO region exceed state-identified system performance targets, as indicated in Table 3.

Highway System Performance	CA-MPO 2017 Baseline	2018 CA-MPO Targets	CA-MPO 2021 Baseline	2023 CA-MPO Targets
Percentage of person-miles traveled that are reliable (Interstate)	99	82*	100	85*
Percentage of person-miles traveled that are reliable (Non-Interstate NHS)	86.21	82.5*	90.7	88*
Truck travel time reliability index (Interstate)	1.13	1.56*	1.15	1.64*
*CA-MPO adopted state-wide target.				

Table 3: Highway System Performance Targets. Source: CA-MPO

Transit Asset Management

Transit agencies that receive federal financial assistance and own, operate, or manage capital assets used to provide public transportation are required to create a Transit Asset Management

(TAM) plan. DRPT maintains a Tier II group plan for qualifying transit providers in Virginia. CAT and Jaunt participate in the state's Tier II group plan, and the CA-MPO adopted targets identified by DRPT as indicated in Table 4.

Asset Category - Performance Measure	Asset Class	FFY2022
Revenue Vehicles		
Age - % of revenue vehicles within a particular asset class that have met or exceeded their Useful Life Benchmark (ULB)	AB - Articulated Bus	5%
	BU - Bus	15%
	CU - Cutaway	10%
	MV-Minivan	20%
	BR - Over-the-Road Bus	15%
	VN - Van	20%
Equipment		
Age - % of vehicles that have met or exceeded their Useful Life Benchmark (ULB)	Non-Revenue/Service Automobile	30%
	Trucks and other Rubber Tire Vehicles	30%
Facilities		
Condition - % of facilities with a condition rating below 3.0 on the FTA TERM Scale	Administrative Facilities	10%
	Maintenance Facility	10%
	Passenger Facilities	15%
	Parking Facilities	10%

Table 4: Transit Asset Management Targets. Source: CA-MPO

Public Safety Transportation Safety

In 2018, the Federal Transit Administration published 49 CFR Part 673, which requires transit agencies receiving Urbanized Area Formula Grants per 49 USC Section 5307 to develop a Public Transportation Safety Action Plan (PTASP). The federal code further requires that states establish a PTASP for small transit agencies. Jaunt and Charlottesville Area Transit (CAT) are both included in the state's PTASP.

The performance measures identified in the PTSAP are reported separately for fixed routes and paratransit/demand response services. The transit agencies developed these performance measures and provided them to DRPT for inclusion in the PTSAP adopted in July 2020.

Performance Measure	Fixed Route	Paratransit/Demand Response*
Fatalities (total number of reportable fatalities per year)	0	0
Fatalities (rate per total vehicle revenue miles by mode)	0	0
Injuries (total number of reportable injuries per year)	5	0

Injuries (rate per total vehicle revenue miles by mode)	Less than 0.5 injuries per 100,000 vehicle revenue miles	Less than 0.5 injuries per 100,000 vehicle revenue miles
Safety events (total number of safety events per year)	10	1
Safety events (rate per total vehicle revenue miles by mode)	Less than 1 reportable event per 100,000 vehicle revenue miles	Less than 1 reportable event per 100,000 vehicle revenue miles
Distance between Major Failures	10,000 miles	10,000 miles
Distance between Minor Failures	3,200 miles	3,200 miles
**Jaunt is under contract to provide paratransit service operations for CAT in urbanized areas.*		

Table 5: Charlottesville Area Transit (CAT) PTSAP Performance Measures

Performance Measure	Fixed Route
Fatalities (total number of reportable fatalities per year)	0
Fatalities (rate per total vehicle revenue miles by mode)	0
Injuries (total number of reportable injuries per year)	9
Injuries (rate per total vehicle revenue miles by mode)	Less than 0.5 injuries per 100,000 vehicle revenue miles
Safety events (total number of safety events per year)	17
Safety events (rate per total vehicle revenue miles by mode)	Less than 1 reportable event per 100,000 vehicle revenue miles
Distance between Major Failures	10,000 miles
Distance between Minor Failures	3,200 miles

Table 6: Jaunt PTSAP Performance Measures

Roadways

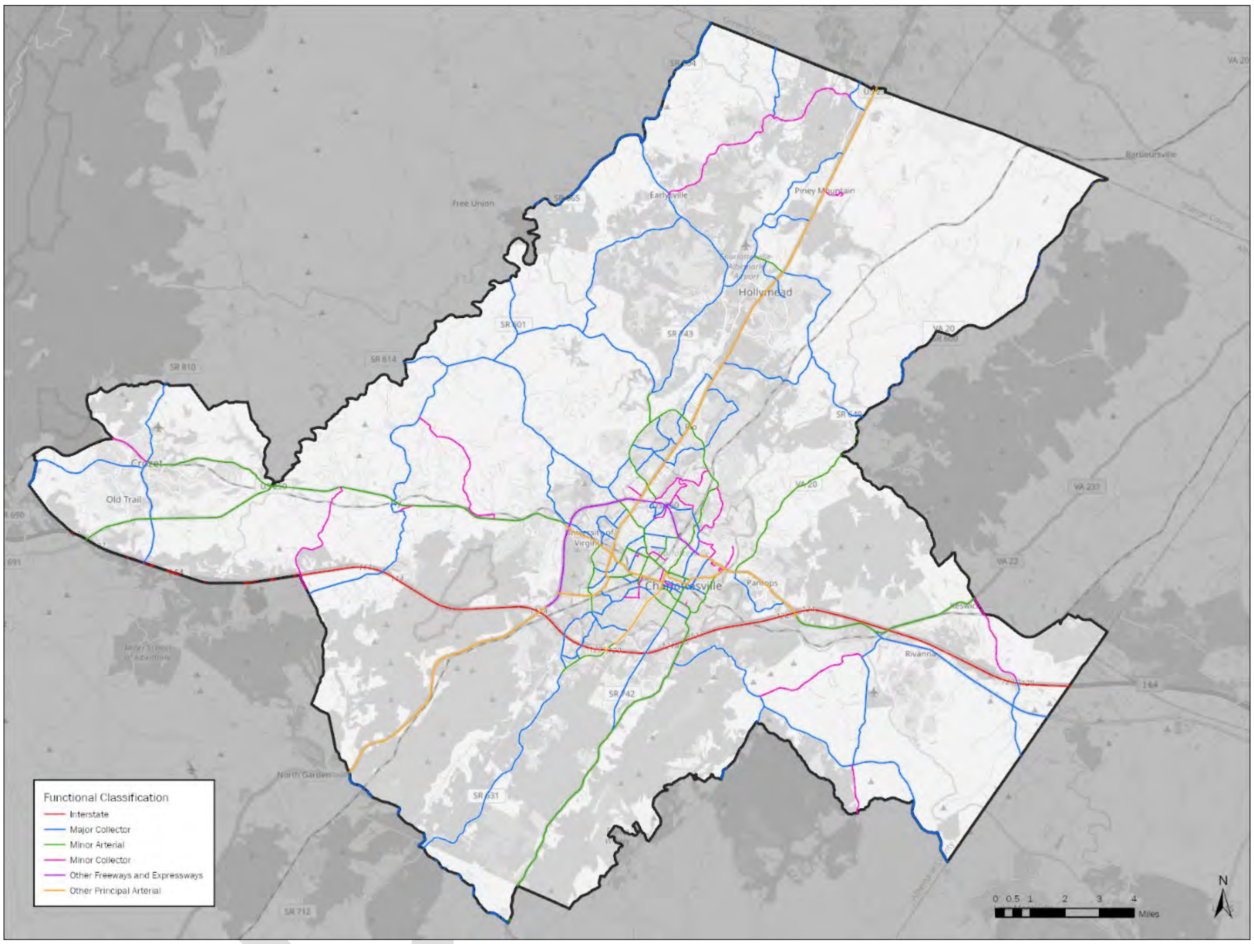
The following section identifies primary roadways and bridges in the MPO region.

Roadway Classification

Per the Federal Highway Administration (FHWA) and American Association of State Highway Transportation Officials (AASHTO), functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of traffic service that they are intended to provide.

There are three functional classifications: arterial, collector, and local roads. Arterials provide the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control. These roads are typically classified as principal arterials (sub-grouped by Interstate, Freeway/ Expressway, and other principal arterials) and minor arterials. Collectors provide a lower level of service at a slower speed and provide service for shorter distances by collecting traffic from local roads and connecting them with arterials. Collectors are typically classified as “major” or “minor”. Finally, local roads consist of all roads not defined as arterials or collectors and primarily provide access to land with little or no through traffic.

VDOT further classifies roadways as interstate, primary, or secondary roads. Interstates are limited-access highways that connect states and major cities. Primary roads connect cities, towns, and interstates. Secondary roads are generally connectors and county routes designated with Route numbers 600 and above.



Map 3: MPO Roadway Classification. Source: VDOT

MPO Roadways

The region’s road network consists of primary, secondary, and local roads. The MPO region contains only one interstate: Interstate 64. U.S. primary roads within the MPO region include Routes 29, 250, 22, 20, and 53. These are the most heavily used commuter and commercial routes.

A network of secondary roads provides residents with connections to local and regional centers. Charlottesville and the urban areas of Albemarle County function as hubs for commercial and economic development within the Planning District. Residents from the urban core and outlying rural areas commute to Charlottesville and Albemarle’s growth areas for work, shopping, and recreation. The following section describes higher-order roadways in the MPO region.

Interstate 64

Interstate 64 is an east-west highway connecting the region to Interstate 95 (east) and Interstate 81 (west). The interstate carries through traffic but also serves local trips in Albemarle County, especially during rush hour, making it a critical roadway in the commuter network. Residents and visitors use Interstate 64 to access urban centers and other primary roads.

U.S. Route 29

U.S. 29 is a north-south route linking the region to other metropolitan areas along the corridor, such as Washington, D.C. and northern Virginia, Lynchburg, Danville, and communities in North Carolina. Within the region, U.S. 29 passes through Greene, Nelson, and Albemarle Counties and the City of Charlottesville. It is also a major commuter and truck freight route through central Virginia. Increased development along U.S. 29 in the Places29 development area of Albemarle County has increased traffic in the corridor. U.S. 29 to the south of Charlottesville experiences less traffic and is a four-lane highway that connects with more rural areas of Albemarle County.

U.S. Route 250

US 250 is an east-west corridor that roughly parallels Interstate 64 and connects the Pantops area, Charlottesville, Ivy, and Crozet. The US 250 Bypass provides an alternative route around downtown Charlottesville. Commuters in Fluvanna and Louisa Counties use this road to travel to job centers located in urban Albemarle and Charlottesville. The Pantops area continues to experience rapid development, which increases traffic volumes on the US 250 corridor, particularly at Free Bridge.

State Route 22

Route 22 intersects US 250 at Shadwell and curves east-west through Louisa County. The road passes through the Town of Louisa and carries a moderate traffic volume. Route 22 experiences seasonal traffic variations due to tourist travel with the Green Springs National Historic Landmark District and Monticello.

State Route 20

Another primary road in Albemarle County is Route 20, a rural highway with a north-south alignment that connects Charlottesville to the Town of Scottsville. VDOT designated this corridor as a Virginia Byway for its scenic and historic qualities because it is part of the historic “Journey Through Hallowed Ground” and carries a moderate amount of tourist traffic.

State Route 53

Route 53 extends from Albemarle into Fluvanna County and intersects with U.S. 15 in Palmyra. Along with secondary Route 616, this road is heavily used by commuters from northwest Fluvanna County, particularly those from the Lake Monticello community. Tourists also use Route 53 when traveling to Monticello and Ashlawn, the historic homes of Thomas Jefferson and James Monroe.

Secondary Roads

The MPO also has a network of heavily used secondary roads that connect residents to local and regional centers. The City of Charlottesville has a dense roadway network with around 110 miles of secondary roads. Albemarle contains around 860 miles of secondary roads, roughly 220 miles of which are unpaved. Secondary roads connect developed areas with residential or commercial centers to larger-scale regional roads or primary routes. Secondary roads are typically more robust than local roads. Examples in the urban area are Rio and Hydraulic Road.

Bridges

VDOT assesses the condition of over 100 bridges and over 100 additional culverts in Charlottesville and Albemarle County. Like roadways, the City of Charlottesville is responsible for bridges within its boundaries, while VDOT maintains bridges in Albemarle County. Additional information about bridges can be found in Chapters 5 and 7.

Public Transit

Several public transit options exist within the MPO region, including commuter, local, regional, and intra-county bus service provided by Charlottesville Area Transit (CAT), Jaunt, and University Transit Service (UTS). Greyhound, Megabus, the DRPT's Virginia Breeze, and BRITE's Afton Express Route provide inter-regional bus service to the region, and Amtrak offers inter-city passenger rail service. In 2017, the Regional Transit Partnership (RTP) was formed to increase communication and coordination between transit providers and identify regional transit goals and opportunities.

Charlottesville Area Transit

CAT currently provides public bus service to the greater Charlottesville area with twelve routes and a trolley service. Service is currently fare-free via a 3-year TRIP grant. Per CAT's ridership data, the average daily ridership in FY 2019 was 5,129. That number dropped significantly in FY 2020 with the onset of the COVID-19 pandemic, which affected the four final months of the fiscal year (March through June). FY 2021's average daily ridership dwindled to 1,690 as the pandemic continued to impact the MPO but began to recover in FY 2022, serving an average of 3,157 riders daily. The routes with the highest ridership in FY 2022 were Route 7, running from Downtown to Fashion Square Mall (28% of trips); Route 5, running from Barracks Road to Wal-Mart (16% of trips); and the Free Trolley, running from Downtown to UVA (14% of trips).

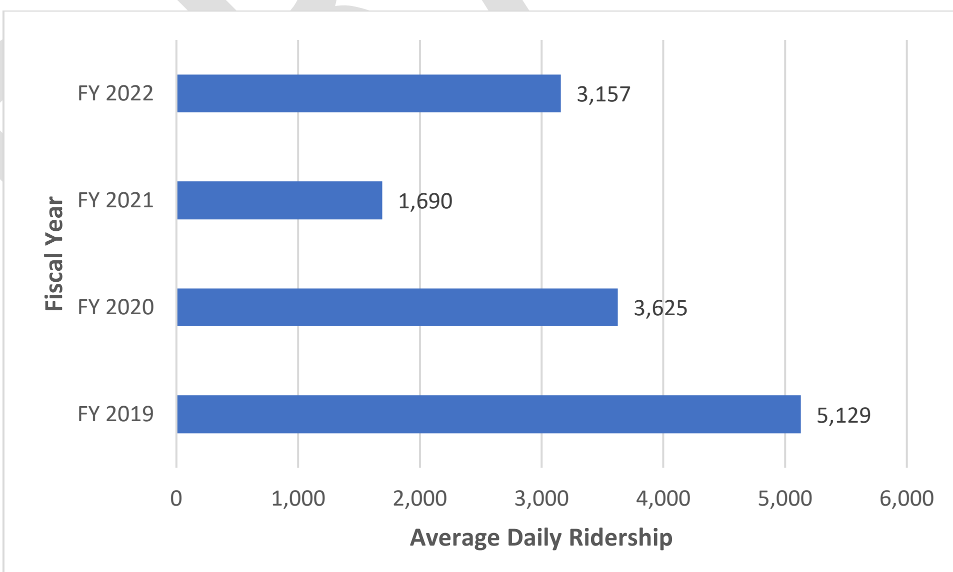


Figure 5: CAT Average Daily Ridership by Route (FY 2022). Source: CAT

Jaunt

Jaunt is a regional transportation system for Central Virginia and serves as the Americans with Disabilities Act (ADA) paratransit service for CAT. Like CAT, service is currently fare-free via a 3-year TRIP grant. Jaunt is funded by Charlottesville, Albemarle, and other local governments, and it uses federal, state, and local funding to supplement fares.

Service is available for all residents of Charlottesville and six surrounding counties in Central Virginia (Albemarle, Buckingham, Fluvanna, Greene, Louisa, and Nelson).

Figure 6 shows annual ridership from FY 2019 to FY 2022.

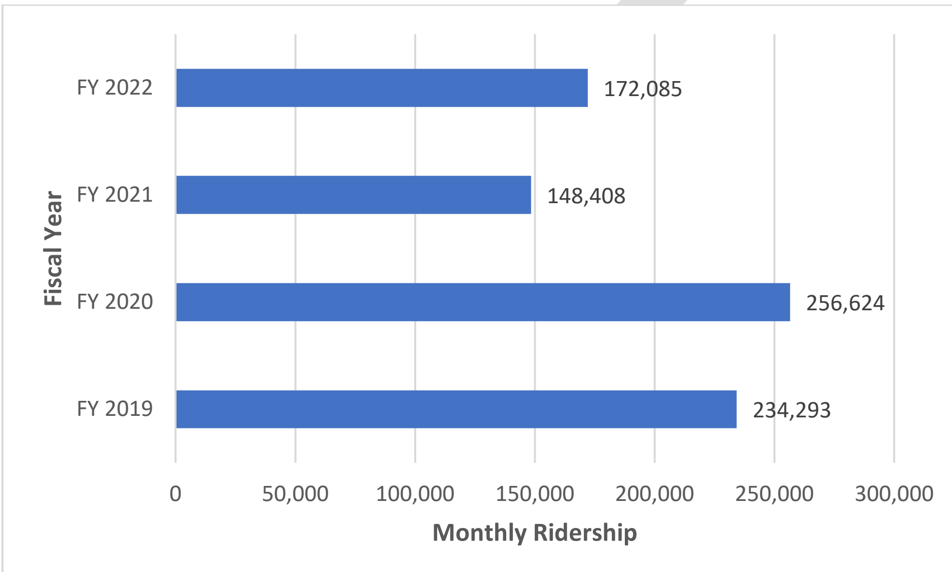


Figure 6: Jaunt Annual Ridership (FY 2019 – FY 2022). Source: Jaunt

University Transit Service (UTS)

UTS is a fare-free transit service UVA provides to its students, faculty and staff, and the general public. UTS services the UVA Hospital and the university's Central, West, and North Grounds. It also serves popular student housing areas, including Jefferson Park Avenue, Grady Avenue, Rugby Road, and 14th Street. UTS currently operates seven routes. Service hours vary by day, route, and time of year.

Regional Transit Partnership (RTP)

The Regional Transit Partnership (RTP) serves as an official advisory board created by the City of Charlottesville, Albemarle County, and Jaunt, in partnership with the Virginia Department of Rail and Public Transportation, to provide recommendations to decision-makers on transit-related matters. The RTP has four main goals:

- **Establishing Strong Communication:** The Partnership will provide a long-needed venue to exchange information and resolve transit-related matters.

- **Ensuring Coordination between Transit Providers:** The Partnership will allow transit providers a venue to coordinate services, initiatives, and administrative duties of their systems.
- **Set the Region's Transit Goals and Vision:** The Partnership will allow local officials and transit staff to work with other stakeholders to craft regional transit goals. The RTP will also provide, through MPO staff updates of Transit Development Plans (TDPs), opportunities for regional transit planning.
- **Identify Opportunities:** The Partnership will assemble decision-makers and stakeholders to identify improved transit services and administration opportunities, including evaluating a Regional Transit Authority (RTA).

Inter-Regional Bus Service

Greyhound offers inter-city bus service from a station on West Main Street in Charlottesville. Bus service is available throughout the day to destinations including Richmond, Lynchburg, Roanoke, Fredericksburg, and Washington, D.C., with connections to major metropolitan areas available. Megabus offers inter-city bus service from Charlottesville to Washington, D.C., where passengers can transfer to other bus or rail routes. The DRPT's Virginia Breeze bus line passes through the MPO in Charlottesville, offering bus service from Danville to Washington, D.C, and BRITE's Afton Express Route provides bus service to and from Charlottesville and the Shenandoah Valley.

Inter-Regional Passenger Rail

Amtrak currently operates three service routes from Charlottesville Union Station:

- The *Crescent*, running daily from New York City to New Orleans;
- The *Cardinal*, operating three days per week between New York City and Chicago; and
- The *Northeast Regional,* offering daily service from Roanoke to New York City.

Amtrak's Northeast Regional line has become a reliable transportation alternative for commuters and travelers along the eastern seaboard. Although Virginia is not strictly part of the Northeast Corridor, some Northeast Regional trains continue into Virginia. Northeast Regional service south to Alexandria, Richmond, Williamsburg, and Newport News formally began in 1976. In 2009, Amtrak extended the Northeast Regional with daily service from Alexandria, VA, via Burke, Manassas, Culpeper, and Charlottesville to Lynchburg. Since 2017, this service has been extended to provide same-seat trips to and from Roanoke, VA, and in 2022, a second daily train between Roanoke and Washington, D.C., was introduced.

As shown in Figure 7, Charlottesville Union Station is one of the state's busiest in terms of total ridership. Ridership was severely impacted by the COVID-19 pandemic in 2020 but increased steadily through 2022, as shown in Figure 8.

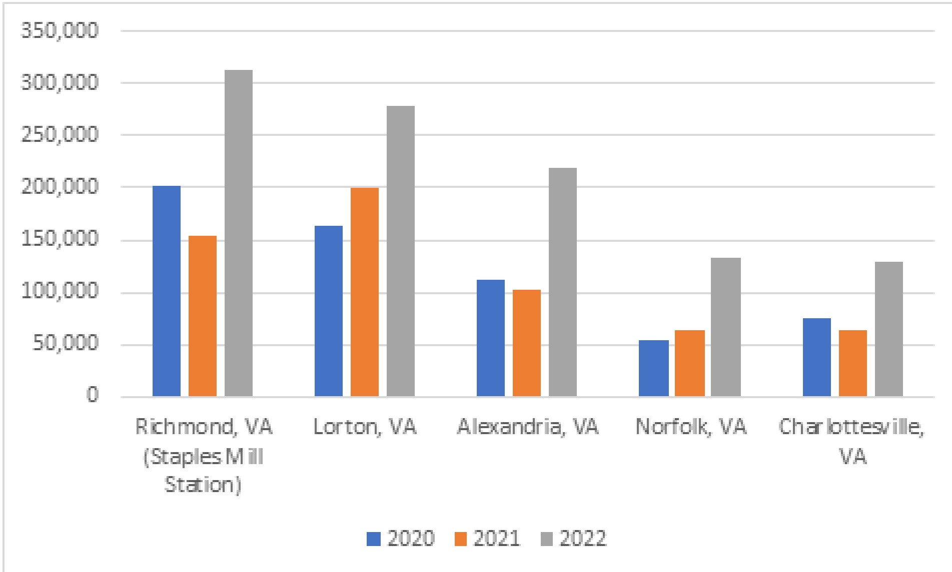


Figure 7: Total Amtrak Station Arrivals & Departures for Top Stations in Virginia (2020-2022). Source: Rail Passengers Association

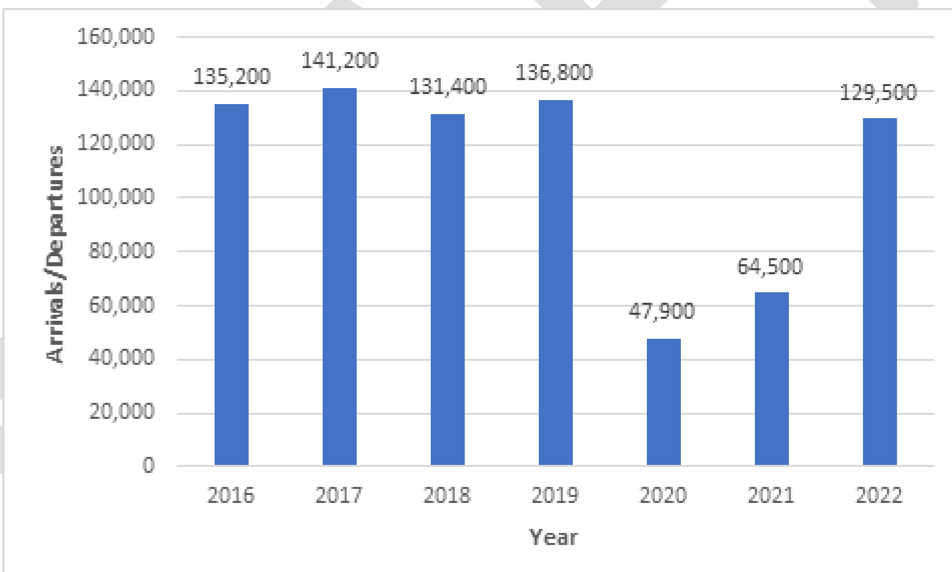


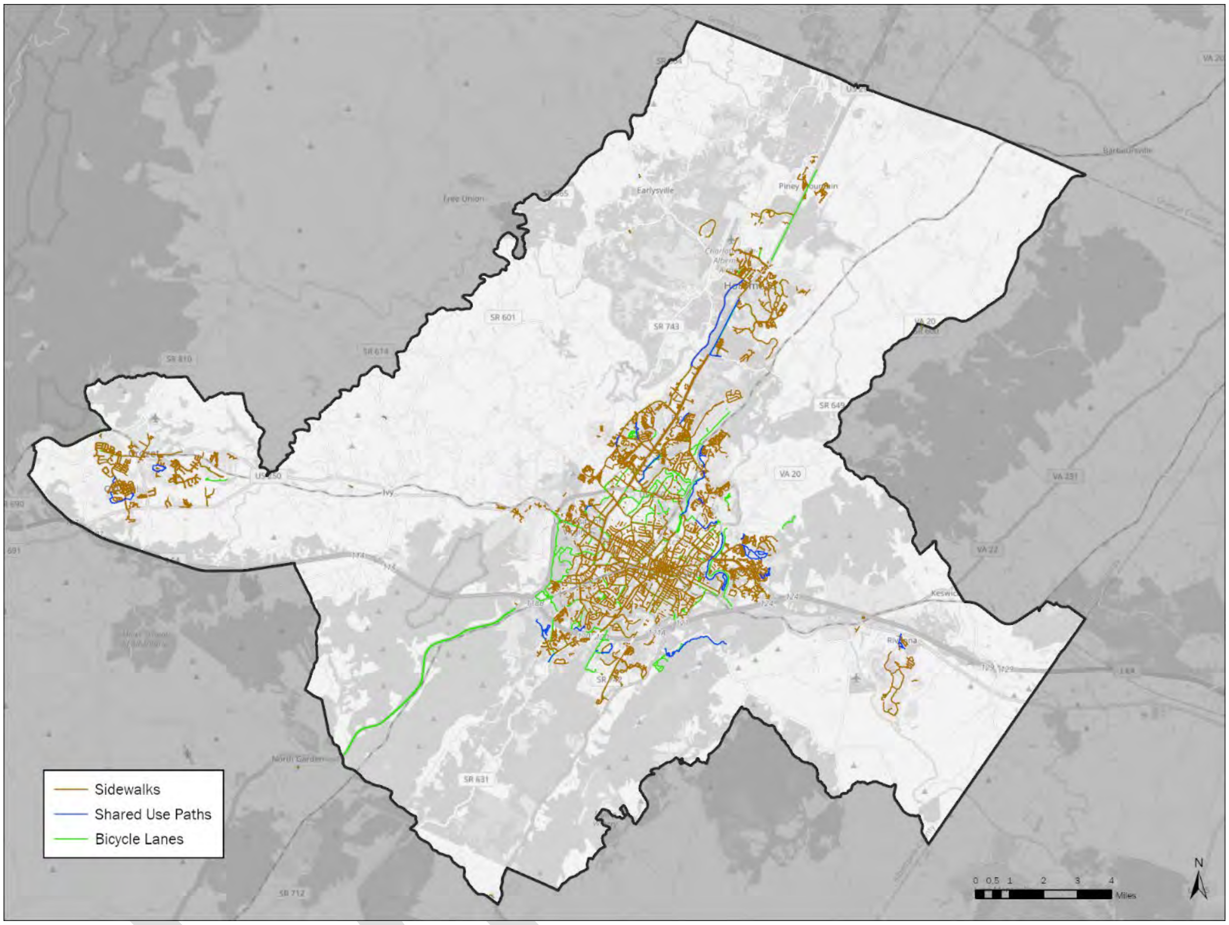
Figure 8: Charlottesville Amtrak Station Arrivals & Departures (2016-2022). Source: Rail Passengers Association

Bicycle and Pedestrian

Charlottesville has been honored as a silver-level Bicycle Friendly Community by the League of American Bicyclists since 2008. The University of Virginia received a silver-level Bicycle Friendly University award from the League of American Bicyclists in 2013. Additionally, the city has been designated a gold-level Pedestrian Community by Walk Friendly Communities since 2011 due to its high walking rates, innovative planning practices, and a centralized, successful Downtown Pedestrian Mall. Nonetheless, the region must continue to increase efforts to improve conditions for bicyclists and pedestrians. Improving safety is a crucial aspect of this plan.

The MPO Policy Board approved an update to the Jefferson Area Bicycle and Pedestrian Plan in March 2019. The updated plan encouraged implementation by providing a focused list of regionally significant bicycle and pedestrian projects that enhance connectivity and provide routes to important residential and economic centers.

Map 4 shows existing and proposed bicycle and pedestrian infrastructure in the MPO.



Map 4: Existing and Proposed Bicycle and Pedestrian Infrastructure. Sources: City of Charlottesville, Albemarle County

Freight

Identifying freight corridors and preserving freight mobility is a Long-Range Transportation Plan component. The MPO is primarily served by truck freight and supplemented by rail service.

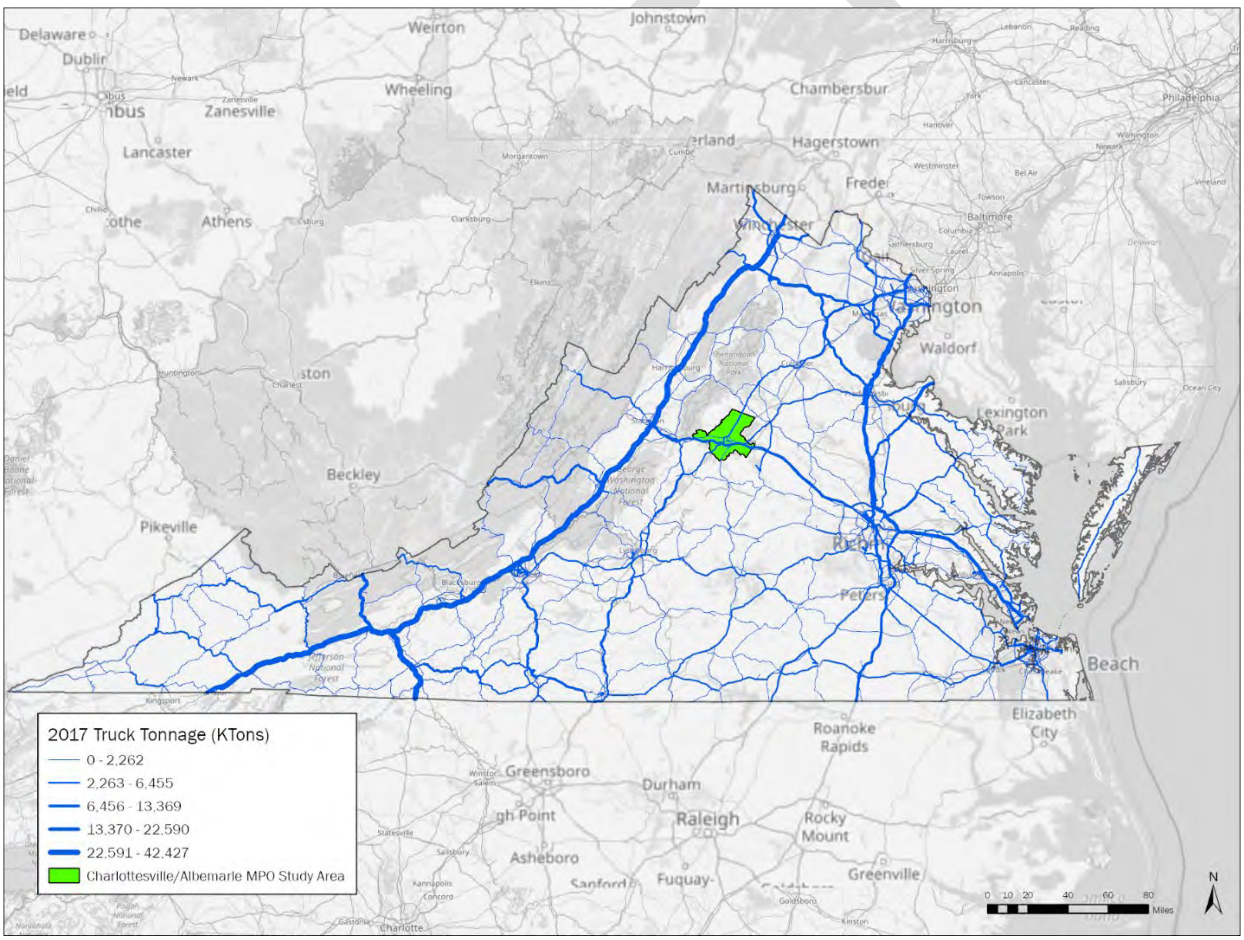
Truck

Interstate 64 is the primary east-west truck route in the MPO region, transporting goods statewide and connecting neighboring industrial centers. In 2022, the portion of Interstate 64, which runs through the MPO area, carried a daily truck traffic volume of approximately 11.8% of total daily traffic in the region. Truck freight also utilizes U.S. 29. U.S. 29 is the primary truck route in the north-south direction and facilitates freight routing changes. One of those routing changes, U.S. 250, also carries significant freight traffic and has become a major shipping corridor in recent years.

Maintaining and improving the roadways for freight movement is critical to the region's economic development and sustainability.

Three roadways provide primary access to the major commercial areas and business centers at the center of the MPO region: Interstate 64, U.S. 29, and US 250. U.S. 20 experiences frequent congestion due to traffic volume, hilly terrain, reduced speed limit, and the number of signalized intersections, creating difficult driving conditions for freight trucks. Continued implementation of Route 29 improvement projects is necessary to prevent Charlottesville from becoming a bottleneck for freight on the U.S. 29 corridor.

As evident from the Freight Analysis Framework (FAF) data shown in Map 5, the highest densities of truck activity are along the I-81 corridor and at Virginia's major population hubs: Northern Virginia, Richmond, and Hampton Roads, with concentrations also visible at Roanoke, Lynchburg, and Charlottesville.



Map 5: Virginia's Inbound/Outbound/Internal Truck Tons (2017). Source: FHWA

Rail

Freight rail is provided via two railroads that cross at grade in downtown Charlottesville: CSX Transportation and Norfolk Southern Corporation, two of the largest railroad conglomerates in the

U.S. The Norfolk Southern line travels north-south through Albemarle County, Charlottesville, and Nelson County. The CSX line, carrying primarily empty coal cars, follows a roughly east-west route through Albemarle County, the City of Charlottesville, and Louisa County.

In 2023, two rail projects in the MPO were awarded $500,000 each in federal funding to study improvements to passenger rail service. The *Commonwealth Corridor* project, proposed by the Virginia Department of Rail and Public Transportation (DRPT), aims to connect Newport News with Richmond, Charlottesville, and the New River Valley. It plans to utilize existing rail lines and complement current Northeast Regional services connecting Washington, D.C., Newport News, and Roanoke. The proposal includes filling a gap in passenger rail service along the Buckingham Branch Railroad freight line, with plans to offer east-west service across Virginia. A study estimates the corridor's annual ridership to be around 177,200 passengers.

Amtrak's project aims to enhance the Cardinal Service, which operates three days a week, to daily service. The route passes through Charlottesville and connects Alexandria, Manassas, Culpeper, and Clifton Forge to destinations such as New York City, Chicago, Philadelphia, Baltimore, and Washington, D.C. Increasing the frequency of the service will improve accessibility and connectivity for passengers along the route.

Figure 9 shows that Virginia's truck and rail freight volumes are expected to double their 2004 tonnage by 2035, an upward trend that is expected to continue through 2050.

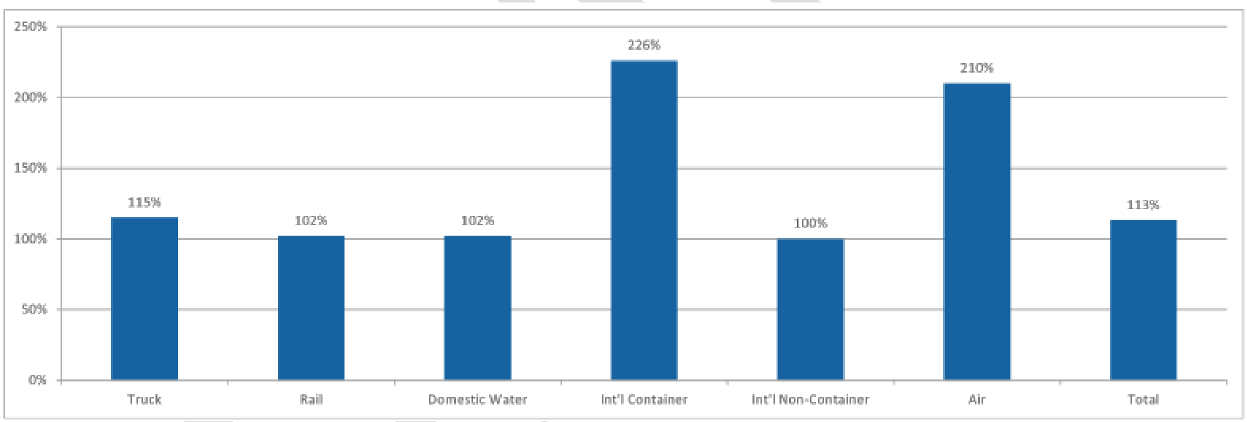


Figure 9: Projected Growth in VA Freight Tonnage through 2035. Source: Virginia Statewide Multimodal Freight Study, Phase I

Airport

Charlottesville-Albemarle Airport (CHO) is the only commercial service airport in the region. The airport is eight miles north of Charlottesville and one mile west of U.S. 29 on Airport Road. It is a general aviation and commercial service airport, offering more than 50 daily non-stop flights to and from Charlotte, Philadelphia, New York, Washington, D.C., Atlanta, and Chicago. Delta, United, and American Airlines serve the airport. The number of enplaned passengers has been steadily increasing since 2013. In FY 2018, enplaned passengers reached 315,099, an 8% increase from FY 2017, the highest total in the last ten fiscal years. The number of enplaned passengers in FY 2021 dwindled to 76,709 due to the COVID-19 pandemic but steadily increased to 275,002 in FY 2023.

General aviation facilities include an executive terminal offering a full-service fixed-base operation, a flight school, and aircraft charter firms.

Daily and hourly parking is available at the airport. Car rentals are available in the terminal facility, and many area hotels provide shuttle service from the airport for guests. Taxi and rideshare services are also available.

Travel Demand Management

Two programs currently implemented for regional Travel Demand Management (TDM) in the MPO region include RideShare and Park & Ride Lots.

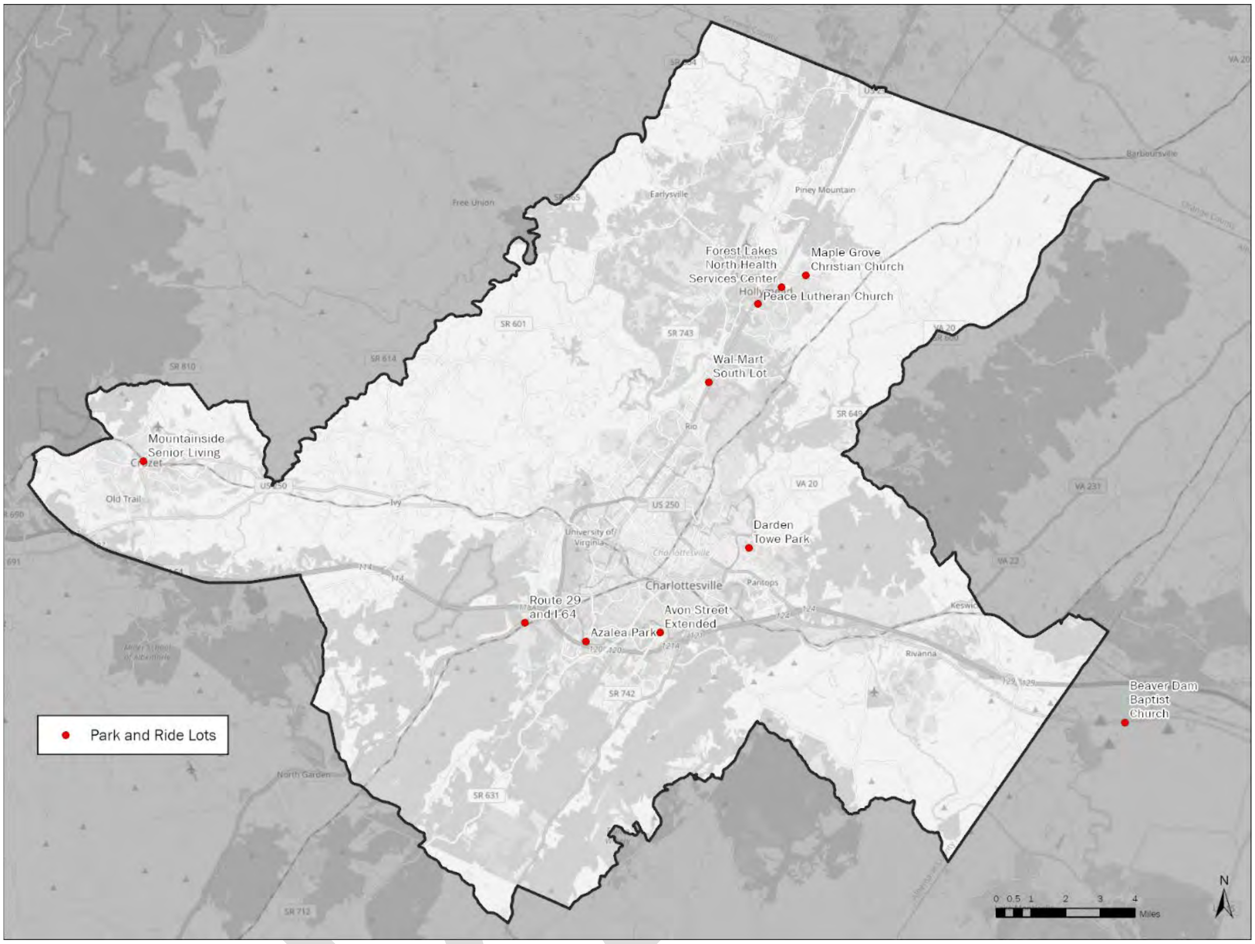
RideShare

RideShare is a program housed within the TJPDC, in cooperation with the Central Shenandoah Planning District Commission (CSPDC), working to reduce traffic congestion and increase mobility throughout Central Virginia and the Central Shenandoah Valley. Services include free carpool matching, vanpool coordination, and a Guaranteed Ride Home program to provide free rides home in an emergency. RideShare also works with employers to develop and implement traffic reduction programs and advertises the region's Park and Ride lots. The RideShare database has 1,682 registered members in the ConnectingVA system and 257 registered users in the Guaranteed Ride Home program database as of April 2024.

Park & Ride Lots

There are thirty Park and Ride lots within the RideShare service area. Twenty-one are located within the TJPDC, and nine are within the MPO area, as listed in Map 6. Some of these lots are formal facilities managed by VDOT, while others are informal lots made available to commuters by businesses or organizations that own the property.

RideShare conducts quarterly inventories of each park & ride lot. The most active lot is in Waynesboro (AUG2), averaging 75 cars each weekday from FY 2021 to FY 2023. Based on interviews conducted at the lot and data collected from RideShare, most travelers parking at this lot commute to Charlottesville. The second most active lot is at Zion Crossroads (LOU1), with an average of 27 cars each weekday from FY 2021 to FY 2023.



Map 6: MPO Park & Ride Lots. Source: RideShare

Chapter 3: Transportation Deficiencies Overview

Overview

Developing a plan for improving any aspect of the community must start with identifying what elements of the community's system are deficient. For this plan, MPO staff examined how the region's future transportation system would function if no future improvements were planned beyond projects included in the State's Six-Year Improvement Program (SYIP) or proffered from local developers. Through this process, MPO staff, working with MPO Committees, identified infrastructure expected to be incomplete or insufficient by 2050. Analysis for each mode considers the population total and distribution as projected for 2050, the employment total and distribution as projected for 2050, and road network conditions as projected for 2050.

Roads, Freight, Bridges, and Intersections

Roads

Most traffic in the MPO travels via the region's roadway system. As the Charlottesville-Albemarle region grows, more people are expected to use this system, which will constrain its capacity and result in congestion and delays. To ascertain how congested the road system would likely be in 2050, the MPO used its travel demand model to forecast where demand on the system is expected to exceed system capacity.

The travel demand model identifies these congested areas by calculating a volume-to-capacity ratio. The ratio indicates the volume of traffic expected on the road compared with the capacity the roadway can accommodate. Roadways approaching or over capacity are considered deficient. Map 7 shows roads expected to be classified under the "Minor Congestion" or "Congested" categories. The MPO used VDOT's volume-to-capacity ratio standards to define minor congestion and congestion. The capacity identified for each roadway varies based on multiple factors, including whether it is leading to an intersection. While this helps estimate the congestion caused by intersections, it is not a detailed analysis of any specific roadway or intersection.

Minor Congestion

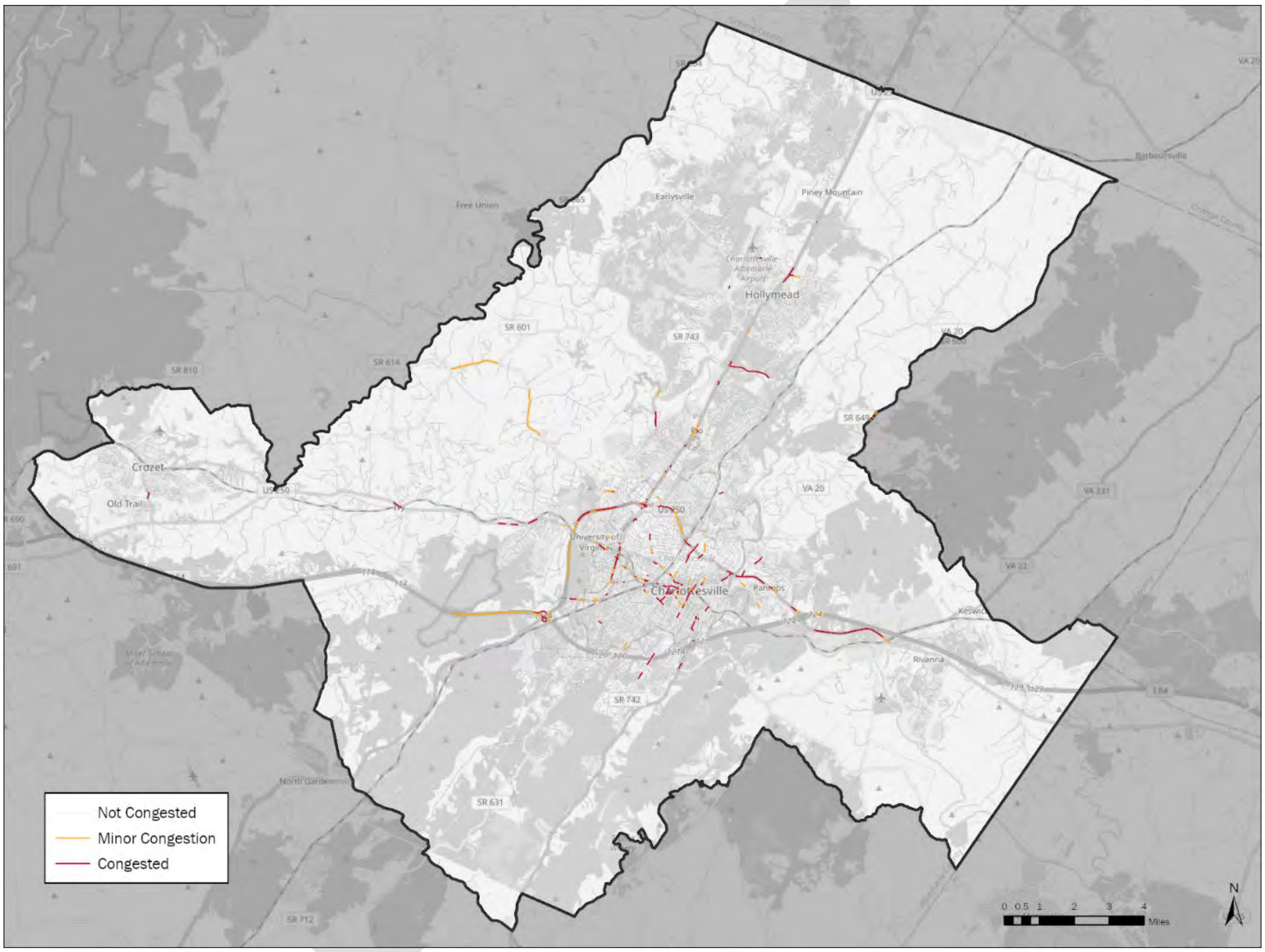
Roads approaching capacity are those with a Level of Service (LOS) E, which indicates that between 85% and 100% of the road's capacity is being used. These roads are expected to experience minor congestion, which means they are likely to be congested during rush hour travel but operate at free-flow conditions during other times.

Congested

Roads over capacity are those with a LOS F, which indicates that the roadway is expected to carry more volume than it was engineered to handle. These roads are expected to be congested throughout the day.

Significance

The transportation system's congestion level in 2050 was identified for two purposes. First, it was used to determine which areas would likely need improvements to reduce congestion and function more efficiently. Second, it served as a base against which each scenario could be compared.



Map 7: 2050 Congestion Levels. Source: VDOT

Freight

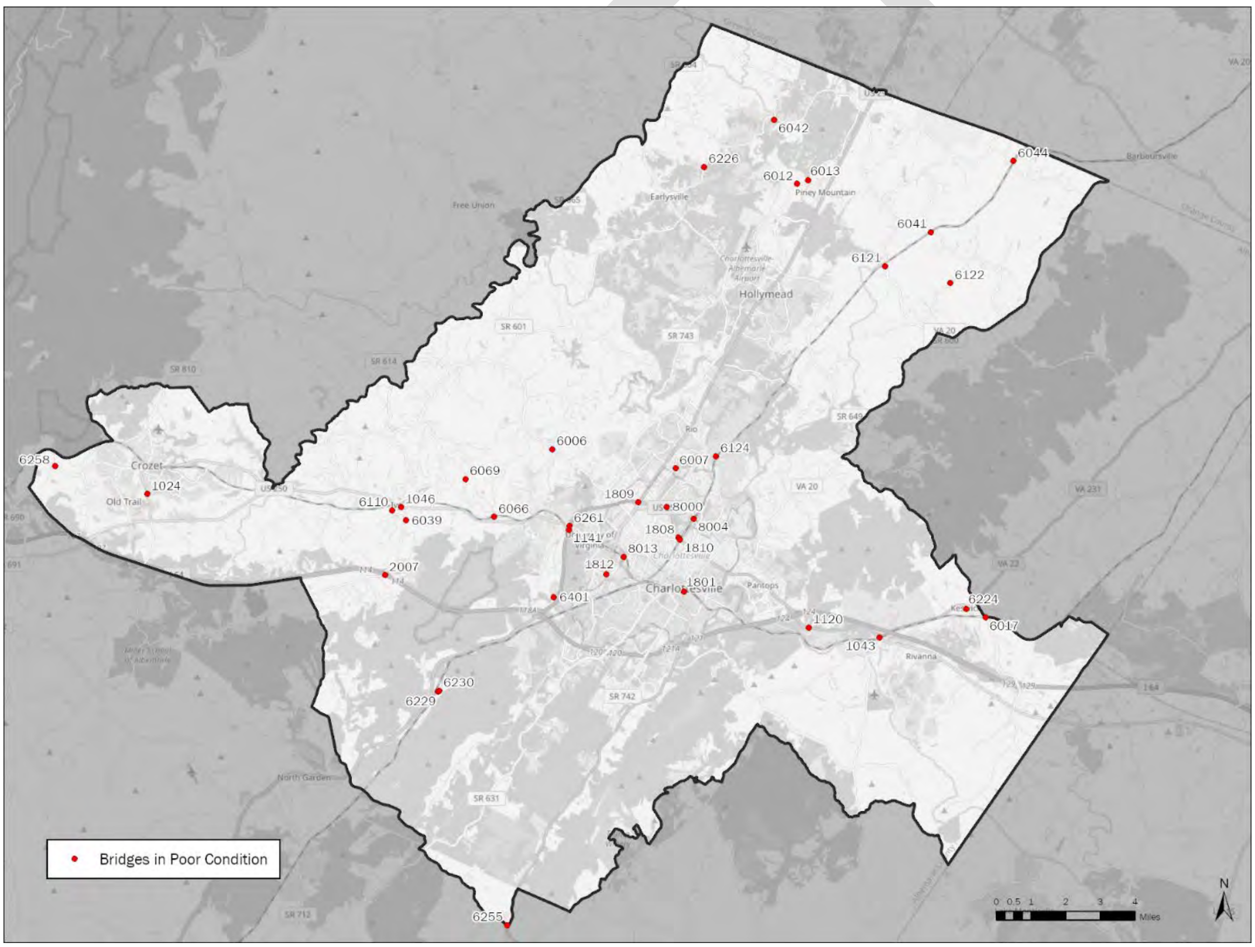
While important, the issue of freight movement throughout the region is not an overriding concern for regional mobility. The region's key freight corridors are Interstate 64 and US 29. Both routes are susceptible to congestion issues affecting general traffic mobility concurrent with freight movements.

Freight movement along rail corridors is also not a prevalent regional traffic concern. Currently, rail freight movement in the region travels to destinations outside the MPO's boundaries. While facilitating the movement of goods throughout the region is a priority, it is not as prominent in the Charlottesville-Albemarle MPO as it is for other MPOs.

Bridges

Safe and adequate bridges are vital components of a fully functional transportation system. Using VDOT bridge condition reports, the entire region of Albemarle County and the City of Charlottesville was reviewed to identify the condition of each bridge and assess the need for improvements. For the federal performance measure, bridges are categorized as "good," "fair," or "poor" and determined by the worst condition of the deck, superstructure, and substructure.

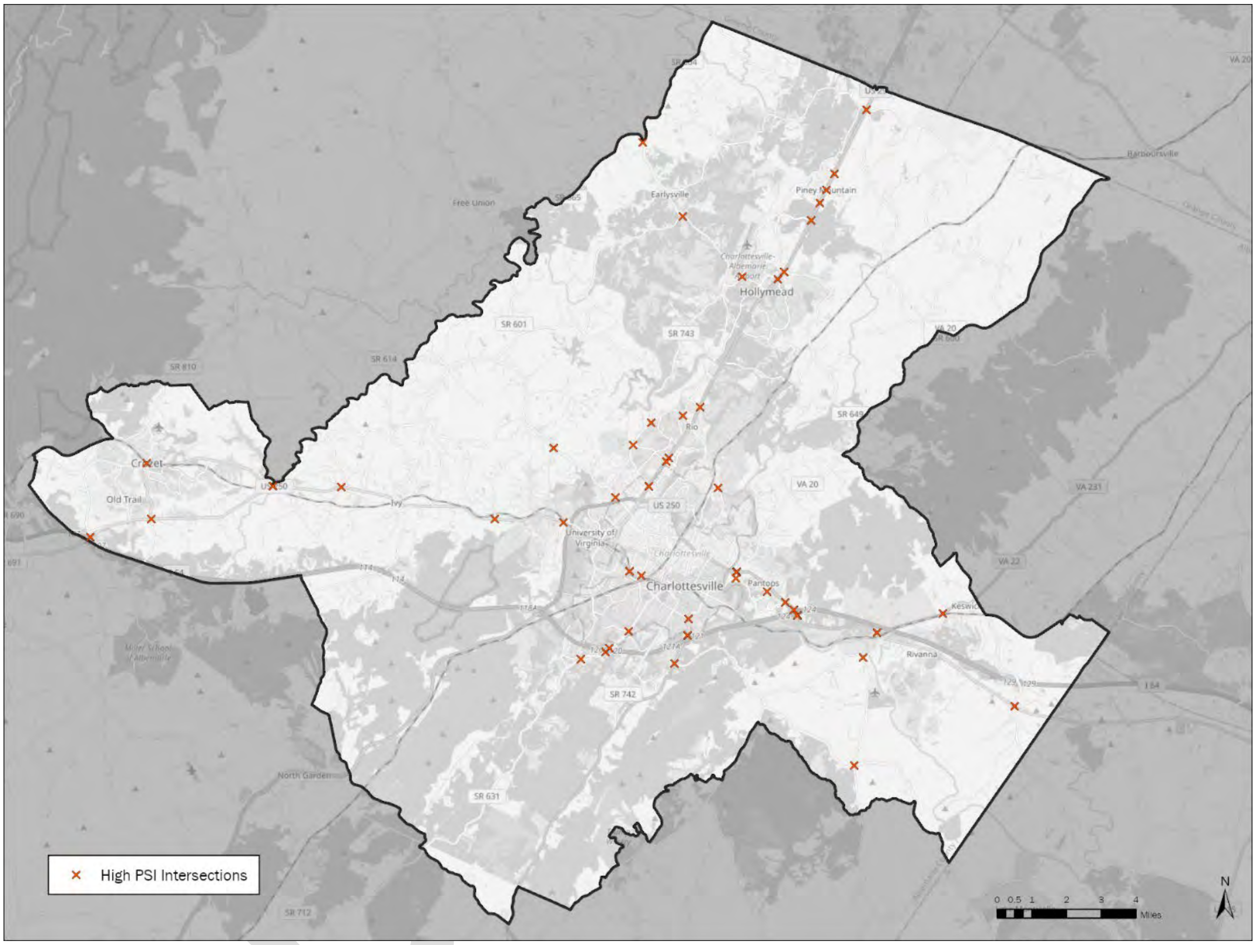
Bridges identified as being in poor condition are shown in Map 8 below. VDOT structure ID numbers are included on the map.



Map 8: Bridges in Poor Condition. Source: VDOT

Intersections

Intersections are a central concern in the MPO, as they are primary areas of congestion, locations where many crashes occur, and barriers to bicycle and pedestrian travel. VDOT evaluates intersections to identify potential for safety improvement (PSI) locations. This evaluation is based on the number of crashes at each intersection from 2016 to 2020 for the City of Charlottesville and 2017 to 2021 for parts of the MPO outside Charlottesville. The region's intersections with the highest PSI scores are shown in Map 9, indicating the most potential benefit from improvements.



Map 9: High PSI Intersections. Source: VDOT

Transit and Rail

Three transit entities serve the MPO: Charlottesville Area Transit (CAT), run by the City of Charlottesville with additional contributions coming from Albemarle County; University Transit Service (UTS), run by the University of Virginia; and Jaunt, which provides transit and para-transit service for several contiguous counties in the region including the City of Charlottesville and Albemarle County. To determine regional transit deficiencies, MPO staff considered regional transit services that have identified stops. Shuttle-style services, like Jaunt's 29 Express and Park Connect services, are not included.

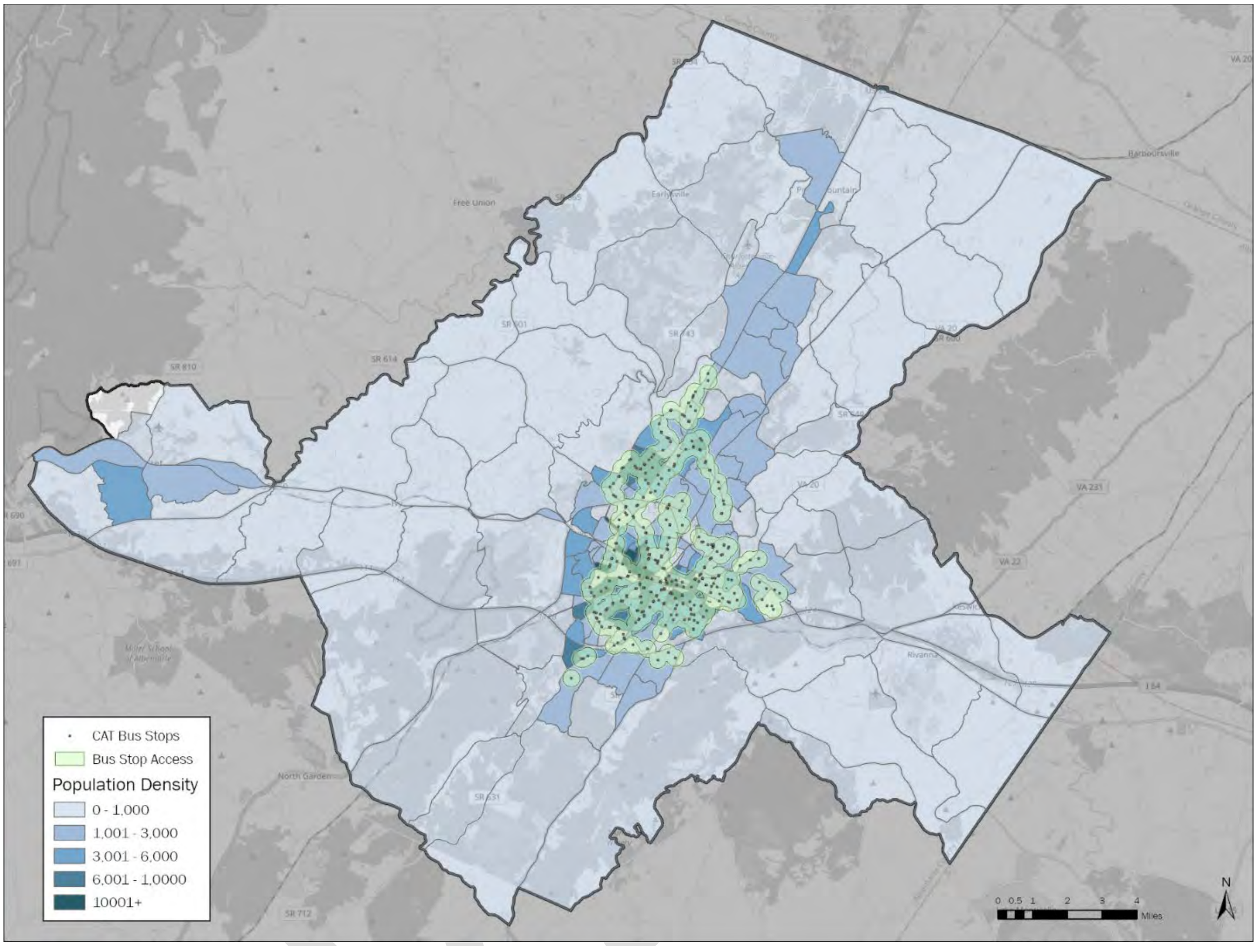
Transit Accessibility to Population and Employment Maps

The travel demand model's 2050 population and employment data was used to map each zone's population and employment densities forecast. Dark shades of blue indicate densely populated zones, while light shades of blue indicate sparse populations (refer to Map 10). Similarly, dark shades of red indicate zones with considerable employment opportunities, while light shades indicate fewer opportunities (refer to Map 11).

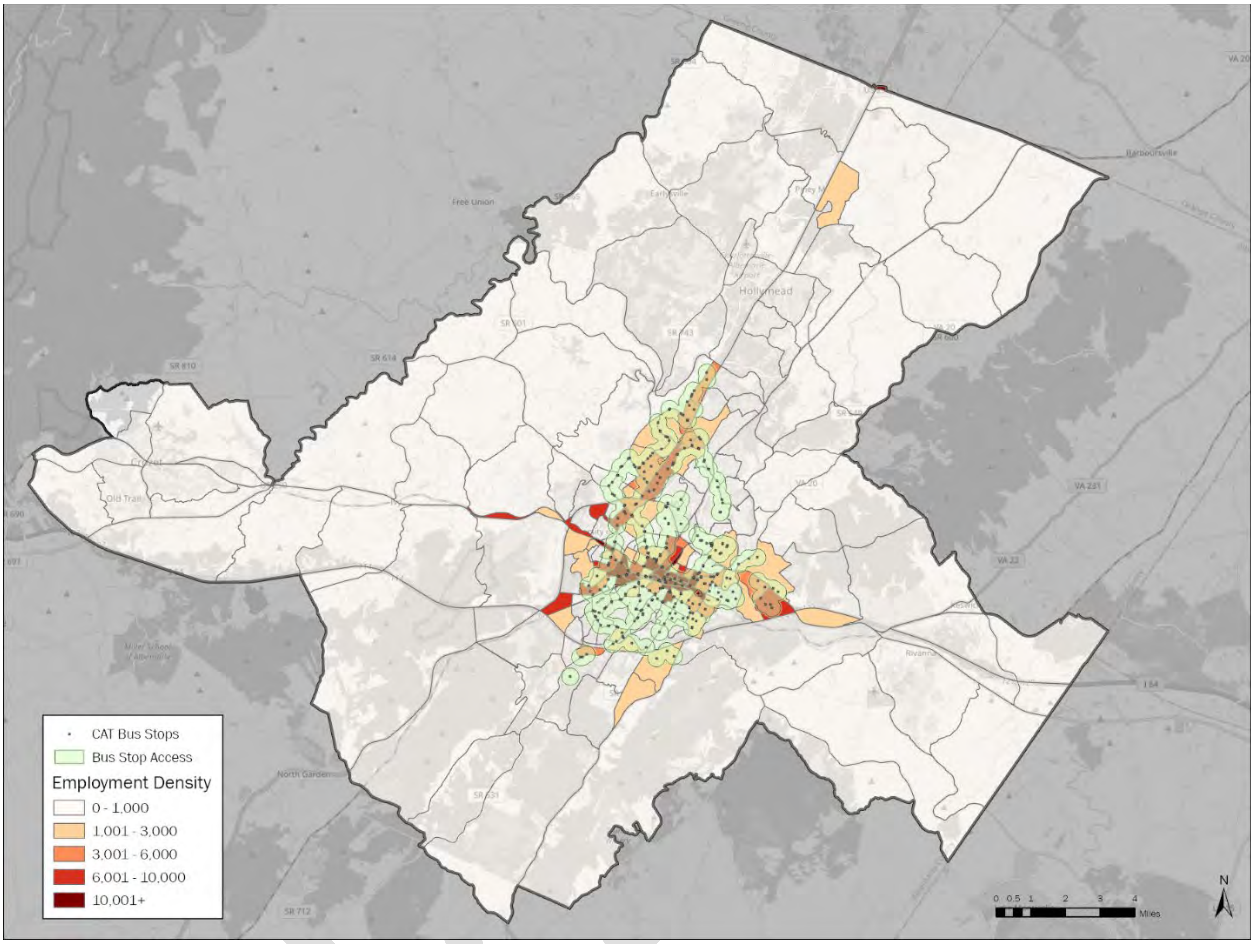
Because future bus stop locations for 2050 cannot be anticipated, existing bus stop locations for UTS and CAT routes were used in our analysis. Projected population and employment within a one-quarter-mile buffer of transit stops were calculated to determine access to transit in 2050. This analysis considers all stops equally, although some routes have a frequency as low as one bus per hour. Map 12 shows current CAT transit routes.

Within the MPO, approximately 49% of the projected population and 73% of projected employment opportunities will be within a one-quarter-mile radius of a bus stop in 2050, indicating an opportunity to expand service to a more significant proportion of residents and increase transit use by residents who live close to existing transit services. These maps help identify general areas that would benefit from additional transit service.

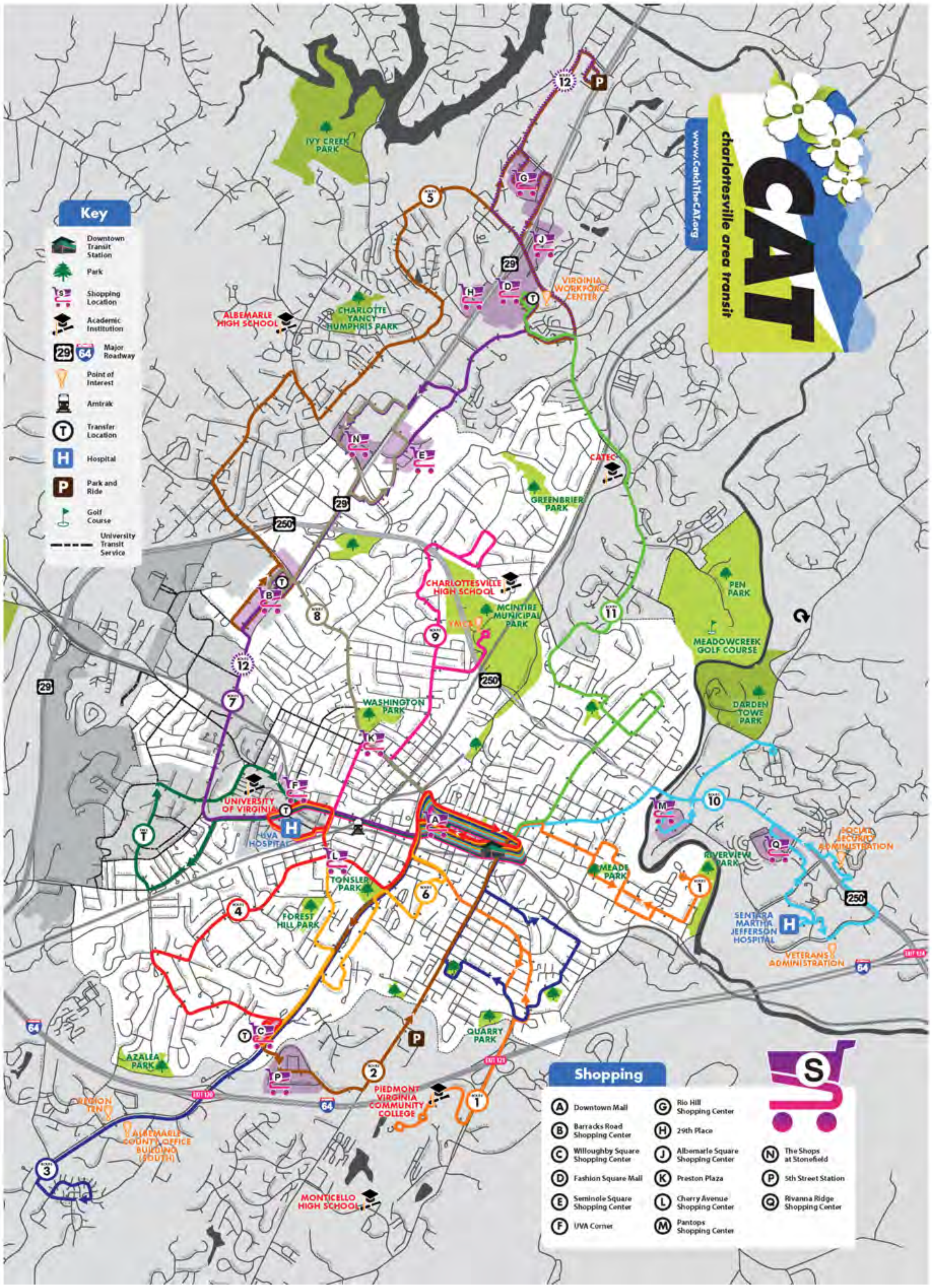
Darker shaded areas without bus stops indicate areas where expanded service is expected to perform well due to the high concentration of residents or employment opportunities in these areas.



Map 10: 2050 Population Access to Transit. Sources: CAT, U.S. Census Bureau



Map 11: 2050 Employment Access to Transit. Sources: CAT, U.S. Census Bureau



Map 12: CAT Transit Routes. Source: CAT

Bicycle and Pedestrian

The MPO's bicycle and pedestrian infrastructure is relatively robust for recreational purposes, but the current network is not extensive or connected enough to be a viable transportation option for most of the 2050 MPO's population and employment base. Public outreach efforts for the 2019 Jefferson Area Bicycle and Pedestrian Plan indicated that the community strongly desires additional infrastructure. Creating a more connected network would increase the desirability of bicycling and walking for transportation and recreation in the region.

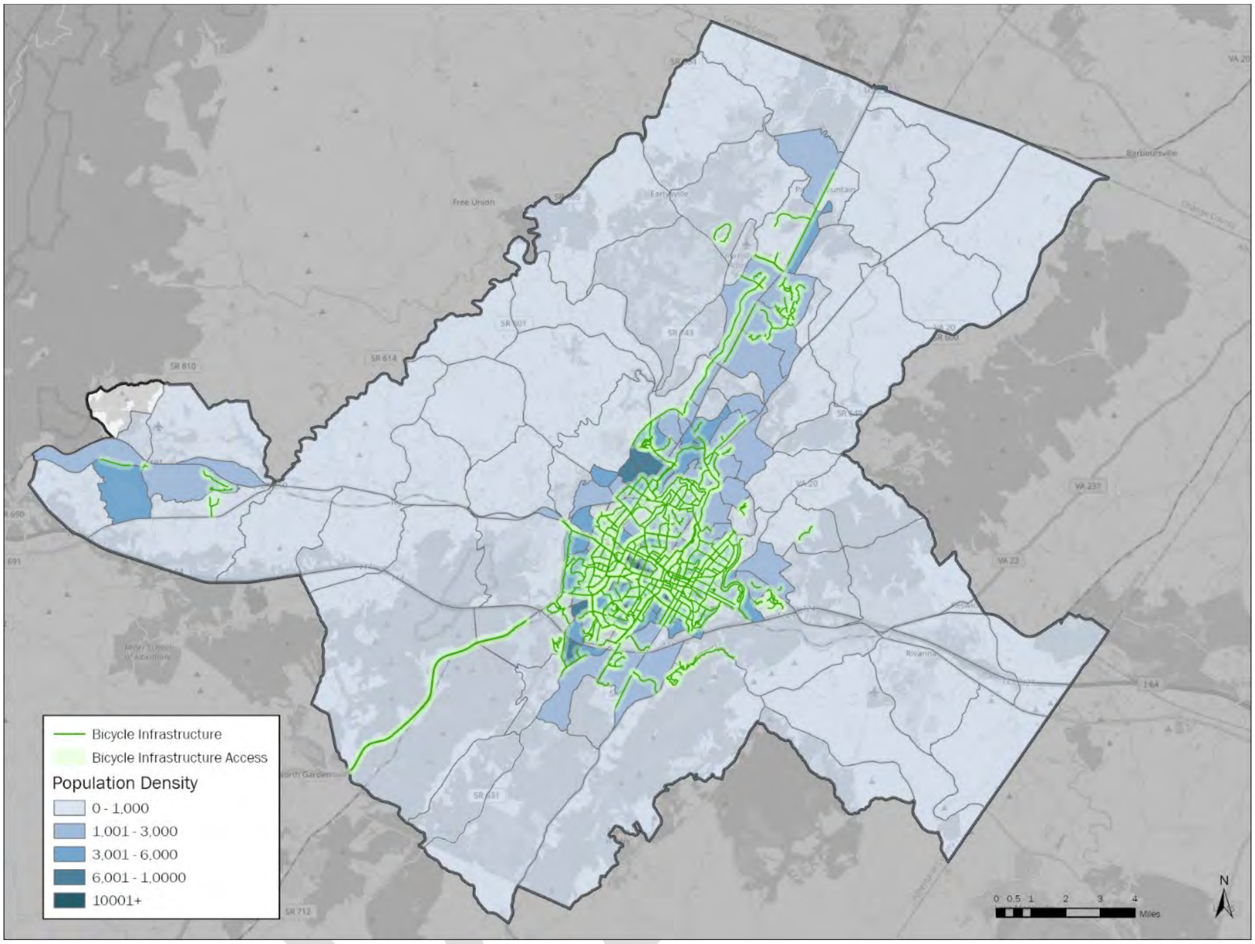
Bicycle

The MPO's bicycle network includes bike lanes, shared-use paths, and shared roadway facilities. This plan's analysis focuses on existing designated bicycling facilities. It does not focus on areas that do not have these facilities but are, in fact, bikeable due to the nature of the roadway. It includes all existing bicycle infrastructure identified, although the Bicycle and Pedestrian Plan identified the need for improved infrastructure in many corridors. Many bike lanes and shared roadways in the region are on roads with speed limits of 35 or 45 mph. In these places, protected bike lanes and shared-use paths could dramatically increase safety and comfort for people riding bicycles.

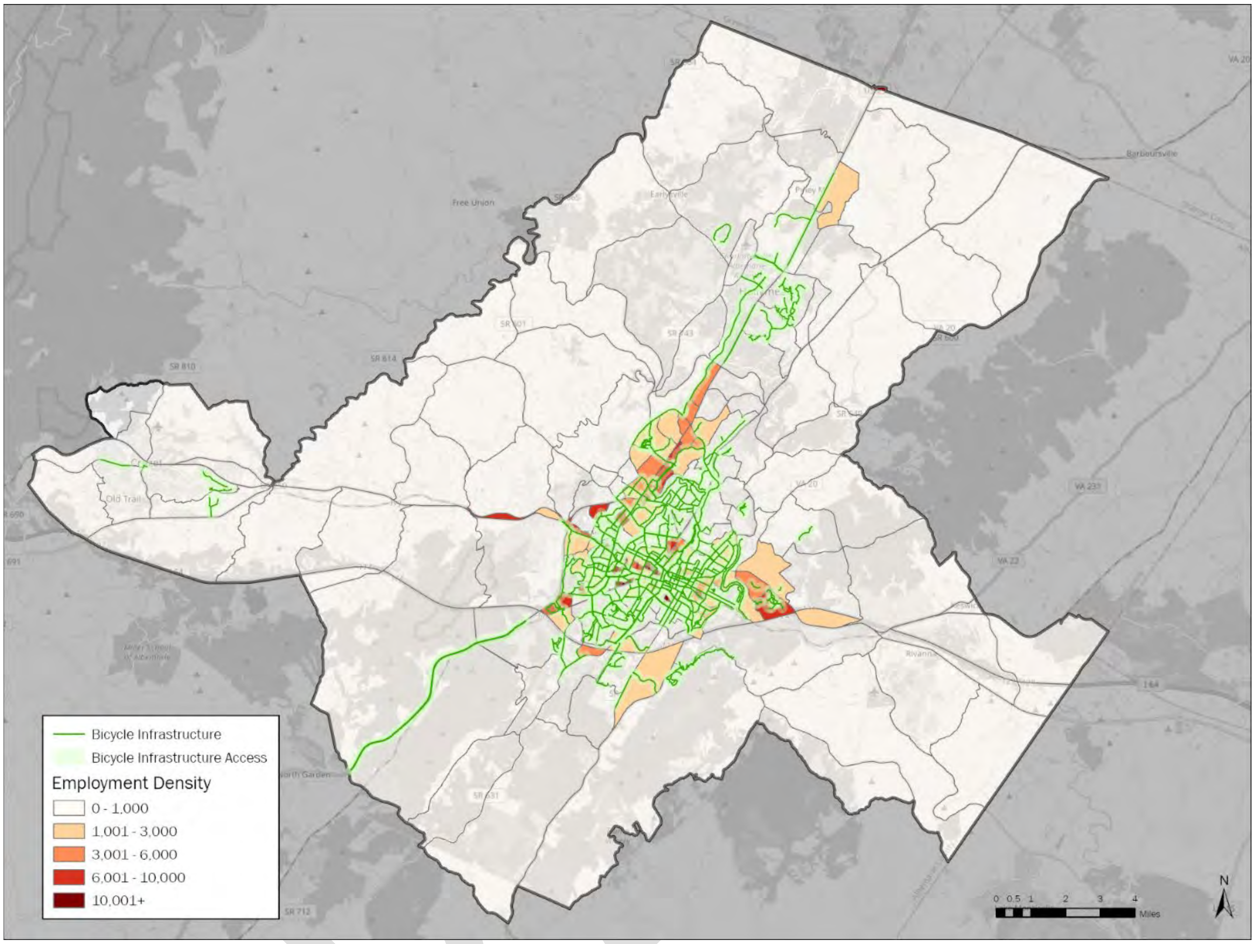
Bicycle Accessibility to Population and Employment Maps

Existing and proposed bicycle facilities were added to each map with a 500-foot buffer. Population and employment within 500 feet were calculated to determine what percentage of the population or employment in 2050 would have relatively easy access to bicycle facilities.

Within the MPO, approximately 31% of the projected population and 49% of projected employment opportunities will be within 500 feet of a bicycle facility in 2050. However, regional biking tends to be limited to smaller zones due to barriers that prohibit bicycling beyond these areas. These maps help identify general areas that would benefit from improved connectivity.



Map 13: 2050 Population Access to Bicycle Facilities. Sources: City of Charlottesville, Albemarle County, U.S. Census Bureau



Map 14: 2050 Employment Access to Bicycle Facilities. Sources: City of Charlottesville, Albemarle County, U.S. Census Bureau

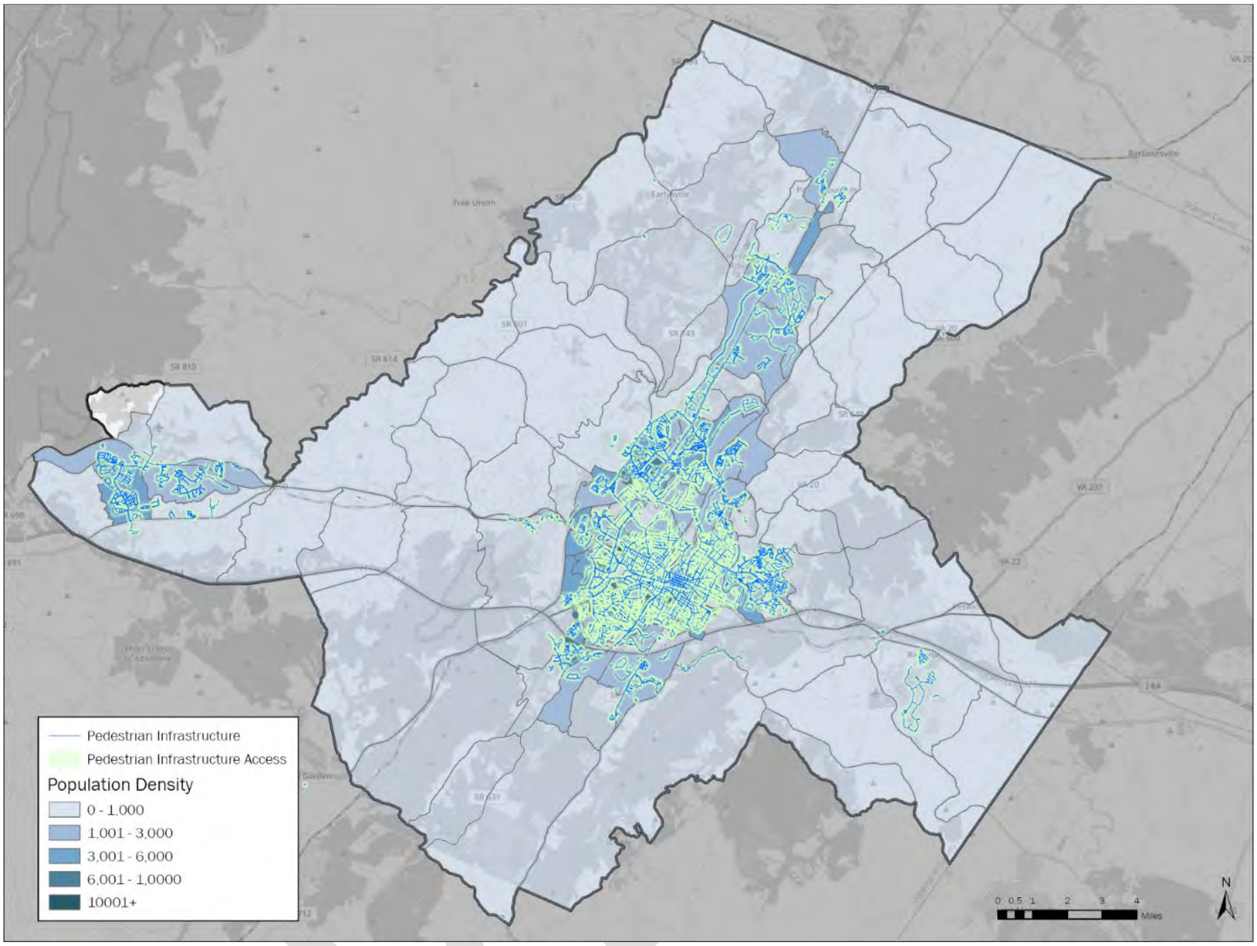
Pedestrian

The MPO's pedestrian network includes sidewalks and walkable areas such as Charlottesville's Downtown Pedestrian Mall. This plan's analysis focused on access to this walkable network.

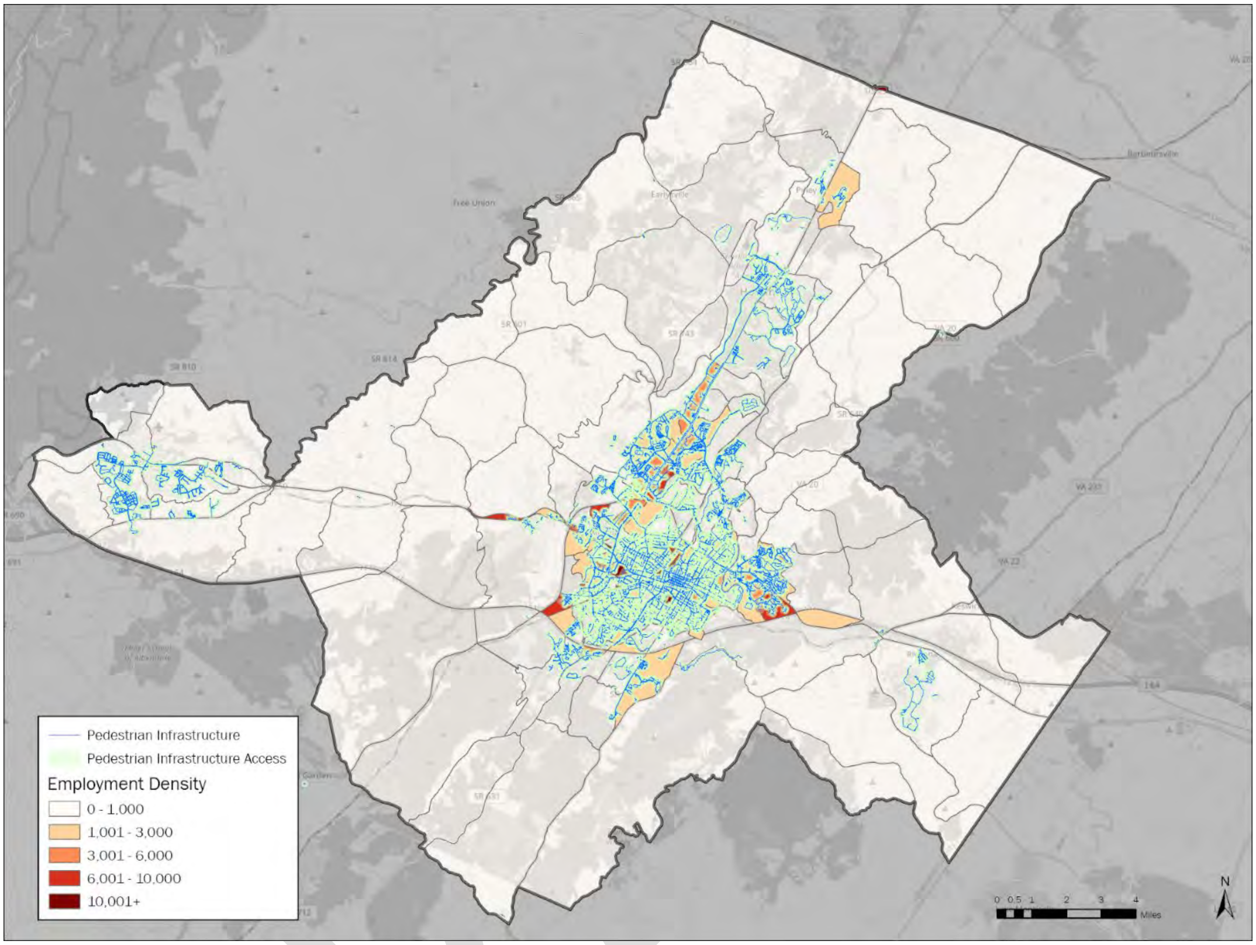
Pedestrian Accessibility to Population and Employment Maps

Existing and proposed pedestrian facilities were added to each map and buffered using a distance of 200 feet. The population or employment within 200 feet of pedestrian facilities was calculated to determine what percentage of the population or employment opportunities in 2050 would have access to a sidewalk or walkable area.

Within the MPO, approximately 48% of the projected population and 63% of projected employment opportunities will be within 200 feet of a pedestrian facility in 2050. The regional pedestrian network, while extensive, is missing links or extensions that would make the network more effective for the region. These maps help identify the general areas that would benefit from improved pedestrian connectivity. Efforts are also necessary to improve conditions on existing sidewalks, as many sidewalks are narrow or difficult to use due to impediments such as utility poles.



Map 15: 2050 Population Access to Pedestrian Facilities. Sources: City of Charlottesville, Albemarle County, U.S. Census Bureau



Map 16: 2050 Employment Access to Pedestrian Facilities. Sources: City of Charlottesville, Albemarle County, U.S. Census Bureau

Conclusion

Transportation deficiency analysis provided MPO staff insights on transportation improvements to consider for Moving Toward 2050. Staff concluded that roadway improvements must be targeted at critical regional locations such as the US 29/US 250 Bypass or US 250 at Pantops. Regarding transit improvements, the ongoing work of the Regional Transit Partnership will be valuable in identifying priorities for the transit system. As part of the Jefferson Area Bicycle and Pedestrian Plan, staff determined that access via bike facilities is limited by significant barriers prohibiting connectivity despite reasonable access to facilities within the urban core. Likewise, staff established that the pedestrian network lacks key links that could provide greater accessibility. Additionally, the development of the needs prioritization process included an evaluation of how access to employment could be improved for each mode.

Staff used this information and recommendations from other plans to develop an initial list of proposed roadway, transit, bicycle, and pedestrian projects targeted at improving these areas. Bicycle and pedestrian projects were taken from the 2019 Jefferson Area Bicycle and Pedestrian

Plan. Intersection and bridge projects were identified based on VDOT and locality evaluations. These projects are discussed further in Chapter 7.

Chapter 4: Needs Evaluation, Project Identification, and Project Prioritization

Overview

This section describes the evaluation process undertaken by MPO staff to evaluate transportation needs, identify candidate projects, and prioritize those projects. The MPO's examination of transportation deficiencies, outlined in Chapter 3, helped inform this process.

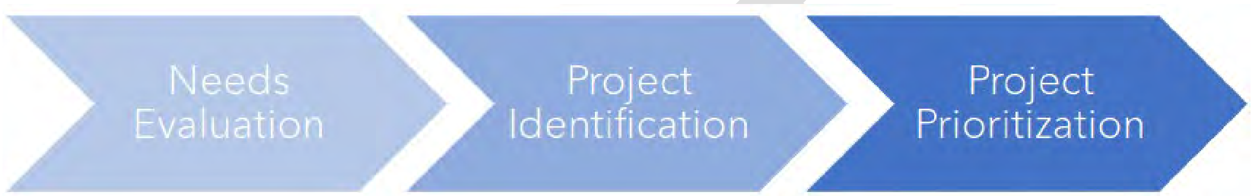


Figure 10: Evaluation Process

Needs Evaluation Process

To prepare for long-range transportation plan development, the MPO successfully applied for and was awarded a technical assistance grant through the Office of Intermodal Planning and Investment (OIPI) to develop a system needs and project prioritization process. This technical assistance aimed to create a process for the MPO to use a data-driven framework to support prioritizing transportation system needs. The process was developed based on MPO-defined goals, and MPO staff worked closely with consultants to identify appropriate evaluation metrics to assess the overall system operations.

The needs prioritization process was developed using the following framework:

1. The process would use publicly accessible data specific to the Charlottesville-Albemarle MPO area.
2. The process itself would be developed based on existing staff and technical capacity.
3. The process is replicable and can be used in future planning efforts.

With the consultant team's support, the MPO identified thirteen metrics to evaluate transportation system needs. The consultants developed two thresholds for each metric, and MPO staff worked with the Technical Advisory Committee and the MPO Policy Board to identify the preferred threshold for each metric. The thresholds determined whether a need was indicated at particular segments.

The final aspect of the needs prioritization process was determining how much weight each metric should carry to prioritize the transportation system's needs. The consultant team developed three potential approaches to the weighting scenarios:

1. ***Accessibility-Focused*:** Prioritizes needs that will improve access to jobs, non-work destinations, and multimodal choices for bicycling, walking, and transit.
2. ***Balanced*:** Prioritizes all categories equally with an increased focus on limiting environmental impacts.
3. ***Mobility-Focused*:** Prioritizes highway and roadway projects that reduce vehicular delay.

The **accessibility-focused** weighting scenario was determined to be the most appropriate for needs prioritization based on feedback received through the engagement process. Table 7 summarizes the data used for the need prioritization process. An in-depth explanation of each evaluation metric can be reviewed in the Charlottesville-Albemarle MPO Performance-Based Planning Process document, included in this plan's appendix.

			Weighting Scenarios		
Prioritization Category	**Evaluation Metric**	**Threshold**	**Accessibility-Focused**	**Balanced**	**Mobility-Focused**
Safety	Roadway Safety (PSI[1])	All PSI locations	15%	12%	15%
	Bike/Ped Safety (PSAP[2] Corridors)	Top 5% District Corridors	15%	13%	15%
Multimodal Accessibility	PAI[3] - Bike/Ped	All segments PAI greater than 0	8%	7%	7%
	PAI - Transit	All segments PAI greater than 0	8%	7%	7%
	PAI - Vehicle	All segments PAI greater than 0	6%	4%	9%
	PAI – Disadvantaged Populations	All segments PAI greater than 0	8%	7%	7%
Efficiency & Economic Development	Travel Time Index (TTI)	Avg weeklong TTI > 1.5 for three hours; > 1.7 for one hour	3%	7%	10%
	Travel Time Reliability (PTI[4])	Avg weeklong PTI > 1.5 for three hours; > 1.7 for one hour	3%	7%	10%
	Transit On-Time Performance[5]	On-time performance less than systemwide average performance from previous year	4%	11%	10%
Land Use Coordination	Walk Access[6] - General	All segments in "somewhat walkable" census tracts	10%	13%	5%

	Walk Access – Disadvantaged Populations	All segments in transit viable EEA[7] that are also in "somewhat walkable" census tracts	20%	12%	5%
Environment	Flooding Exposure	Segments Exposed to Historical Flooding	Applied to aggregate score in other factor areas		
		Additional Adjustment for economically distressed communities	Applied to aggregate score in other factor areas		

Table 7: Needs Prioritization Metrics

After metrics were standardized, they were combined into a needs score for the need category they supported. All standardized values were then summed into a weighted average score, assigning different weights to each metric in the scoring process for each factor. Finally, all need category scores were combined into an aggregate needs score that reflected total need based on all five categories, and staff created a map showing the need score for each road segment (see Map 18).

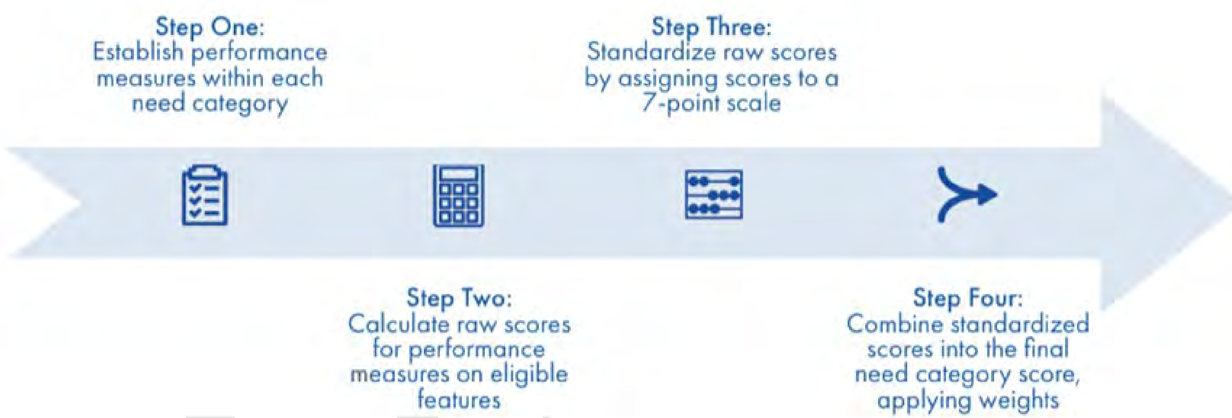
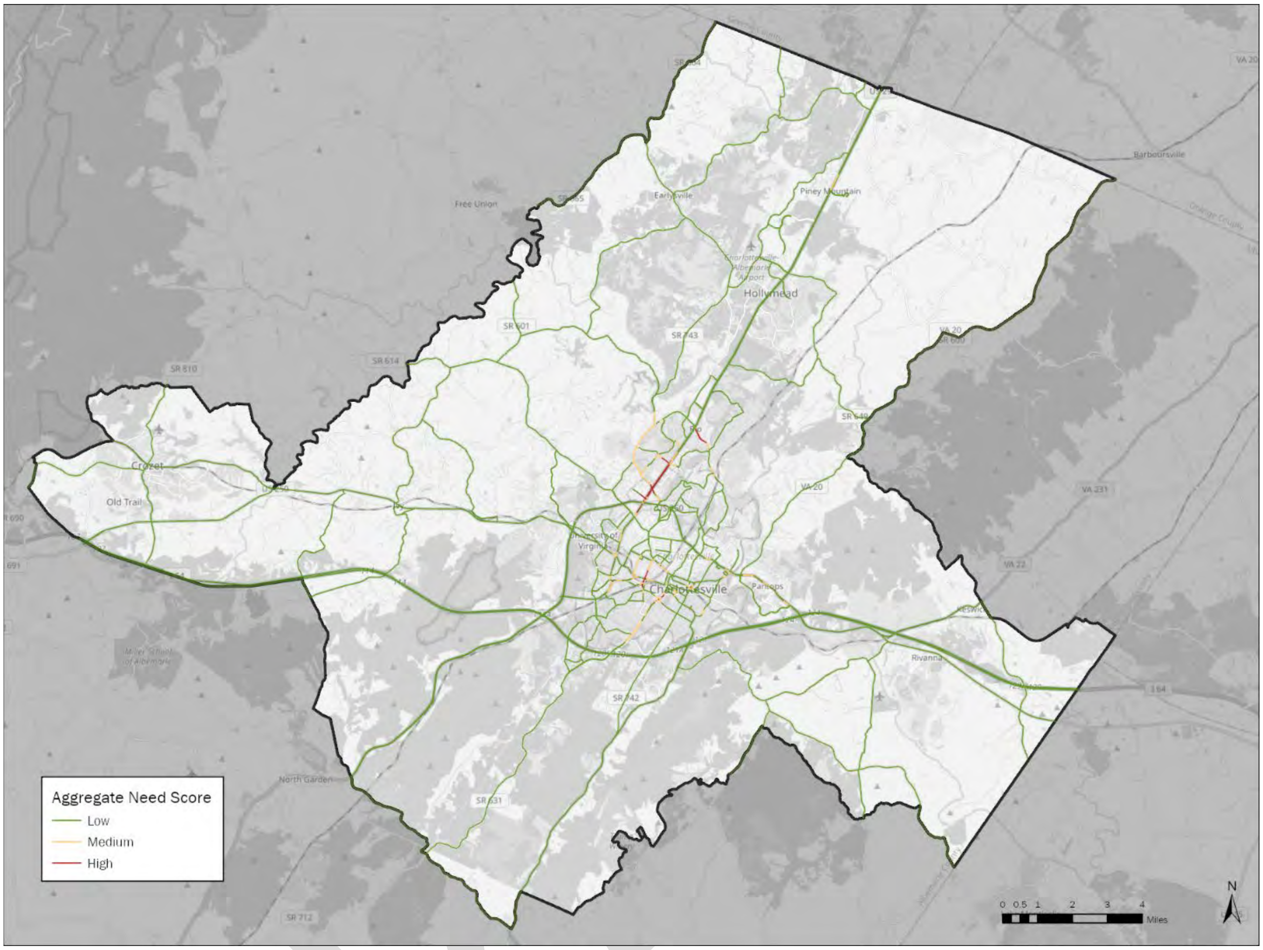


Figure 11: Needs Prioritization Process



Map 17: Road Segments by Aggregate Need Score

Limitations of Needs Analysis

The following limitations were considered as part of the needs evaluation process:

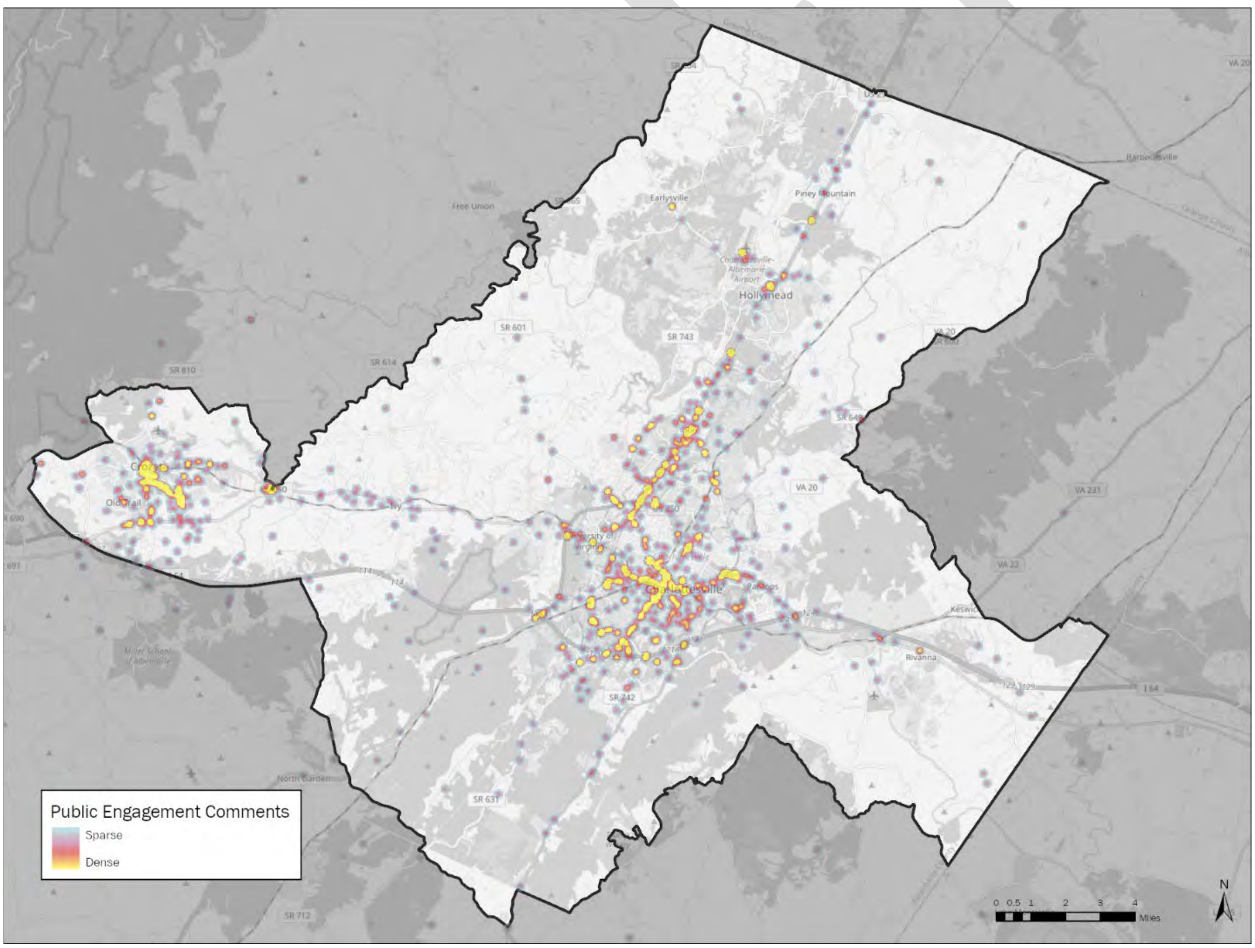
- Staff used 2016-2020 PSI data for analysis. While 2017-2021 PSI data was available, it did not include needs indicated in the City of Charlottesville.
- Needs were coded to existing roadway segments and did not necessarily capture those that could be addressed through off-road shared-use paths or new road alignments.
- Congestion mitigation was incorporated into the need prioritization process using present-day conditions and high thresholds, limiting future operational conditions' impact in determining priority segments. While mitigating vehicular congestion was not a high priority based on public feedback, this also limits needs indicated where multimodal congestion solutions could be identified.
- The Potential for Accessibility Improvement (PAI) measure determines where a high population of people could access more jobs with an accessibility improvement, not necessarily where the improvement needs to occur.

- The aggregation process de-emphasized individual evaluation metrics. A need could be very high in a single category, but it may not be indicated as a high need overall if it does not demonstrate additional needs in other categories.

Public Feedback

MPO staff used public feedback to supplement the data analysis process and review locations with high concentrations of indicated needs. First, staff created a heat map of public comments indicating specific transportation improvements (see Map 19). Then, staff compared the public feedback heat map to the needs analysis output maps to determine where there was overlap and divergence.

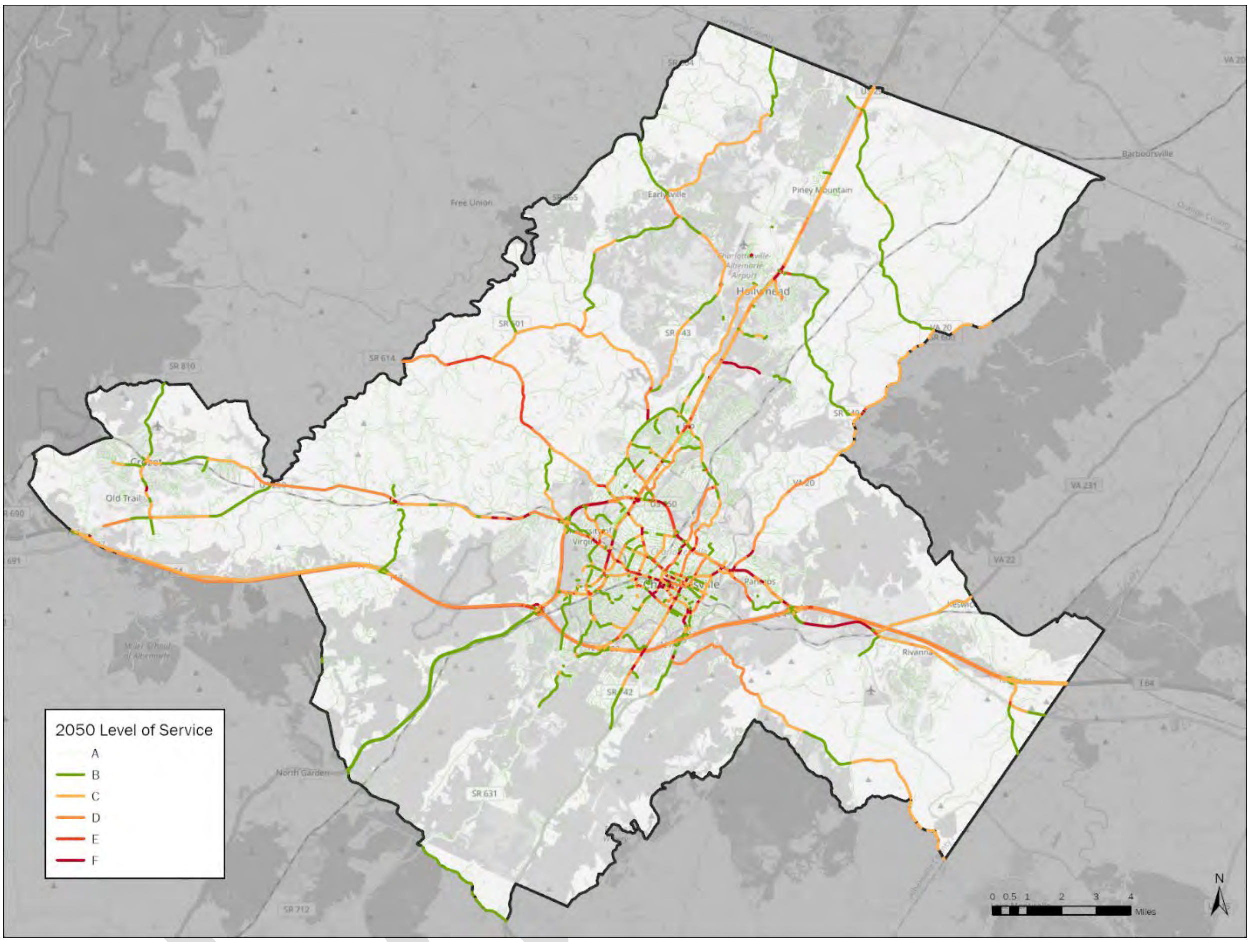
For the most part, public feedback confirmed the needs identified through the data analysis process. However, some exceptions were noted where public feedback indicated strong support for improvements, whereas the data analysis indicated low or no need. Public feedback was also reviewed to determine whether projects under consideration would garner support from the community.



Map 18: Public Engagement Heat Map

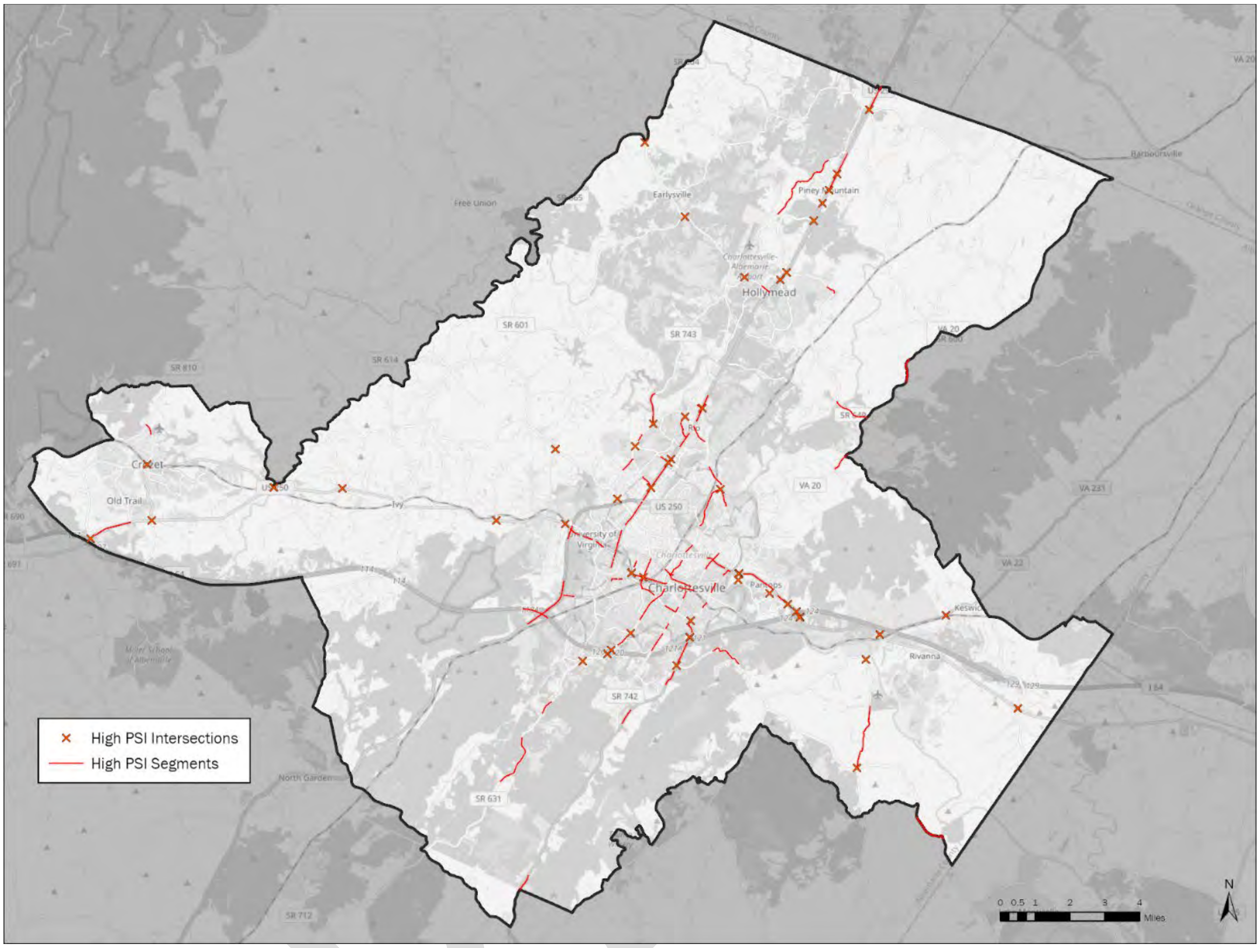
Additional Data Reviewed

To address limitations of the data analysis process, MPO staff also considered future Levels of Service to determine where there may be future capacity concerns based on regional growth projections (see Map 20). This ensured the plan accounted for future travel needs based on projected population and employment growth.



Map 19: 2050 Levels of Service. Source: VDOT

MPO staff also mapped PSI needs to review potential projects' proximity to locations with an indicated need for safety improvements (see Map 21). This additional consideration for projects identifying operational and safety needs aligns with previous efforts to identify priority improvements. It provides some continuity between past efforts and current plan development.



Map 20: PSI Intersections and Segments (2017-2021). Source: VDOT

Project Identification Process

Staff compiled a list of candidate projects based on improvements identified through previous planning efforts or studies, including:

- Small Area Plans
- Corridor Studies
- Transit Strategic Plans
- Regional Plans
- VDOT Project Pipeline & STARS Studies

Project Prioritization Process

After compiling a list of candidate projects, staff worked to prioritize them. Priority projects were identified based on the following:

- Locally identified priority improvements
- Candidate projects that addressed needs identified through the Moving Toward 2050 prioritization process

Indicated needs not addressed by a committed or recently implemented project or a priority project were flagged as *planning priorities*, which will inform the efforts the region undertakes over the next several years to identify solutions to address these identified needs.

Conclusion

The evaluation process has helped identify transportation needs, select candidate projects, and prioritize them effectively. By employing a data-driven framework and engaging stakeholders and the public, the MPO has developed a comprehensive system for prioritizing transportation projects, considering safety, accessibility, efficiency, and environmental impact. Chapter 7 describes how the evaluation process will inform decisions regarding transportation infrastructure investments, ensuring alignment with community priorities and future growth projections.

Chapter 5: Additional Transportation System Elements

Overview

Moving Toward 2050 is a comprehensive process that identifies the needs of many transportation system elements. This chapter will provide information about intersections, bicycle and pedestrian improvements, and bridge needs. These aspects were separated from the roadway and transit analysis for multiple reasons, including the fact that some funding is dedicated to one type of project. Challenges are associated with measuring the impact of various kinds of improvements. For example, the travel demand model used to estimate the congestion impact of roadway and transit projects cannot calculate the effect of intersection or bike/ped improvements. Nonetheless, the transportation network is one system, and any decision should consider all aspects of the network to ensure maximum system performance and a good quality of life for residents of the region.

Intersections

Intersections are a central concern in the MPO, as they are primary areas of congestion, locations where many crashes occur, and barriers to bicycle and pedestrian travel. Given this, VDOT and the localities continuously evaluate conditions at intersections and work to identify improvements that increase safety and multimodal flow through intersections. Intersections identified as essential locations for improvements are listed in Chapter 7.

Regional Bicycle and Pedestrian Network

In 2019, the MPO adopted the Jefferson Area Bicycle and Pedestrian Plan to provide a regional vision for implementing regional bicycle and pedestrian infrastructure. While the Bicycle and Pedestrian Plan identified many corridors and projects, it was not an attempt to compile all potential projects. As such, local efforts will identify additional bicycle and pedestrian needs within and between neighborhoods.

Bridges

Like intersections, bridges are continuously evaluated by VDOT and the localities to ensure safe travel now and in the future. This LRTP includes information that VDOT has collected regarding bridge conditions, and the MPO will continue to monitor these conditions as part of the national performance measures. A list of bridges currently identified as being in poor or fair condition or otherwise needing improvement is provided in Chapter 7. Chapter 7 also contains a list of bridge improvement projects that have already been funded.

Chapter 6: Planning for Uncertainty

Overview

This chapter discusses some uncertainties related to long-range transportation planning and provides an overview of technologies and trends essential to transportation planning. While there is constant debate about how innovations will change how we move people, goods, and services, this plan acknowledges the uncertainties of 20-year plans.

Changing Technologies

The transportation sector is entering a period of rapid change and technological disruption. New services such as bike-sharing and Transportation Network Companies (TNCs) coupled with a move towards autonomous vehicles and connected infrastructure are reshaping how people and goods move. These new technologies and new travel modes have the potential to reshape the transportation landscape radically. With some technologies being relatively new and evolving, there is very little consensus around planning for them and making assumptions for the future. Long-range plans require a two-decade planning horizon, and many planning assumptions used for that 20-year vision are based on historical trends. These trends are changing rapidly and may not represent future transportation systems. Therefore, it is important to monitor trends and new developments and adapt the plan to meet the needs of this changing landscape. It is also crucial that local, regional, and state decision-makers are aware of these trends and are prepared to embrace or regulate them as necessary. Currently, the City of Charlottesville and Albemarle County are taking action to encourage appropriate use of some of the new technologies described in this chapter.

This plan continues the process of understanding the new modes and technologies. Future iterations will have to adapt continuously to the changing nature of transportation. Many of the projects included in this plan are designed to fix current capacity constraints and improve operational efficiency, safety, and mode choice. Therefore, the projects are expected to help meet the transportation needs in both the short- and long-term.

Transportation Network Companies

The Metropolitan Planning Area (MPA) is serviced by two Transportation Network Companies (TNCs), also known as Mobility Service Providers (MSPs). Uber and Lyft rely on online-enabled platforms to connect users and drivers. One of the hallmarks of these systems is the use of noncommercial vehicles. This differs from local taxi services, which have provided similar on-demand transportation services to the region for many decades.

The arrival of TNCs has already begun to change some travel behaviors, especially with Charlottesville's large university population lacking personal cars. As these services continue to grow in popularity, planners may need to rethink the design of downtown streets better to facilitate drop-off and pickup activities at the curb. TNC services will likely play a small but growing role in the Moving Toward 2050 planning horizon.

Shared Mobility Programs

Shared mobility programs are one form of innovation reshaping active transportation by addressing the demand for quick and affordable transportation in urban areas. Since the 2045 LRTP was adopted, many companies have taken on the role of bike-share providers and have introduced dockless electric scooters. In 2018, the City of Charlottesville approved a temporary Dockless Scooter and Bicycle Policy Pilot Program to evaluate their impacts in Charlottesville. The City provided permits to two providers (Lime and Bird), and the first dockless scooters were introduced in December of 2018. Veo, a competitor to Lime and Bird, now provides dockless scooters and electric bikes, which have become a regular fixture on local streets.

While shared mobility provides convenient travel options, these programs have also caused many concerns. Ensuring their appropriate and safe use is essential if scooters are to remain as a mode of travel. Appropriate scooter parking is necessary to avoid obstructing sidewalks or otherwise endangering or limiting pedestrian access. Despite bike-share and other shared mobility programs aiming to provide affordable mobility options, the cost and dependence on smartphones and credit cards can still make them inaccessible to some vulnerable populations. To make bikes and scooters accessible to everyone, many programs have introduced discounts or subsidized passes for riders based on income thresholds and have options for text-to-unlock features. Given these concerns locally and in cities nationwide, it is unclear if electric scooters will continue to serve as a valid transportation option or disappear in the coming years.

Electric Bikes and Scooters

Electric bicycles (e-bikes) continue to grow in popularity as technological advancements allow for lower costs and longer battery life. Additionally, some e-bikes can match travel speeds with city speed limits, allowing riders to keep pace with automobile traffic. The Department of Energy reports that e-bike sales skyrocketed by about 30 percent, from 325 thousand bikes sold in 2018 to 1.1 million in 2022. These improvements are especially influential in hilly communities like Charlottesville, where stronger motors and batteries make biking available to more riders.

The region may expect more trips to transition from single-use occupancy vehicles as electric bikes and scooters become more popular. Additional bike facilities can accommodate this shift. The region may also want to consider more bike storage and racks. The MPO may need to reevaluate the modal split in the model for future updates of the LRTP.

Connected and Autonomous Vehicles

Connected Vehicles (CVs) and Autonomous Vehicles (AVs) are two technologies likely to impact transportation significantly within the 2050 planning horizon. CVs refer to vehicles that can communicate with one another to achieve goals such as reducing traffic congestion and improving safety. Autonomous vehicles refer to vehicles that can travel independently of a human operator. The precise timeframe for the widespread implementation of these technologies is uncertain.

There is disagreement on the costs and benefits the technologies will have on the transportation network. Some research indicates a potential upside for the capacity of roadways, while other predictions indicate a scenario with roads clogged with roving AVs. The technology has several potential benefits, such as reduced traffic congestion, increased safety, reduced fuel consumption and travel time, lower insurance and healthcare costs, better city planning due to less need for parking, increased productivity, and improved personal mobility and public transit.

The impact of CVs and AVs on future commuting patterns is not clear. Some research suggests that they could increase vehicle miles traveled (VMT) by encouraging workers to live farther away from employment and take advantage of their commute time to increase productivity. The impact of CVs and AVs on vehicle ownership is another significant factor. Some research suggests that they will reduce personal vehicle ownership, and consumers will use on-demand driverless transportation services for most of their travel. CVs and AVs also have the potential to change transit, freight movement, and other travel significantly. Since autonomous vehicles would not have drivers, transit and freight costs would dramatically decrease. The decrease in other limitations, such as required breaks and rest stops, may lead to these vehicles being operational continuously or for more hours of the day.

There are barriers to the widespread adoption of CVs and AVs, such as public safety and privacy concerns from possible equipment failures and cyber security. There is also uncertainty regarding the impact of the partial implementation of CVs and AVs, which would result in a mixed fleet of driverless and non-autonomous vehicles. Estimates for how long it would take for the vehicle fleet to transition from non-autonomous to driverless vehicles are generally more than ten years. Fully automated safety features, such as highway autopilot, are not expected to be used across a large portion of the vehicle fleet for many years. VDOT has developed a Connected and Automated Vehicle Program Plan, and the MPO will continue to monitor systems as they evolve over the next five years.

Transit

New technologies and their applications continue to influence transit services across the country. Strategies like bus-only lanes and bus priority at traffic signals make routes more efficient and reliable. Technology also has the potential to make paying transit fares quicker and easier than in the past. Autonomous transit vehicles, including those tested in Albemarle County, could dramatically decrease transit service costs. On-demand mobility is also an opportunity for transit agencies, as they may determine that they can provide improved service and efficiency by replacing low ridership routes with flexible, on-demand services.

Access to real-time transit data, often on cell phones, has made transit more desirable for riders. However, the increase in other transportation options, such as the on-demand mobility services provided by TNCs, may decrease the number of people using transit. CAT is currently implementing a micro-transit pilot called “Micro-CAT,” and Jaunt is currently undergoing a micro-transit study. It is also possible that the transportation changes discussed in this chapter will lead to fewer households owning cars and an increase in transit use in combination with other modes.

Telecommuting and Remote Work

Even before the COVID-19 pandemic, a growing proportion of the workforce worked from home. Before 2020, the U.S. Census Bureau showed that approximately 7% (5,402) of residents in the MPO area worked from home — a 22% increase since 2010. Nationally, the number of Americans working from home increased from 2.2 million in 1980 to 11 million in 2020. During the pandemic, the 2021 American Community Survey showed that 27.6 million people (17.9% of the workforce) primarily worked from home. In 2023, 12.7% of full-time employees worked from home. While many employers ask their workers to return to the office, Forbes reports that teleworking will continue to increase, following a forty-year trend.

As these trends continue, the region should incorporate communications and internet access as transportation assets, satisfying the commuting needs of a growing proportion of the workforce. Modeling should also consider how these changing conditions could influence roadway volumes.

Unmanned Aerial Vehicles (UAVs)

Debates and research continue into the application of Unmanned Aerial Vehicles (UAVs), commonly referred to as drones. Several industries are researching ways to use UAVs to deliver goods for commercial purposes and even medical services.

There are too many technological, business, and legal uncertainties to predict how UAVs may influence the transportation network in the next two decades. However, the MPO should continue to track this topic and adjust plans as drone applications evolve.

Sustainable and Resilient Transportation Systems

The region's transportation system is a notable source of greenhouse gas emissions and is vulnerable to climate change impacts in the short and long term. Using gasoline to power vehicles contributes significantly to greenhouse gas emissions in this region and nationwide. Albemarle's climate action data suggests that in 2000, the transportation sector was responsible for 52% of greenhouse gas emissions in the County, the largest share of emissions by sector, followed by residential (27%) and commercial (11.5%). The 2016 Greenhouse Gas Inventory in Charlottesville indicated that transportation sector emissions were approximately 28% of total emissions in the City. A similar proportion came from residential uses (30%) and commercial uses (27%).

Coordinating transportation and land use planning is essential to reducing transportation emissions. Land use decisions significantly influence the number and length of trips made in the region and the mode used for each trip. These land use factors include the density of development and how it is connected to the transit, roadway, bicycle, and pedestrian networks.

Strategies that could reduce regional transportation greenhouse gas emissions include increasing public transit frequency and routes, building more bicycle and pedestrian infrastructure, encouraging ridesharing, installing charging stations for electric vehicles, and increasing the number of people who work from home. Many of these strategies involve changing resident behavior to reduce the number of vehicle trips. Strategies should substantively involve citizens to reduce regional greenhouse gas emissions successfully.

Climate change raises important questions about community resilience and adapting infrastructure for an environment that may have different precipitation or temperature patterns than we experience today. For example, communities in our region and nationally have recently been confronted with increases in flooding. Transportation planning in the 21st century will require increased attention to resiliency and environmental protection. Roads and parking lots are generally impervious surfaces, which increase runoff, pollution of waterways, and potential for flooding. For these reasons, transportation planning must continue to avoid flood-prone areas, maintain wetlands, and include flood mitigation strategies.

Chapter 7: Transportation Projects Identified

Overview

As explained in Chapter 4, a primary requirement for the LRTP is the creation of constrained lists of projects based on estimates of future funding. Estimating future funding has become more challenging in recent years, particularly since Virginia has moved to a competitive method of distributing major funding, SMART SCALE. Including a project in the constrained list of this LRTP has less impact than in the past, as each project needs to compete for state and federal funding regardless of whether it is in the constrained list or the vision list. Nonetheless, the constrained and vision lists are an essential component of this LRTP, and they identify projects that the region desires to receive state and federal funds to construct.

Transportation projects in the region were split into four categories, based on Transportation Improvement Program (TIP) groupings, for evaluation and inclusion in the constrained and vision lists. These categories are:

- **Safety and Operational Improvements** that improve safety and flow for those using vehicles, as well as improving bicycle, pedestrian, and transit infrastructure.
- **Transportation Enhancements** that create safe and desirable infrastructure for bicycling and walking.
- **Transit Projects** that increase transit service in the region.
- **Bridge Projects** that rehabilitate or replace bridges to ensure the region's bridges remain safe and in good condition.

Funding Estimates

MPO staff worked with VDOT staff to create estimates for the state and federal transportation funds the region will receive before 2050. The amount of money currently programmed for each type of project in the TIP was used to estimate funding.

New Construction Projects

Steps taken to determine the constrained amount for new construction projects are outlined below.

First, staff reviewed the following funding sources from VDOT's budget forecast spreadsheet for 2040 – 2050.

Budget Forecast 2024 - 2050	
District Grant Program Funding	$220,735,991
High-Priority Projects Program Funding	$196,303,710
Interstate Corridor Fund	$536,563
Other Federal Funding	$16,201,840
Total	**$433,778,105**

Next, the total from the above funding sources was divided proportionally among three TIP groupings:

Groupings	TIP	% of Total	LRTP Constrained Budget Amount
Safety and Operational Improvements	$243,333,199.00	92.90%	$ 402,970,535.24
Transportation Enhancements	$10,365,594.00	3.96%	$ 17,165,881.92
Traffic and Safety Operations	$ 8,237,514.00	3.14%	$ 13,641,687.36
Total	**$261,936,307.00**	**100%**	**$ 433,778,104.53**

Then, staff combined the Safety and Operational Improvements and Traffic and Safety Operations into a single category:

Groupings	LRTP Constrained Budget Amount
Safety and Operational Improvements (combined)	$ 416,612,222.60
Transportation Enhancements	$ 17,165,881.92
Total	**$ 433,778,104.53**

Note: *Budget projections do not include Revenue Sharing allocations or any funding through US DOT discretionary grant programs. Revenue Sharing is available every two years with an allocation of up to $10 million per locality (the maximum amount a locality can receive per funding cycle and the entirety of an individual project; the match for revenue sharing is 50%).*

Non-Construction Bridge Projects

Non-construction bridge projects will be funded through a combination of maintenance and State of Good Repair (SGR) funding sources. Steps taken to determine the constrained amount for new bridge projects are outlined below.

First, staff referred to the following funding sources from VDOT's budget forecast spreadsheet for 2040 – 2050.

Budget Forecast 2024 - 2050	
Maintenance - Localities	$100,483,900
Maintenance - VDOT	$1,004,271,230
State of Good Repair	$177,315,823
Total	**$1,282,070,953**

Next, the total from these funding categories was divided proportionally among the following TIP groupings:

Groupings	TIP	% of Total	LRTP Constrained Budget Amount
Bridge Projects	$ 9,624,826.00	12.38%	$158,678,934.20
Preventative Maintenance	$ 49,752,817.00	63.98%	$ 820,245,890.66
Bridge Maintenance	$ 18,387,625.00	23.65%	$ 303,146,128.29
Total	$ 77,765,268.00		**$ 1,282,070,953.14**

Note: Preventative Maintenance projects do not need to be included in the LRPT. They are referenced to determine how much funding can be allocated for bridge maintenance and repair.

Then, the Bridge Projects and Bridge Maintenance categories were grouped into one category:

Grouping	LRTP Constrained Budget Amount
Bridge Projects	$ 461,825,062.49

Funded Projects

Each year the Virginia Commonwealth Transportation Board (CTB) creates a funding plan for projects for the next six years, referred to as the Six-Year Improvement Program (SYIP). The full list of projects can be viewed on VDOT's Six-Year Improvement Program website.

Constrained and Vision Lists by Category

Following the evaluation process described in Chapter 4, MPO staff created final project lists. The MPO Technical Committee, Citizens Transportation Advisory Committee, and Policy Board reviewed the lists at multiple meetings in 2023 and 2024. All projects listed here should be considered equally eligible for federal, state, or local funding, given the uncertainty related to funding sources and the likelihood that different projects will be eligible and competitive for various funding sources.

Safety and Operational Improvements
Constrained Projects
Rio Road Peanut-Shaped Roundabout and Shared Use Path
Airport Road and US 29 Intersection Improvements
Ivy Road Corridor Improvements, including Multimodal Improvements on Old Ivy Road
US 250 Corridor Improvements from Crozet Avenue to Old Trail Drive
Avon Street Extended and Mill Creek Drive Intersection Improvement

Eastern Avenue Connection between Westhall and US 250
Barracks Road Corridor Improvements between Georgetown Road and Emmet Street (Pipeline)
Ridge/McIntire/W. Main/South/Water Street Intersection Improvement
Rio Road Corridor Improvements between Huntington Road and Greenbrier Terrace
Hillsdale South Extension, including 250 Interchange and Multi-Modal Improvements
Peter Jefferson Parkway & Rolkin Road Access Management/Pedestrian Improvements
Vision Projects
US 29 between US 250 and Hilton Heights Road (including Greenbrier Drive)
Multimodal Connectivity Studies
US 29 between Exit 118 and Ivy Road
E. High Street from US 250 to Locust Avenue
Route 29 Corridor Improvements, Hydraulic Road to Rio Road
Route29 Corridor Improvements, Rio Road to the Rivanna River.
5th Street Station/5th Street Intersection Improvements
Louisa/Milton Road Pipeline Bundle
Greenbrier and Commonwealth Drive Intersection Improvements
Greenbrier and Route 29 Intersection Improvements
Earlysville Road Corridor Improvements between Ivy Creek and Hydraulic Road
Implement improvements identified through the development of the Comprehensive Safety Action Plan

Table 8: Safety and Operational Improvement Projects

Transportation Enhancement
Constrained Projects
I-64 and 5th Street Interchange Improvement
Old Lynchburg Road Shared Use Path between Ambrose Commons and 5th Street
Berkmar Drive Shared Use Path between Rio Road and Hilton Heights Road
5th Street Multimodal Improvements from Harris Road to City/County Line, including Moores Creek Crossing
Preston Avenue Multi-Modal Improvements from 10th Street NW to Ridge/McIntire
Peter Jefferson Parkway & Rolkin Road Access Management/Pedestrian Improvements
Rivanna River Bicycle and Pedestrian Bridge between Pantops and Woolen Mills
Vision Projects
Three Notched Trail Shared Use Path
10th and Page Multimodal Improvements, including improvements along 10th Street between Preston and Cherry Avenue
North side of Jefferson Park Avenue from W. Main Street to McCormick Road
29 North/West Main/UVA Bus Rapid Transit Alternatives Analysis
Route 20 Shared Use Path
Greenbrier Drive/John Warner Parkway Multimodal Connection
Shared Use Path connection between the 10th & Page neighborhood and Schenk's Greenway (Rail to Trail Project)

Three Notched Trail Section Improvements (as identified by the Albemarle County RAISE Grant)
Hydraulic Road from Earlysville Road to Georgetown Road (including Lambs Lane Campus) Multimodal Improvement
Emmet Street between Barracks Road and US 250 Bypass Multimodal Improvements
Biscuit Run Bicycle and Pedestrian Connections
14th Street NW from Grady Avenue to W. Main Street Multimodal Improvements

Table 9: Transportation Alternative Projects

Transit Projects
Microtransit in Pantops
Microtransit along Northern 29 Corridor
Free Trolley Service Improvements
Route 7 Service Improvements
Route 8 Service Improvements
Expanded Bus Stop Amenities
Expanded Microtransit Service in Charlottesville and Albemarle Growth Areas
CAT Existing Facility Expansion

Table 10: Transit Projects

Bridge Projects
Keswick Road over Carroll Creek (VDOT Structure #6224, Poor Condition)
Arrowhead Valley Road over Branch Moores Creek (VDOT Structure #6229, Poor Condition)
Arrowhead Valley Road over Branch Moores Creek (VDOT Structure #6230, Poor Condition)

Table 11: Bridge Projects

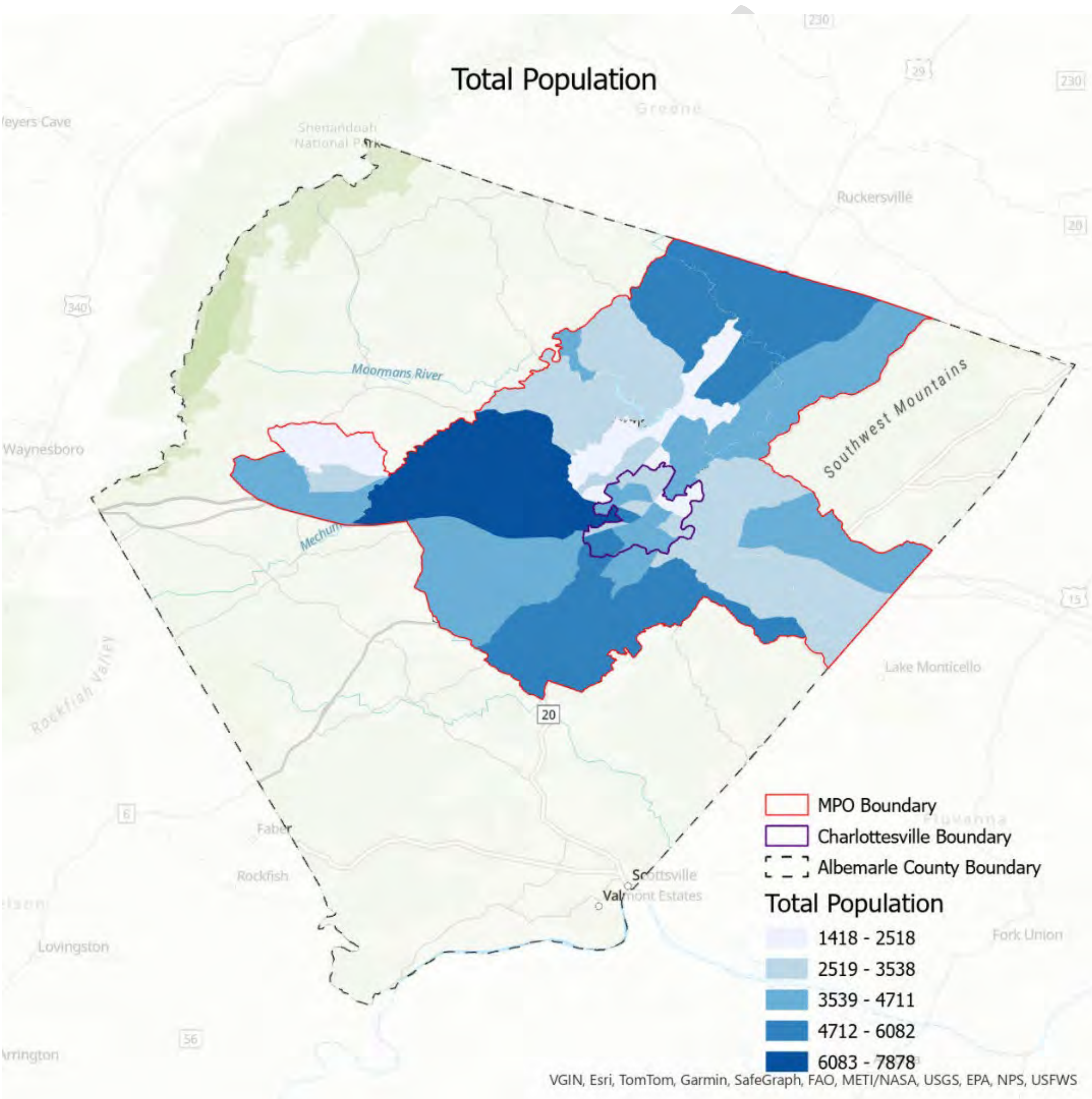
Conclusion

As FHWA and FTA require, the MPO has created constrained project lists and identified additional projects included in vision lists. These lists will ensure coordinated decision-making by federal, state, and local officials regarding important regional projects in the MPO in the coming years.

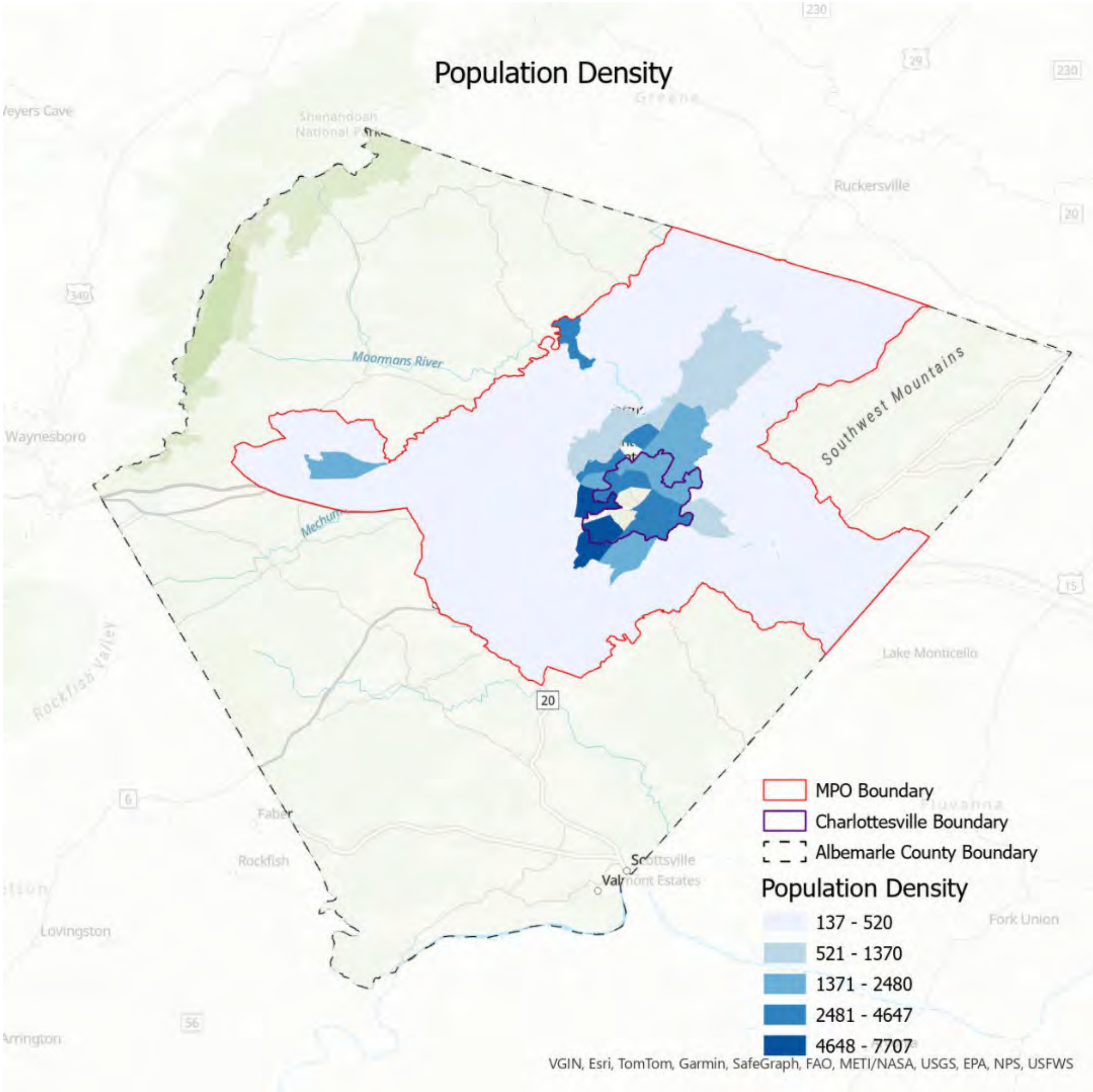
Appendix A: Demographics

Population

The MPO's population is concentrated most densely in the City of Charlottesville and its immediate surroundings, with moderate densities also located along US Route 29 and Crozet. The following maps provide a clearer picture of the area's overall population and densities by US Census block groups according to 2022 American Community Survey (ACS) 5-year data.



Map 21: Total Population



Map 22: Population Density

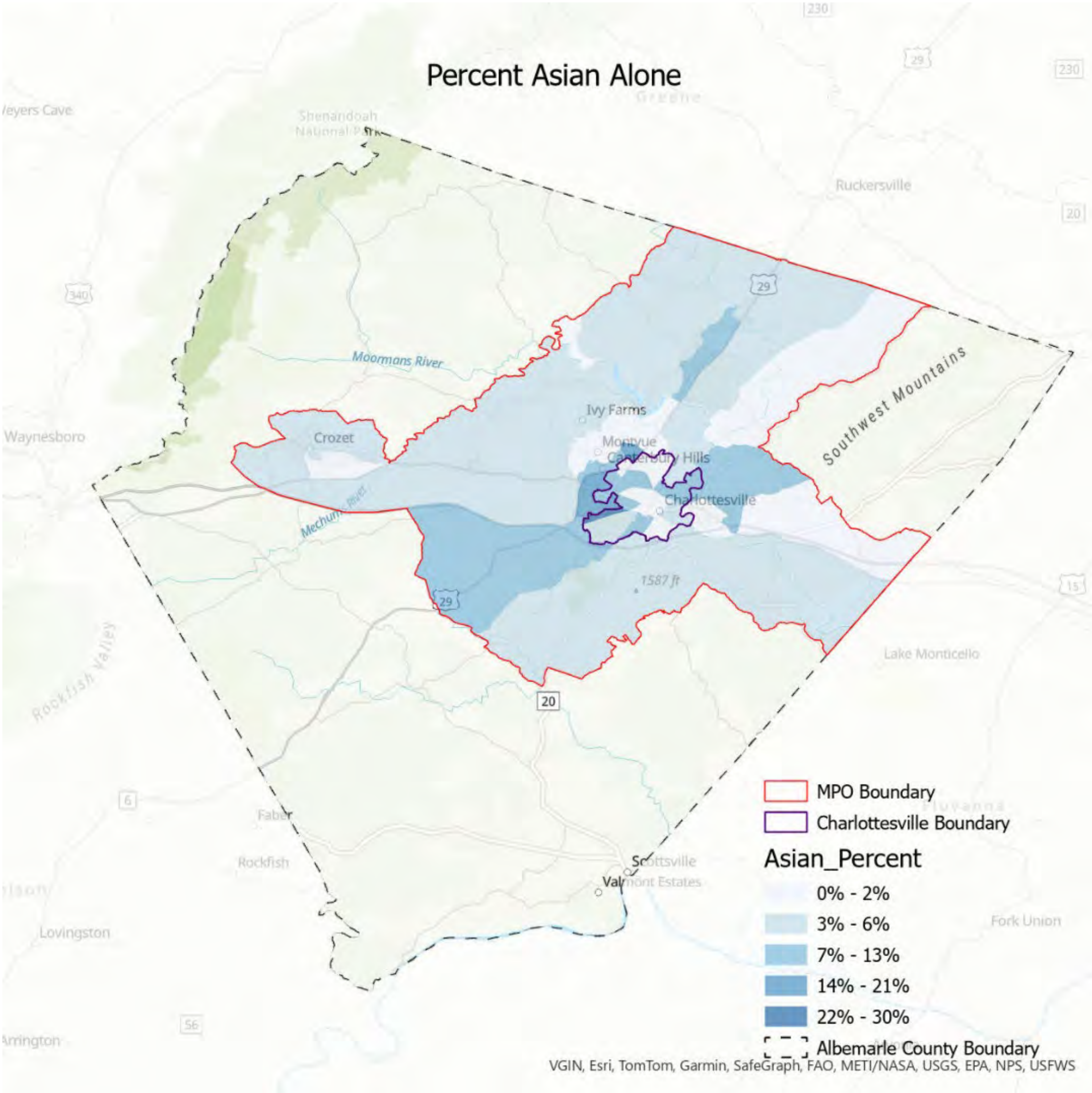
Race & Ethnicity

The City of Charlottesville and Albemarle County contain diverse populations. The table below summarizes some basic demographics for the area using the latest American Community Survey estimates.

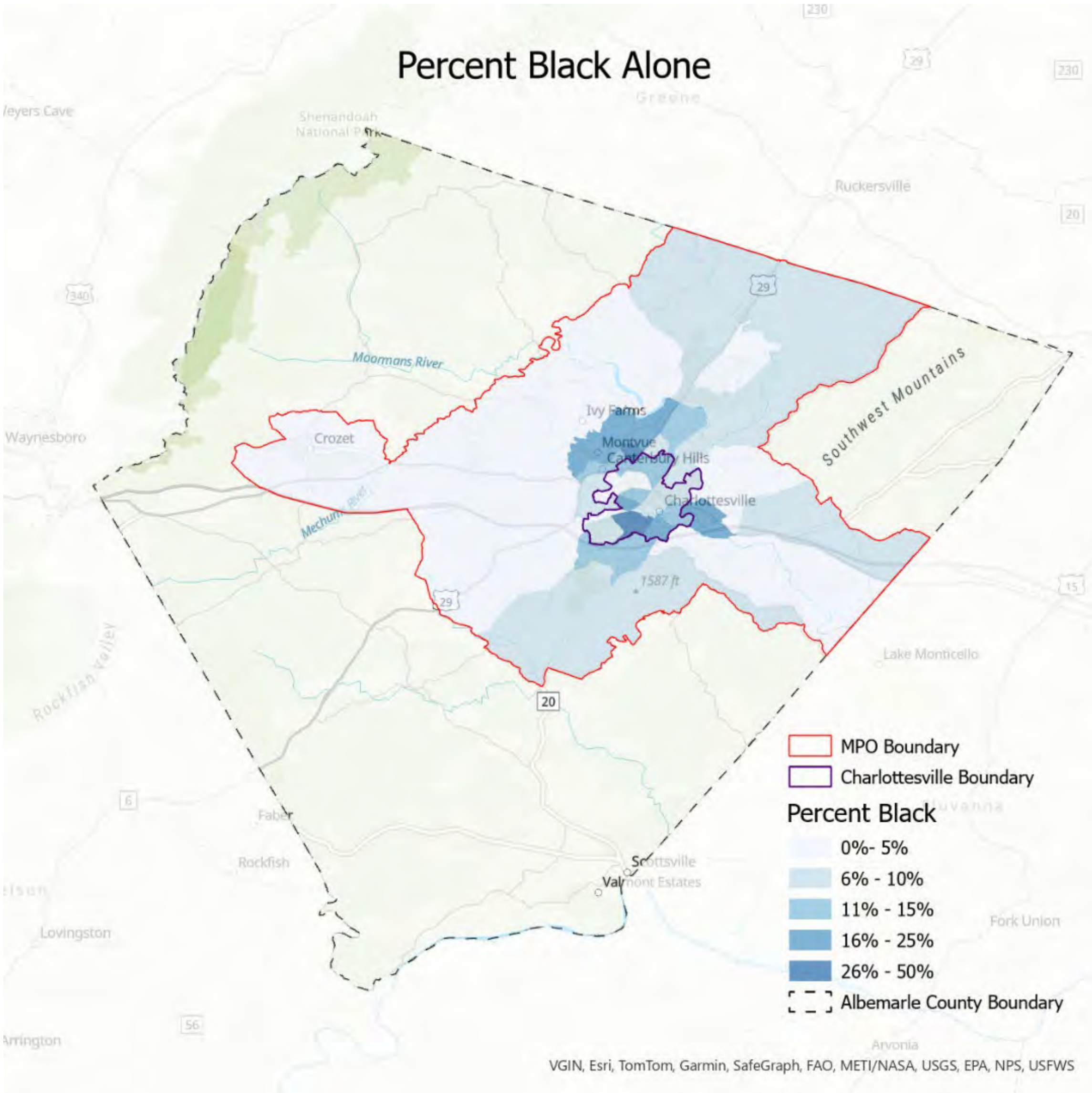
Racial Identity/Ethnicity	Charlottesville	Albemarle County
Non-Hispanic White	68.5%	74.7%
Black or African American	17.2%	8.0%
Asian	7.0%	5.4%
Hispanic	5.8%	5.8%
American Indian and Alaska Native	0.2%	0.2%
Native Hawaiian and Other Pacific Islander	0.0%	0.0%
Some other race	1.2%	3.4%

Table 12: Race & Ethnicity. Source: ACS 5-Year Estimates (2022)

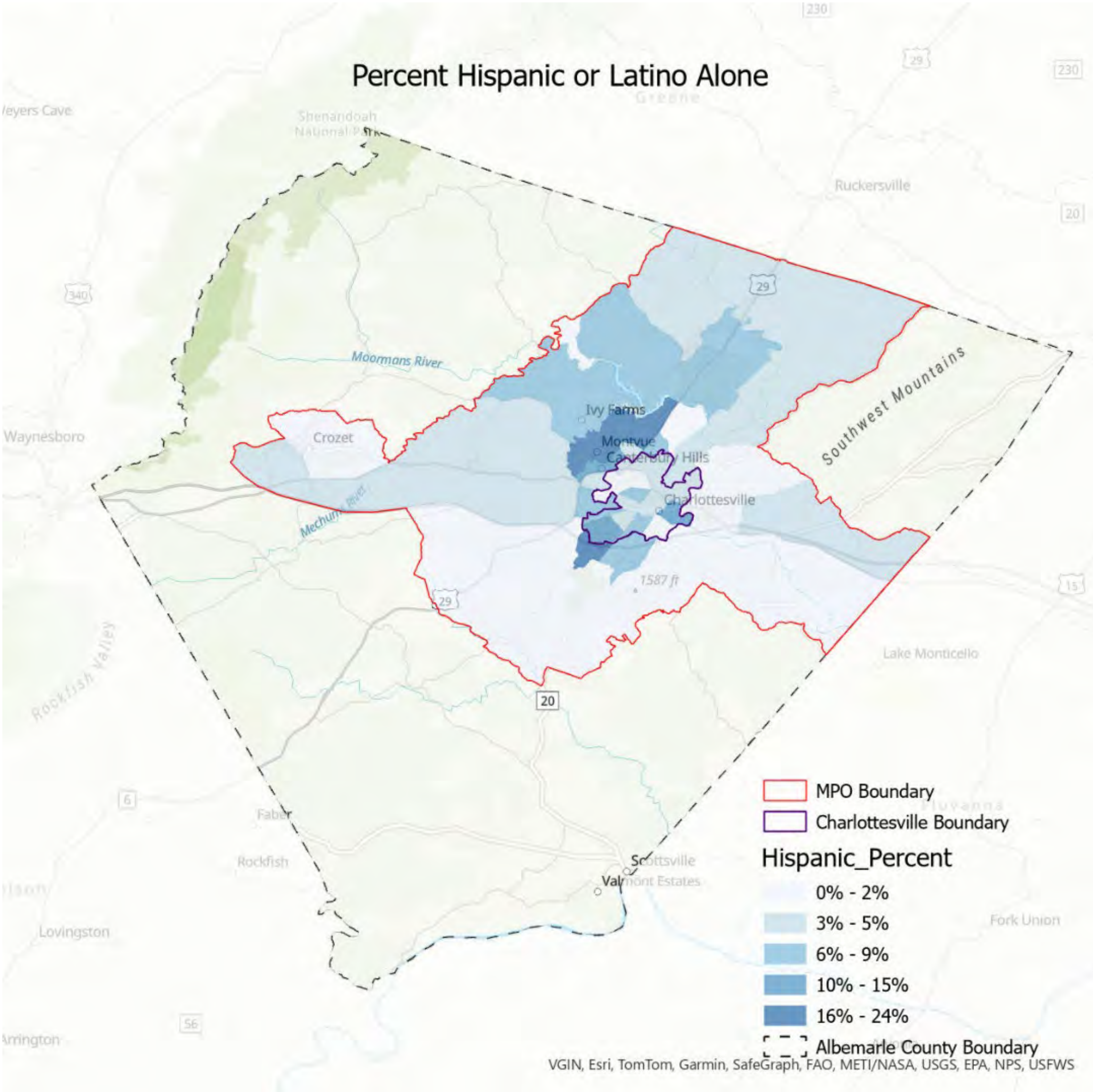
The following maps provide a more detailed breakdown of the region's racial/ethnic identity.



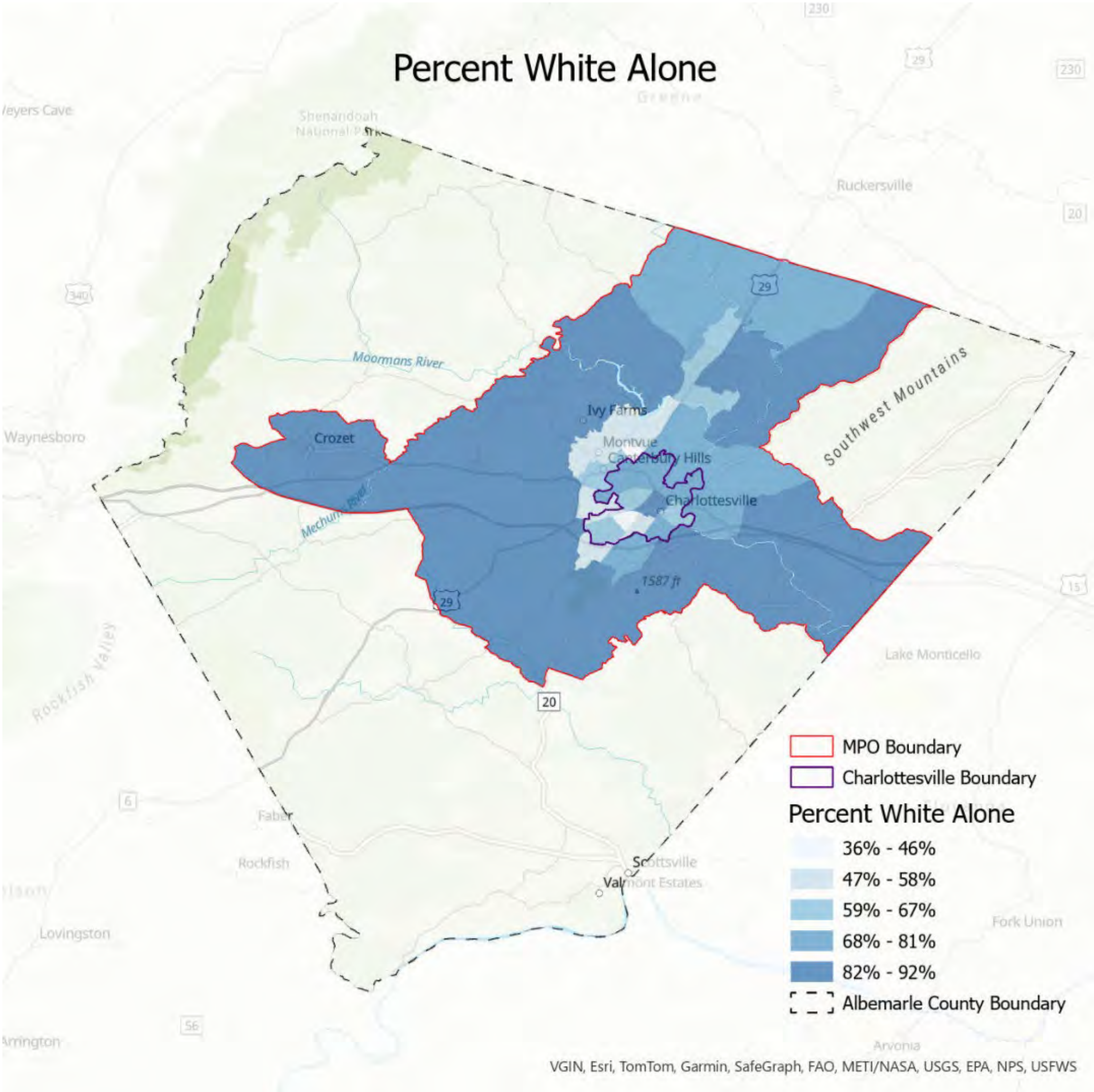
Map 23: Race/Ethnicity - Asian Alone



Map 24: Race/Ethnicity - Black Alone



Map 25: Race/Ethnicity - Hispanic or Latino Alone



Map 26: Race/Ethnicity - White Alone

Age

According to 2022 American Community Survey estimates, the median age of Charlottesville residents is 32.4 years, which is likely influenced by the university population. The median age of Albemarle residents is notably older, at 38.6 years. According to the U.S. Census Bureau, the national and statewide median age for comparison is 39 years. The age pyramid below highlights the relatively large number of those aged 20-24, which likely reflects the large undergraduate student body at the University of Virginia.

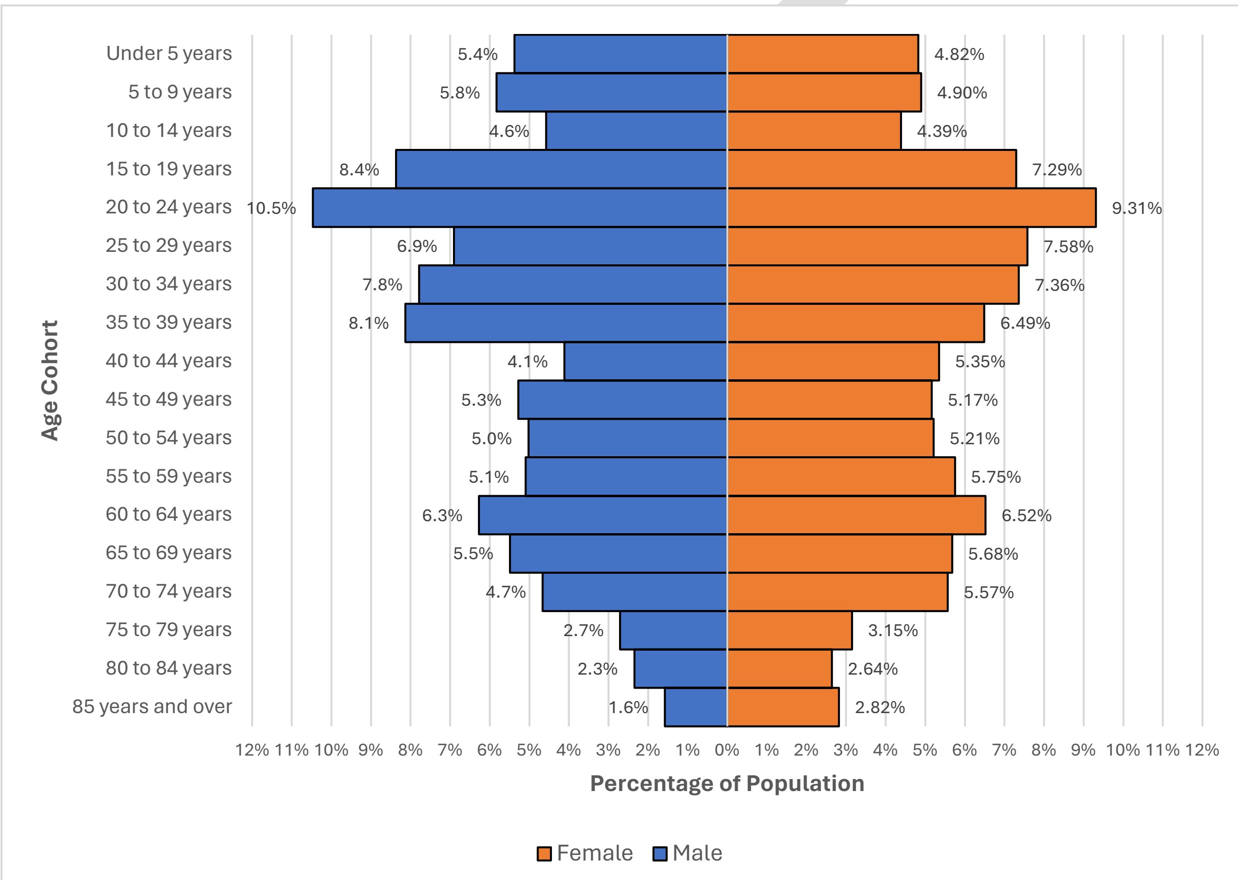
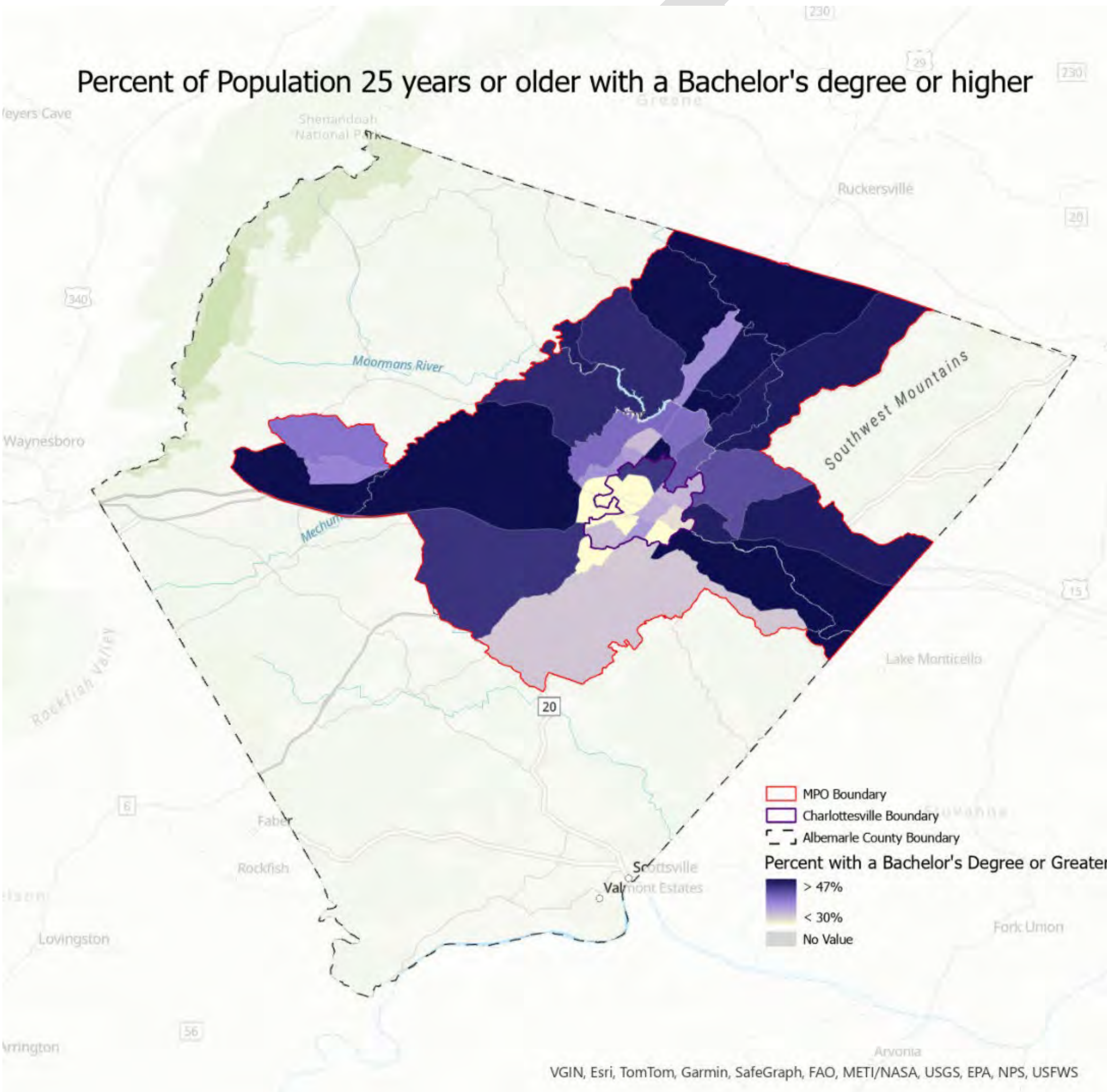


Figure 12: Age Pyramid (City of Charlottesville and Albemarle County). Source: ACS 5-Year Estimates (2022)

Education

The region is comparatively highly educated. Across the United States, 35.7% of the "25 or older" population has at least a bachelor's degree. In Albemarle County and the City of Charlottesville, this figure is 59.8% and 58.9%, respectively (ACS 2022 5-Year Estimates, Table S1501). This comparatively high proportion of college-educated residents is a significant advantage for attracting certain industries, such as Northrop Grumman's presence in the Charlottesville area and the development of Rivanna Station.

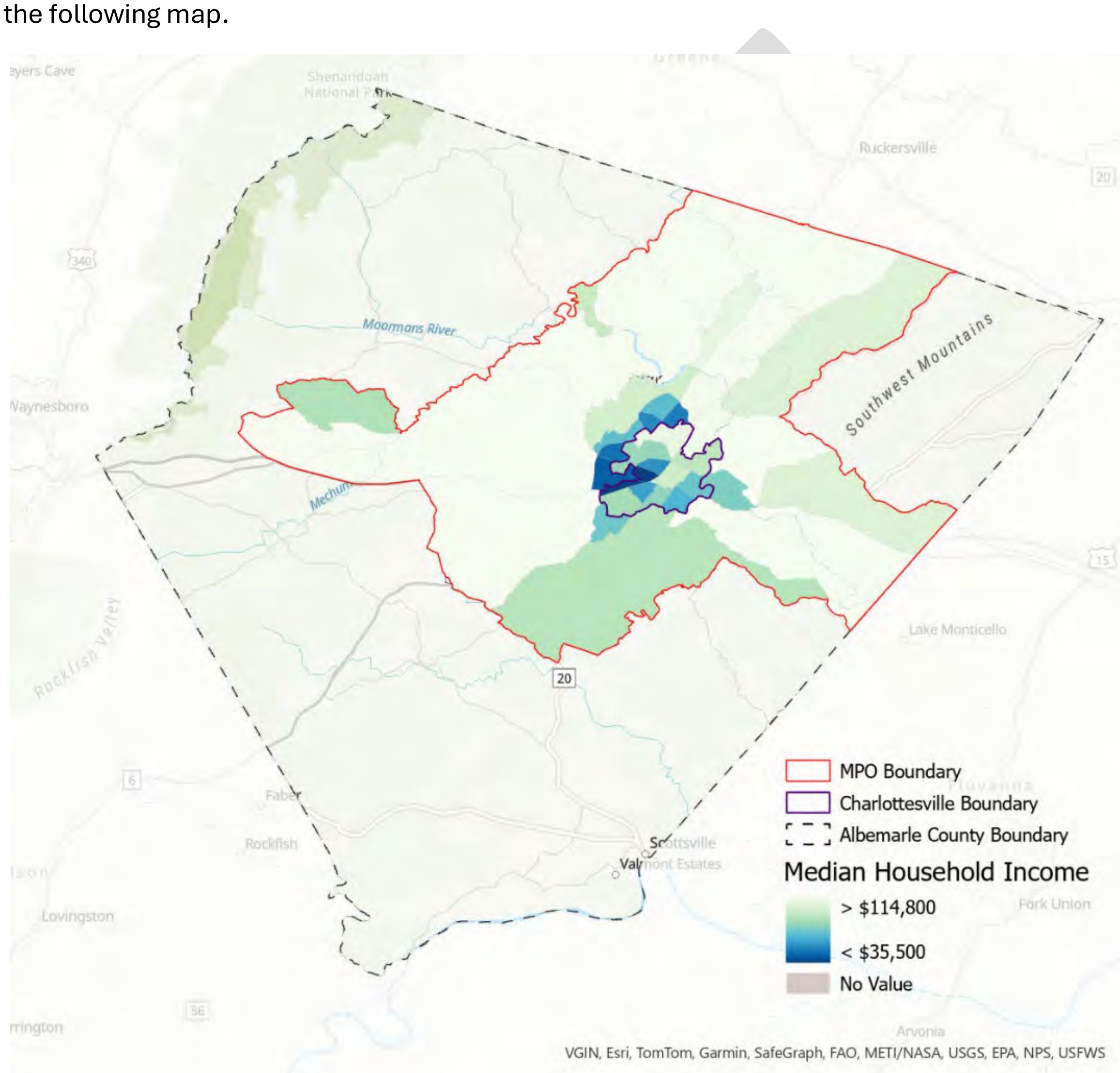
The following map presents the percentage of the total population with a bachelor's degree by Census Block Group according to ACS 2022 5-year estimates.



Map 27: Percent of Population with Bachelor's Degree or Higher

Income

Median household incomes in the United States and Virginia are $74,755 and $85,873, respectively. Median household income in Charlottesville and Albemarle County is $67,177 and $93,691, respectively (ACS 2022 5-year Estimates Table S1901). Despite Charlottesville's high educational attainment, its median household income lags somewhat behind that of the United States and Virginia. Albemarle County, however, out-earns most of the country and Virginia by this metric. In addition, significant geographic disparities in median household income are highlighted on the following map.



Map 28: Median Household Income

Housing

Like much of the United States, the region is in need of more affordable housing. Median rents in Albemarle County and Charlottesville were $1,550 and $1,357, respectively, compared to a nationwide median rent of $1,300. Home values are also higher in Charlottesville and Albemarle County than across the United States.

The graph below shows gross rent as a percentage of household income in Albemarle County and Charlottesville.

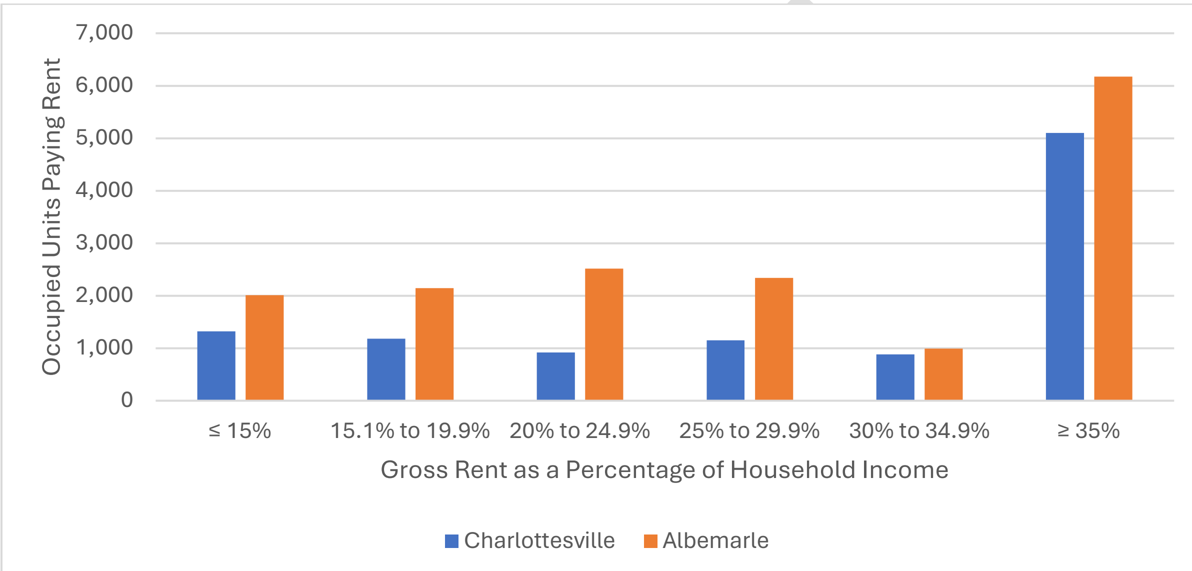


Figure 13: Gross Rent as a Percentage of Monthly Income. Source: ACS 5-Year Estimates (2022)

Type	Albemarle County	City of Charlottesville
Owner-occupied housing units	27,692	8,262
Renter-occupied housing units	17,486	11,249

Table 13: Housing Tenure. Source: ACS 5-Year Estimates (2022)

Vehicle Ownership

The number of vehicles owned by households is diverse and variable across Albemarle County and Charlottesville. Notably, 5.2% of Albemarle County households and 11.8% of Charlottesville households do not have access to a vehicle. These residents are those most reliant on multimodal alternatives to vehicles. The graph below shows vehicle access by housing tenure for Albemarly County and Charlottesville, highlighting the disparity in vehicle access between owners and renters.

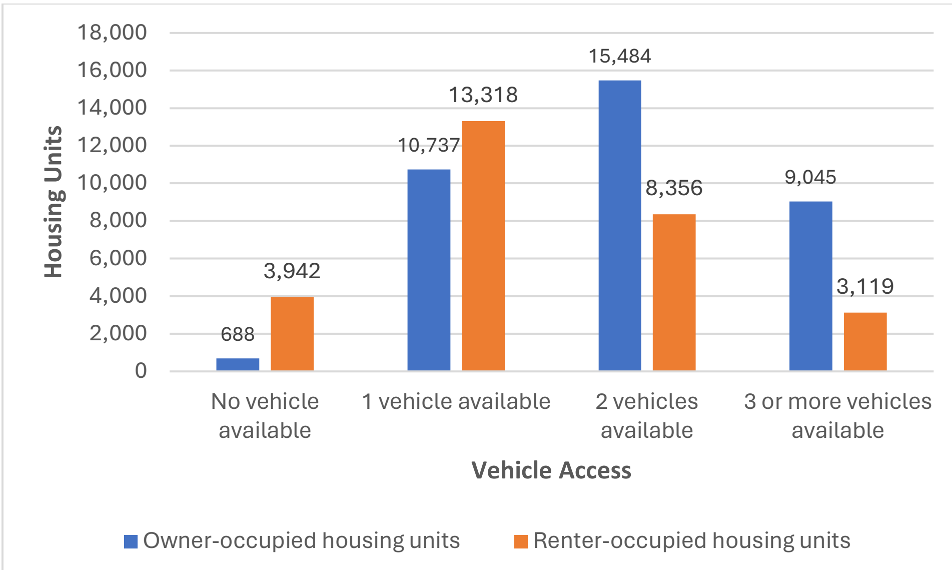


Figure 14: Vehicle Access by Housing Tenure. Source: ACS 5-Year Estimates (2022)

Economy and Employment

According to Bureau of Labor Statistics data, the average unemployment rate for the combined area of the City of Charlottesville and Albemarle County remained at 2.65% between 2018 and 2022. During that time, the area's unemployment rate was lower than the Virginia state unemployment rate of 2.8%. Both the size of the labor force and the number of employees increased during this period.

The relative strength of the Charlottesville area is due in large part to its central Virginia location and the nature of the local economy. As the seat of both the City of Charlottesville and Albemarle County governments, Charlottesville serves as an economic, cultural, and educational center in Central Virginia. As the home of the University of Virginia, one of the most prestigious and highly-regarded universities in the country, the City derives a number of benefits, both economic and in the quality of life associated with this area.

The predominant economic sectors are healthcare, education, service-related industries, tourism and hospitality. Some emerging sectors include technology and renewable energy.

Specialized Communities

The Charlottesville-Albemarle MPO's Title VI Plan outlines how the MPO achieves Title VI and Environmental Justice compliance. The plan discusses the MPO's efforts to include specialized populations in the regional planning process including minorities, the elderly, the disabled, low-income populations, and limited English-speaking populations. The plan also discusses the demographic breakdown of the MPO region. It outlines a procedure for filing complaints should any MPO stakeholders feel they were subject to discrimination under Title VI guidelines and accompanying policies, including negative impacts on the health or environment of minority and low-income populations.

Racial Minorities

American cities have historically left minority voices out of planning processes that affect their communities. The legacy of marginalization and segregation is seen in the fact that African American, Asian, and other racial minorities are largely clustered in central areas of Charlottesville and Albemarle, like in many cities in the United States. Map 28, which represents the percentage of residents that identify as White only, shows the higher concentration of minority residents near the downtown area of Charlottesville. Given the region's history, it is important to target outreach and engagement to reach minority populations. In addition to being racially diverse, the MPO area is ethnically diverse, with a large Spanish-speaking population and schools with students speaking more than 30 different first languages. Outreach to this community and other more recent immigrants may require accessible materials for limited English-speaking populations.

Older Adults

As shown in Figure 12, 18.37% (29,538) of the population in the Charlottesville-Albemarle MPO area is 65 years or older. Older adults may face various barriers that prohibit them from engaging in planning processes. Involving older adults may mean targeted strategies like sending letters, making phone calls, or making neighborhood visits.

Persons with Disabilities

According to the American Community Survey, disability is defined as the product of interactions among individuals' bodies, their physical, emotional, and mental health, and the physical and social environment in which they live, work, or play. Disability exists where this interaction results in limitations of activities and restrictions to full participation at school, at work, at home, or in the community.

Figure 15 provides estimates of these characteristics for Albemarle County and the City of Charlottesville. The total share of the population with disabilities increases with age and estimates skew toward residents living with an Independent Living Difficulty.

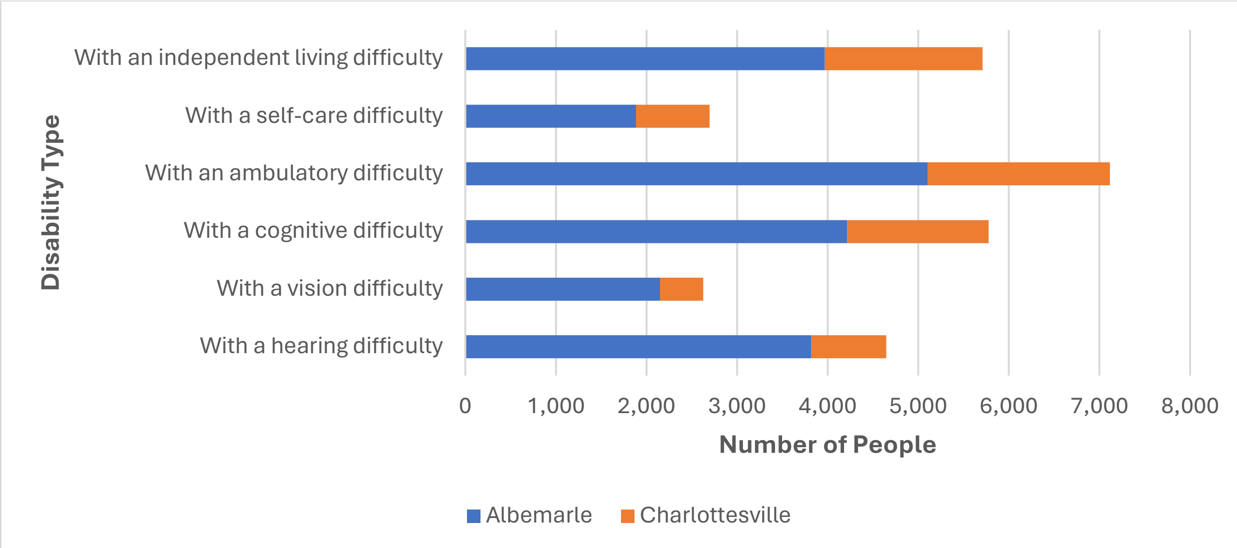


Figure 15: Disability Characteristics. Source: American Community Survey

Low-Income

According to the U.S. Census Bureau's American Community Survey 2022 estimates, 9% of Albemarle County residents and 23.6% of residents in the City of Charlottesville lived below the poverty level. Poverty thresholds are the dollar amounts used by the U.S. Census Bureau to determine poverty status. Each person or family is assigned one out of 48 possible poverty thresholds, which vary according to the size of the family and the ages of the members. Persons living in poverty frequently live in low-resource communities where the outcome of a planning project can be a higher risk for residents. Additionally, low-income residents are often not active in planning processes due to limited leisure time and energy outside of work and family responsibilities. Engaging low-income communities that could be affected by planning processes is important because appropriate planning projects can potentially improve a community's quality of life.

Due to the large population of unemployed full-time students at UVA, the survey results are skewed. Census block groups on and adjacent to the UVA campus have a median household income of less than $20,000, likely because a majority of the residents in these areas are students. There are a few block groups (e.g., east of the UVA campus in the 10th & Page neighborhood, in the southeast Belmont neighborhood, and in the westernmost area of the TJPDC) where the median household income is also less than $20,000, even though there are fewer students that live in these areas. The median household income in Albemarle County is significantly greater than the national average, and due to the student-populated block groups adjacent to the UVA campus, the median household income in City of Charlottesville is lower than both the national and Virginia state average.

Limited English-Speaking Population

As of 2019, Limited English-speaking populations made up approximately 4.7% of the Charlottesville-Albemarle total population. These populations require targeted outreach in an appropriate language.

Responsibilities and Strategies

The MPO makes efforts to include stakeholders in both the development and approval of regionally significant transportation plans to ensure that its planning efforts are holistic and include all populations that are part of the regional community. The MPO hosted several public input events prior to the approval of the 2050 Plan. There have also been a variety of ways to comment on the plan. Residents were able to provide comments at the events, at MPO committee meetings, through the website comment box, or directly to MPO staff. Also, as a federally-funded agency, the Charlottesville-Albemarle MPO has developed a method for receiving and handling complaints should they be made.

Growth Projections

The University of Virginia's Weldon Cooper Center for Public Service produces population estimates and forecasts for Virginia and its jurisdictions. According to the Weldon Cooper Center's most recent estimates, Albemarle County had a population of 115,495 in 2022 and is forecast to grow to 155,102 in 2050. Charlottesville had a population of 51,278 and is forecast to reach 49,691 by 2050.

Jurisdiction	2022	2030	2040	2050
Albemarle County	115,495	124,016	138,523	155,102
City of Charlottesville	51,278	48,920	48,939	49,691

Table 14: Growth Projections. Source: Weldon Cooper Center for Public Service

This would indicate a population growth of 34.3% in Albemarle County from 2022 to 2050 and a population decline of 3.2% in Charlottesville from 2022 to 2050. Combining Charlottesville and Albemarle would yield a 22.8% population increase over the same period, rising from 166,773 to 204,793. Comparatively, the Population of Virginia is expected to grow 21.1% over the same period, with the population increasing from 8,696,955 to 10,535,810.

Appendix B: Project Review Pages

Project Description: **I-64 and 5th Street Interchange Improvement**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI

Transit PAI

- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index

Walk Access - General

Walk Access - Disadvantage Population

2050 Level of Service: D/E

Additional Information:

This project is being developed for a Round 6 SMART SCALE application submission. It will include bike/ped accommodations through the interchange. The project will improve operational efficiency and address safety concerns at the interchange, as well as improve multi-modal connectivity at the existing bridge over I-64.

Project Description: **Rio Road Peanut-shaped Roundabout and Shared Use Path**

Prioritization Process Overall Need: High/Medium

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: D/E

Additional Information:

This project would construct a peanut-shaped roundabout at the intersections between Rio Road and Northfield Road, Old Brook Road, and Hillsdale Drive. This project would improve safety at these intersections and provide more comfortable bicycle and pedestrian accommodations through this section of the Rio Road corridor.

Project Description: **Airport Road and 29 Intersection Improvements**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: E/F

Additional Information:

Intersection improvements at the intersection of Airport Road and 29 to address operational and safety concerns. Several alternatives were identified in the US 29 Corridor Study completed in 2023 that would be further evaluated.

Project Description: **Ivy Road Corridor Improvements, including multimodal improvements on Old Ivy Road**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI

- Disadvantage Population PAI

Travel Time Index

Planning Time Index

- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: E

Additional Information:

This is a project pipeline study conducted by VDOT with project recommendations expected to be developed in spring of 2024. The purpose of the study is to identify project recommendations for the U.S. 250 (Ivy Road) corridor, including the interchange with U.S. 29. The study focuses on improving safety, reducing traffic congestion, improving access, and enhancing multimodal accessibility and and connectivity for pedestrians, bicyclists, and transit users, including how these needs might be satisfied by facilitiies within the Old Ivy Road corridor.

Project Description: **US 250 Corridor Improvements from Crozet Ave to Old Trail Drive**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: E

Additional Information:

PSI needs are indicated at the intersection between US 250 and Crozet Avenue/ Miller School Road and along the segment of US 250 west of and up to Old Trail Drive. Public feedback also indicated concern for the intersection between Crozet Avenue and Old Trail Drive related school traffic. This project includes three roundabouts along US 250 at the intersection with Old Trail Drive, at the entrance into Henley Middle School, and at the intersection with Crozet Avenue/Miller School Road as well as a shared use path along this segment.

Project Description: **Avon Street Extended and Mill Creek Road Intersection Improvement**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: E/F

Additional Information:

Intersection improvements, potentially a roundabout, at Avon Street Extended and Mill Creek Road would improve operations and safety and potentially provide some traffic calming measures, addressing concerns about traffic speeds along Avon Street received through the MPO's public engagement process.

Project Description: **Old Lynchburg Road Shared Use Path between Ambrose Commons and 5th Street**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI

Disadvantage Population PAI
Travel Time Index
Planning Time Index
Walk Access - General
Walk Access - Disadvantage Population

2050 Level of Service: A/B

Additional Information:

The intersection between Old Lynchburg Road and 5th Street is a PSI location and a hot spot for public comment. Public feedback indicated concerns about safety at the intersection, as well as a desire for improved multimodal accessibility along this segment of Old Lynchburg Road. Connectivity for desired multimodal connections along 5th Street should be coordinated.

Project Description: **Berkmar Drive Shared Use Path between Rio Road and Hilton Heights Road**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI

Transit PAI

Vehicle PAI

- Disadvantage Population PAI

Travel Time Index

Planning Time Index

- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: C/D D/E/F

Additional Information:

The intersection of Rio Road and Bermark Drive is a PSI location. Public feedback indicated a desire for additional bicycle and pedestrian infrastructure along Berkmar, which would provide an alternative multimodal connection to travel through the local area. The parallel segment of US 29 from Rio Road to Hilton Heights Road shows future LOS of D/E/F indicating significant future congestion concerns. This SUP would support multimodal travel options increasing overall mobility through this segment of US 29.

Project Description: Eastern Avenue Connection between Westhall and 250

Prioritization Process Overall Need: N/A

Prioritization Process Identified Needs:

Roadway Safety	• Disadvantage Population PAI
Bike/Ped Safety	Travel Time Index
• Bike/Ped PAI	Planning Time Index
• Transit PAI	Walk Access - General
• Vehicle PAI	Walk Access - Disadvantage Population

2050 Level of Service: N/A

Additional Information:

This project would extend Eastern Avenue to connect to 250, providing an alternative access into and out of Crozet on the eastern side of the development area. There was significant public support for this project expressed through the public engagement process. While Eastern Avenue itself wasn't indicated as a need through the MPO's prioritization process, Crozet Avenue was indicated as a low need with future LOS projected as F along the parallel segment of Crozet Avenue. This connection would reduce demand on Crozet Avenue, and provide a direct access from the Westhall area to 250, which would also reduce through-traffic that is currently directed through local neighborhood streets and support improvements in pedestrian safety.

Project Description: **Barracks Road Corridor Improvements between Georgetown Road and Emmett Street**

Prioritization Process Overall Need: Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: D/E/F

Additional Information:

There are operational concerns at the intersection between Barracks Road and Georgetown Road, as well as at the interchange between Barracks Road and 250. The interchange is also indicated as a PSI need. This corridor is currently being studied as a VDOT project pipeline study. The focus of the study is to improve roadway safety and enhance multimodal accessibility and connectivity for pedestrians, bicyclists, and transit users. Project recommendations are anticipated to be identified by Spring 2024 in time to be submitted as application(s) for SMART SCALE Round 6.

Project Description: **Ridge/McIntire/W. Main/South/Water Street Intersection Improvement**

Prioritization Process Overall Need: Medium

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
  Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
  Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: E/F

Additional Information:
Five roads intersect at this intersection. It is identified as a medium priority need in the MPO's need prioritization process and was a hot spot for public feedback. Public comments received primarily indicated a desire to improve the safety of multi-modal travel through the intersection. Specific improvements have not been identified.

Project Description: **Rio Road Corridor Improvements between Huntington Road and Greenbrier Terrace (Access Management)**

Prioritization Process Overall Need:

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI

  Travel Time Index

  Planning Time Index

  Walk Access - General

  Walk Access - Disadvantage Population

2050 Level of Service: D/E

Additional Information:

There is a PSI need indicated along this segment and future LOS is indicated as D/E demonstrating both safety and operational concerns. Specific improvements are not currently identified for this segment, including at the intersection with Greenbrier Drive, but improving this segment is a priority for Albemarle County. There are a number of service stations located in close proximity along this segment, so improvements may include access management strategies.

Project Description: **5th Street Multimodal Improvements from Harris Road to City/County Line, including Moores Creek Crossing**

Prioritization Process Overall Need: High/Medium/Low

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI

- Disadvantage Population PAI
  Travel Time Index
  Planning Time Index
  Walk Access - General
  Walk Access - Disadvantage Population

2050 Level of Service: E

Additional Information:

This project would provide a continuous multimodal connection along 5th Street from the intersection of Harris Road south to 5th Street Landing, facilitating access across Moores Creek. Future operations along 5th Street show segments operating at LOS E. This project would improve the safety of multimodal travel along the corridor and support multimodal travel as an alternative in response to increased future congestion.

Project Description: **Preston Avenue Multi-Modal Improvements from 10th Street NW to Ridge/McIntire**

Prioritization Process Overall Need: High/Medium

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: E/F

Additional Information:

In addition to being a high/medium need indicated throught the MPO's prioritization process, this segment was a hot spot for public feedback. Public feedback indicated a desire for additional transit access and improved bicycle and pedestrian access. Bicycle and pedestrian safety was specifically an expressed concern. Congestion is expected to worsen in the future horizon year, and improved multimodal infrastructure can provide an alternative travel mode to reduce roadway demand. Specific improvements have not been identified.

Project Description: **Hillsdale South Extension, including 250 Interchange and Multi-Modal Improvements**

Prioritization Process Overall Need: High

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: F

Additional Information:

The parallel segment of US 29 is indicated as a high need through the MPO's prioritization process and was a hot spot for public comment. The Travel Demand Model shows the interchange operating at LOS F in the future year scenario. This project would extend Hillsdale Drive south to provide a complete connection from Hydraulic Road to the 250 bypass. The interchanges between 29 and 250 would be removed wishing to make those movements would be directed through the local road network. The project would also include multimodal improvements.

Project Description: **Peter Jefferson Parkway and Rolkin Road Access Management/Pedestrian Improvements**

Prioritization Process Overall Need: Medium

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: D/E/F

Additional Information:

This bundle of projects was identified through a project pipeline study in preparation for SMART SCALE Round 5. The project includes access management measures along US 250 between Peter Jefferson Parkway and Pantops Mountain Road, a park and ride lot that will accommodate 50 vehicles, and pedestrian improvements at the intersection of US 250 and Rolkin Road supporting pedestrian movement across US 250 and extending the sidewalk on the southern side of US 250 from the intersection with Rolkin Road to State Farm Boulevard.

Project Description: **Rivanna River Bicycle and Pedestrian Bridge between Pantops and Woolen Mills**

Prioritization Process Overall Need: Medium (at Free Bridge)

Prioritization Process Identified Needs:

- Roadway Safety
- Bike/Ped Safety
- Bike/Ped PAI
- Transit PAI
- Vehicle PAI
- Disadvantage Population PAI
- Travel Time Index
- Planning Time Index
- Walk Access - General
- Walk Access - Disadvantage Population

2050 Level of Service: F (at Free Bridge)

Additional Information:

This project would construct a bicycle and pedestrian bridge to aid multimodal access across the Rivanna River and provide an alternative multimodal crossing from Free Bridge. The TJPDC is submitting a RAISE application for the project to complete the preliminary engineering phase to better estimate right-of-way and construction costs. There was a large concentration of public feedback in the area of Free Bridge, with respondents commenting on the desire for another bridge across the Rivanna River and frustration with congestion along US 250 coming into Charlottesville. The proposed bike/ped bridge would provide that alternative multi-modal connection and support stronger efforts to promote mode shift as a way of addressing increased congestion.

Appendix C: Public Participation Record of Input

Date	Name	Comment
2/28/2024	Jim Duncan	More bike and ped infrastructure. Simple, connected, protected bike and pedestrian infrastructure connecting neighborhoods to urban(ish) areas, and connecting City & County to each other.
2/28/2024	Peter Krebs	The shared use path along Route 20 between the City line and VA-53 is a longstanding, very high priority yet it is absent from the list. This is not some aspirational nice-to-have concept. It is actually one of the most thoroughly vetted connections, Albemarle has a very feasible, buildable plan. But for the change recent changes to SmartScale, it would likely be included in *this* round of SmartScale submissions. Route 20 (City line to 53) should be on the list of "Infrastructure Priorities."
3/6/2024	John Hossack	The top priority - by a long way - should be a GSI at Hyrdaulic/29. Unfortunately, we know that costs about $100M and it scored low in recent funding exercise. I note with profound regret and anger that MPO was against this GSI in 2014 when the money was sitting right in front of us. I remember the discussion involving MPO members and Lynchburg representatives when they argued this matter in May 2014. This mistake will cost thousands of wasted hours, injuries and a few lives. I hope that sits well with you.
3/8/2024	Peter Ohlms	The Draft Priority Projects list lacks detail on the "Planning Priorities," a list that wasn't fully presented at the Open House. I am interested in knowing more about several of these, including "North side of JPA from W. Main to McCormick," "29 North/West Main/UVA Bus Rapid Transit Alternatives Analysis," and "E. High Street from 250 to Locust Avenue." If they are what I think they are, I'd like to see them studied very soon. Also, I noticed that 2050 LOS seems to be one of the key ways of identifying needs. Is that automobile LOS, and if so, why is it used? It is not such a great way of representing conditions in urban areas. VDOT and OIPI are not using it much.
3/11/2024	Linda Capacchione	I appreciate this public forum offering that involves needed education as well as the inclusion of interested community members' with our relevant input for safer healthier car-free transportation planning. This is especially important as we now must to take action to address our climate crisis. Presently. I'm planning on attending this Thurs. March 7th program around 5:30 PM when I'm available after my work day. Thank you so much, Linda.

4/3/2024	Herb Levy	A bus rapid transit project along Main, Emmett and Seminole Trail is identified. With all the development that is underway at Hydraulic and Seminole, and the likely increase in development at Fashion Square and Seminole and Rio, a bus rapid transit line connecting at least these three nodes and UVA makes a great deal of sense. With proper screening the rightmost lanes on Seminole could also become a bike lane, providing not only access to the shopping on Seminole for bicycles but also enhancing the use of bicycles to commute to work and school.

Appendix D: EPA EJScreen Community Reports

See attachment.

Appendix E: Relationship to Other Plans

Federal Priorities

Transportation Improvement Program

The Transportation Improvement Program (TIP) is a prioritized listing of transportation projects developed by a metropolitan planning organization (MPO), in cooperation with the State, localities, and affected public transportation operators, as part of the metropolitan transportation planning process. The TIP lists transportation projects where federal funding has been committed for implementation. Projects included in the TIP must also be included in the MPO's long-range transportation plan.

The TIP covers a four-year period and is updated every three years. The MPO is responsible for preparing the TIP in coordination with the Virginia Department of Transportation and regional transit providers receiving federal funding.

Statewide Plans

Virginia Six-Year Improvement Program

The Six-Year Improvement Program (SYIP) is the approved plan allocating public spending for transportation projects. The SYIP is approved by the Commonwealth Transportation Board annually, and includes funding allocations for transportation system studies and construction. The SYIP includes all projects that were selected to receive funding through the programs administered by the Virginia Department of Transportation and the Virginia Department of Rail and Public Transportation.

VTrans

VTrans is Virginia's statewide multimodal transportation plan. VTrans establishes the overall vision and goals of the state's transportation system at the direction of the Commonwealth Transportation Board. VTrans uses a ten-year planning horizon to identify mid-term needs. These mid-term needs are used to identify projects that may be eligible for funding through state funding programs such as SMART SCALE, and are intended to inform the prioritization of funding requests.

VTrans also maintains an extensive database known as InteractVTrans for the purposes of identifying, analyzing, and monitoring longer range trends as part of their long-term planning process.

Moving Toward 2050 uses data available through the InteractVTrans dataset in the evaluation of its regional need priorities, and the statewide goals and objectives were considered in the development of the regional priorities.

Arrive Alive: Virginia 2022-2026 Strategic Highway Safety Plan

Arrive Alive is the required five-year plan for road safety efforts in the state. As a state agency, the Virginia Department of Transportation has adopted a Towards Zero Deaths initiative that supports initiatives identified by multiple federal agencies and national organizations. *Arrive Alive* provides specific goals and strategies that the state is undertaking in order to achieve the established vision of zero deaths or serious injuries from motor vehicle crashes. The plan establishes an initial goal of reducing motor vehicle-related fatalities and serious injuries 50 percent by the year 2045, and outlines a number of strategies the state is undertaking using a safe system approach, as identified by the FHWA. The safe system approach involves anticipating that humans will make mistakes and considering those mistakes in the design and management of roadway infrastructure to mitigate risk and minimize harm to the human body.

Arrive Alive strategies will inform state priorities and safety performance targets. These strategies could potentially lead to adjustments to state funding priorities, so it is important that the MPO remains aware of the plan and opportunities to align local initiatives with statewide priorities.

Pedestrian Safety Action Plan

Virginia's statewide Pedestrian Safety Action Plan (PSAP) was initially adopted in 2018. The PSAP was developed in response to rising pedestrian fatalities throughout the state and identifies both statewide and regional priority corridors for pedestrian safety improvements, as well as identified countermeasures that should be considered to address major factor areas contributing to pedestrian crashes.

The PSAP is intended to complement other statewide safety planning initiatives such as *Arrive Alive*, and a companion Map Viewer developed in conjunction with the PSAP report is updated on a biennial basis. Data from the most PSAP Map Viewer is used as part of the transportation system evaluation in the needs and project prioritization.

Statewide Rail Plan

The Statewide Rail Plan was most recently updated in 2022. The plan is encouraged by the Federal Railroad Administration to identify priorities and strategies to enhance rail within each state that benefits the public and guide federal and state rail investments. The Statewide Rail Plan addresses both freight and passenger rail service. Of note, Virginia recently established a new Virginia Passenger Rail Authority (VPRA) that has assumed all responsibility for state-sponsored passenger rail services, and has a stated mission to promote, sustain, and expand the availability of passenger and commuter rail service throughout the state.

An east-west passenger rail connection that would provide a direct connection between Charlottesville and Clifton Forge to the west/Doswell to the east has been identified by VPRA as a priority, and the Statewide Rail Plan reflects the right-of-way acquisition for this rail corridor as a needed infrastructure project. VPRA applied for a grant through the BIL's Corridor Identification and Development Program to develop and scope passenger rail corridor improvements for this Commonwealth Corridor. State efforts to improve this east-west service could be further bolstered by local initiatives to enhance and improve the capacity and accessibility of the Charlottesville Amtrak Station.

Electric Vehicle Infrastructure Deployment Plan

The Bipartisan Infrastructure Law (BIL) signed in 2021 allocated $5 billion for the National Electric Vehicle Infrastructure (NEVI) program. Combined with additional funding allocated to the discretionary Charging and Fueling Infrastructure grant program, the goal is to establish a comprehensive network of 500,000 EV chargers nationwide by 2030. The NEVI program requires each state to establish an EV Infrastructure Deployment Plan that prioritizes the installation of EV charging infrastructure along Alternative Fuel Corridors (AFCs). Virginia's NEVI plan was completed in September of 2022, and identified the section of I-64 that passing through Charlottesville as an existing gap in the network of publicly accessible fast-charging EV infrastructure, which means that this section of I-64 is identified among the statewide priorities for deployment of new EV charging infrastructure. As the MPO identifies its priority projects in its long-range transportation plan, consideration for appropriate inclusion of EV charging infrastructure during project identification and scoping could be considered to support the achievement of this established goal.

Transit Plans

Jaunt's Transit Development Plan

The state requires transit agencies that do not serve a census-designated urbanized area and have a bus fleet of fewer than 20 vehicles are required to adopt a Transit Development Plan (TDP) every ten years. Jaunt's service is primarily intended to provide transit service for rural localities outside of the urbanized area, but much of their service is transporting riders to the urbanized areas to access jobs, goods, and services. Jaunt has also historically contracted with Charlottesville Area Transit (CAT) to provide their para-transit services.

TDPs are intended to identify transit service needs and support the planning, execution, funding, and implementation of transit services. The TDP is used to guide funding requests for service improvements, support financial planning for ongoing capital and operational expenses, and facilitate the inclusion of transit service needs in statewide and regional planning initiatives.

Charlottesville Area Transit's Transit Strategic Plan

Transit agencies serving census-designated urbanized areas and with a bus fleet of at least 20 vehicles must complete a Transit Strategic Plan (TSP). The TSP is intended to ensure that transit services are being planned effectively to meet the public transportation needs of the communities in which they operate based on existing funding structures.

While both the TDP and TSP are largely focusing on operating and capital improvements, there may be opportunities to identify infrastructure improvements that could better support effective delivery of public transportation. These infrastructure improvements should be considered in developing the candidate projects and assessing the transportation system needs in the long-range transportation plan.

Regional Plans

- Regional Transit Vision Plan
- Jefferson Area Bicycle and Pedestrian Plan
- Planning for Affordability

Environmental Plans

- Regional Hazard Mitigation Plan
- Albemarle County Climate Action Plan
- Charlottesville Climate Action Plan

Comprehensive Plans

- Albemarle County Comprehensive Plan
- Cville Plans Together

Small Area Plans

Small Area Plans are intended to provide a long-range vision for the future of a specific community. While similar to Comprehensive Plans in planning for future growth and development, Small Area Plans focus on a much smaller geographic area, allowing for specific needs and recommendations to be developed. Albemarle County has developed a Small Area Plan for each of its growth areas, and the City of Charlottesville has identified priority communities to work with to develop Small Area Plans in the near future.

Listed below are the Small Area Plans that were reviewed as part of this development of the Moving Toward 2050 plan. Transportation recommendations from these plans were considered as transportation priorities when developing the list of potential transportation projects.

- Crozet Master Plan
- Pantops Master Plan
- Places 29 Master Plan
- Urban Rivanna River Corridor Plan
- Southern and Western Urban Neighborhoods Master Plan
- Cherry Avenue Small Area Plan

Transportation Studies

Once a transportation need is identified, stakeholders undertake a more technical study to better understand the specific issues of concern along a corridor and identify potential solutions. Since the previous long-range transportation plan was developed in 2019, several corridor studies have been completed by Albemarle County and VDOT to identify recommended improvements to improve the safety and operations along priority corridors. A list of the transportation studies that were reviewed are listed below.

- North 29 Corridor Study
- Albemarle Transit Expansion Feasibility Study
- Avon Street (Re)Vision

- Rio Road Corridor Study
- 5th Street Corridor Study
- VDOT Project Pipeline Studies

Appendix F: Charlottesville-Albemarle MPO Performance-Based Planning Process

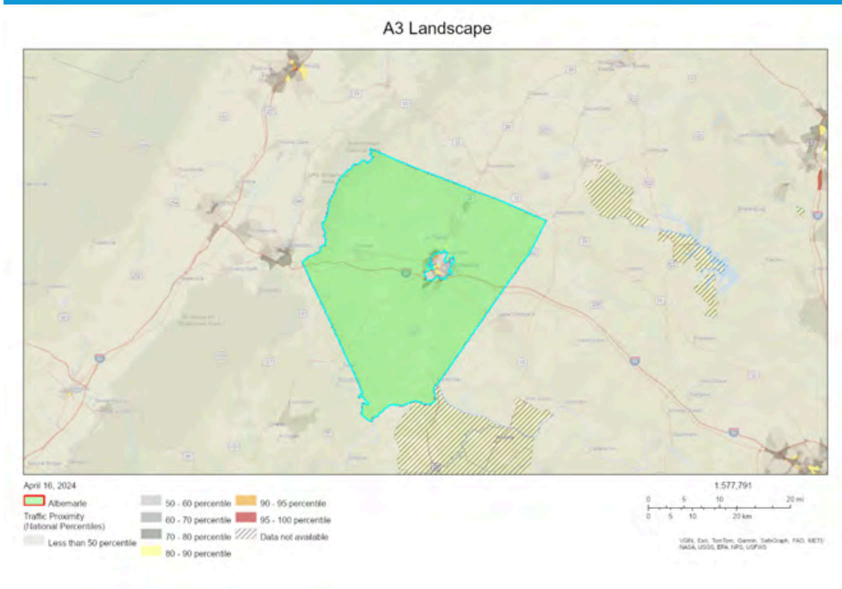
See attachment.

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Albemarle County, VA

County: Albemarle
Population: 111,438
Area in square miles: 725.96



COMMUNITY INFORMATION

Low income: 17 percent
People of color: 24 percent
Less than high school education: 7 percent
Limited English households: 2 percent
Unemployment: 3 percent
Persons with disabilities: 10 percent
Male: 48 percent
Female: 52 percent
79 years Average life expectancy
$49,942 Per capita income
Number of households: 43,066
Owner occupied: 66 percent

BREAKDOWN BY RACE

White: 76%
Black: 9%
American Indian: 0%
Asian: 6%
Hawaiian/Pacific Islander: 0%
Other race: 0%
Two or more races: 3%
Hispanic: 6%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	20%
From Ages 18 and up	80%
From Ages 65 and up	19%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	62%
Speak Other Indo-European Languages	14%
Speak Asian-Pacific Island Languages	18%
Speak Other Languages	6%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race. Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	87%
Spanish	5%
French, Haitian, or Cajun	1%
German or other West Germanic	1%
Russian, Polish, or Other Slavic	1%
Other Indo-European	2%
Chinese (including Mandarin, Cantonese)	1%
Other Asian and Pacific Island	1%
Total Non-English	13%

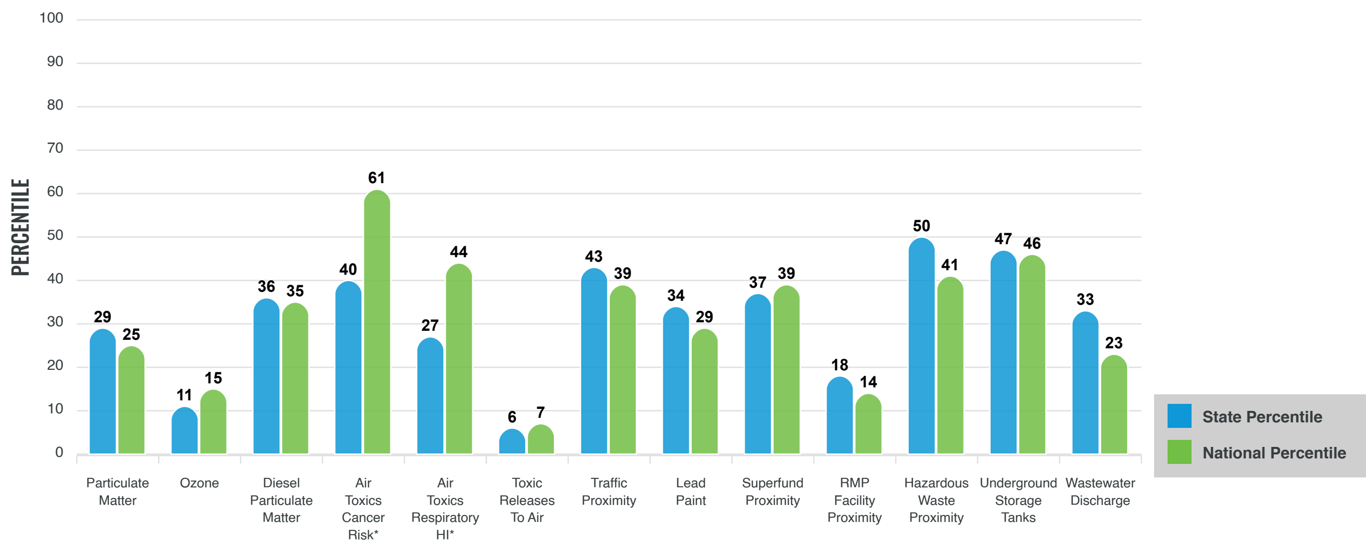
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

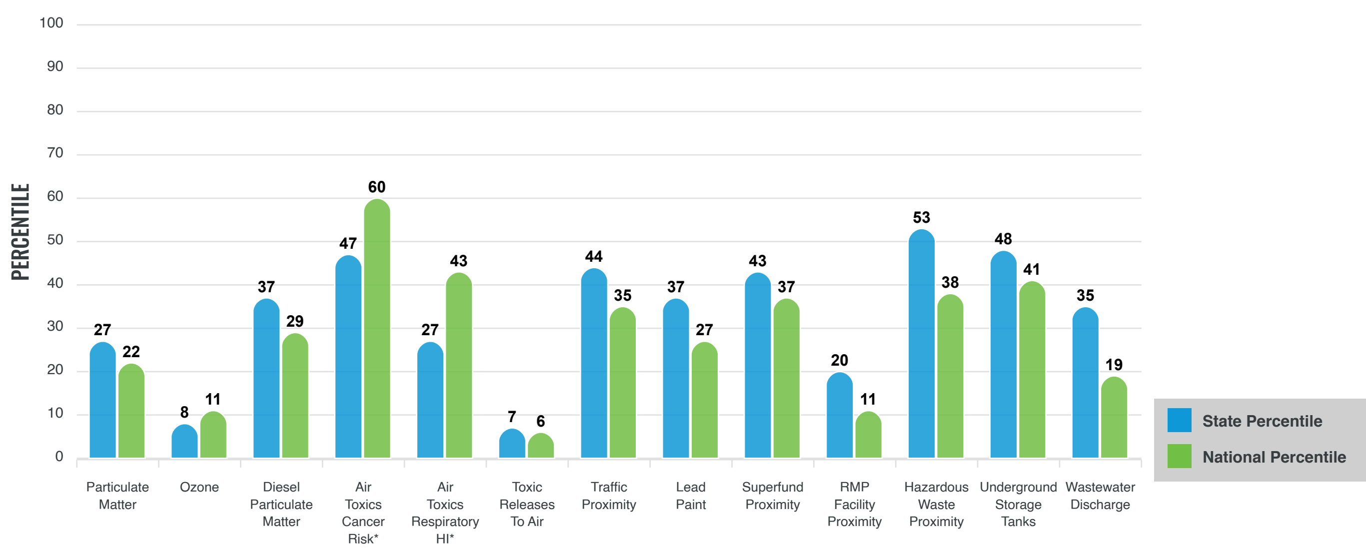
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for County: Albemarle

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	7.09	7.53	25	8.08	22
Ozone (ppb)	55.8	59.1	8	61.6	12
Diesel Particulate Matter (µg/m^3)	0.137	0.209	28	0.261	27
Air Toxics Cancer Risk* (lifetime risk per million)	28	29	0	25	5
Air Toxics Respiratory HI*	0.3	0.33	0	0.31	4
Toxic Releases to Air	6.6	4,300	6	4,600	7
Traffic Proximity (daily traffic count/distance to road)	56	150	48	210	42
Lead Paint (% Pre-1960 Housing)	0.11	0.22	46	0.3	37
Superfund Proximity (site count/km distance)	0.052	0.11	44	0.13	44
RMP Facility Proximity (facility count/km distance)	0.054	0.21	17	0.43	12
Hazardous Waste Proximity (facility count/km distance)	0.43	0.61	67	1.9	47
Underground Storage Tanks (count/km^2)	1.7	1.9	61	3.9	56
Wastewater Discharge (toxicity-weighted concentration/m distance)	5.5E-05	7.2	45	22	26
SOCIOECONOMIC INDICATORS					
Demographic Index	21%	31%	34	35%	34
Supplemental Demographic Index	10%	12%	41	14%	32
People of Color	24%	38%	36	39%	42
Low Income	17%	25%	42	31%	32
Unemployment Rate	3%	5%	52	6%	45
Limited English Speaking Households	2%	2%	69	5%	61
Less Than High School Education	7%	10%	48	12%	44
Under Age 5	5%	6%	55	6%	54
Over Age 64	19%	17%	63	17%	62
Low Life Expectancy	16%	20%	14	20%	15

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

- Superfund 1
- Hazardous Waste, Treatment, Storage, and Disposal Facilities 2
- Water Dischargers 77
- Air Pollution 94
- Brownfields 0
- Toxic Release Inventory 13

Other community features within defined area:

- Schools 26
- Hospitals 5
- Places of Worship 118

Other environmental data:

- Air Non-attainment .... No
- Impaired Waters .... Yes

Selected location contains American Indian Reservation Lands* .... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community .... Yes
Selected location contains an EPA IRA disadvantaged community .... Yes

Report for County: Albemarle

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	16%	20%	14	20%	15
Heart Disease	5.1	5.5	45	6.1	31
Asthma	9.2	9.6	35	10	27
Cancer	6.6	6.1	55	6.1	57
Persons with Disabilities	9.3%	12.6%	34	13.4%	27

CLIMATE INDICATORS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	5%	9%	49	12%	43
Wildfire Risk	2%	2%	93	14%	79

CRITICAL SERVICE GAPS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	11%	13%	53	14%	49
Lack of Health Insurance	6%	8%	41	9%	42
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

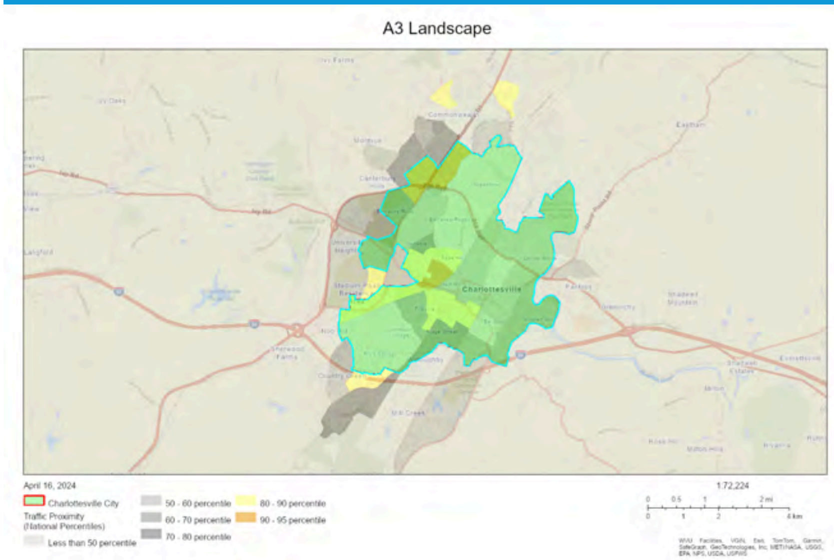
Report for County: Albemarle

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Charlottesville, VA

City: Charlottesville
Population: 46,597
Area in square miles: 10.26



COMMUNITY INFORMATION

Low income: 38 percent

People of color: 35 percent

Less than high school education: 8 percent

Limited English households: 2 percent

Unemployment: 4 percent

Persons with disabilities: 9 percent

Male: 48 percent

Female: 52 percent

67 years — Average life expectancy

$45,490 — Per capita income

Number of households: 19,312

Owner occupied: 41 percent

BREAKDOWN BY RACE

White: 65%

Black: 18%

American Indian: 0%

Asian: 7%

Hawaiian/Pacific Islander: 0%

Other race: 1%

Two or more races: 3%

Hispanic: 6%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	16%
From Ages 18 and up	84%
From Ages 65 and up	12%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	30%
Speak Other Indo-European Languages	16%
Speak Asian-Pacific Island Languages	18%
Speak Other Languages	36%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	86%
Spanish	4%
French, Haitian, or Cajun	1%
Other Indo-European	3%
Chinese (including Mandarin, Cantonese)	2%
Other Asian and Pacific Island	1%
Arabic	1%
Other and Unspecified	1%
Total Non-English	14%

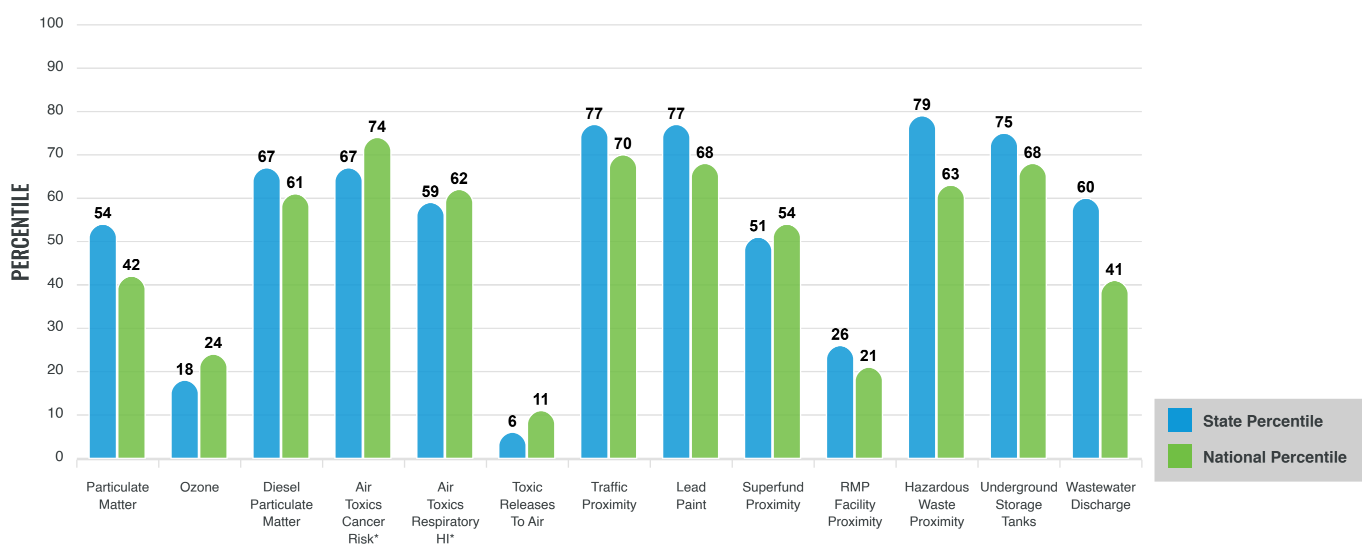
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

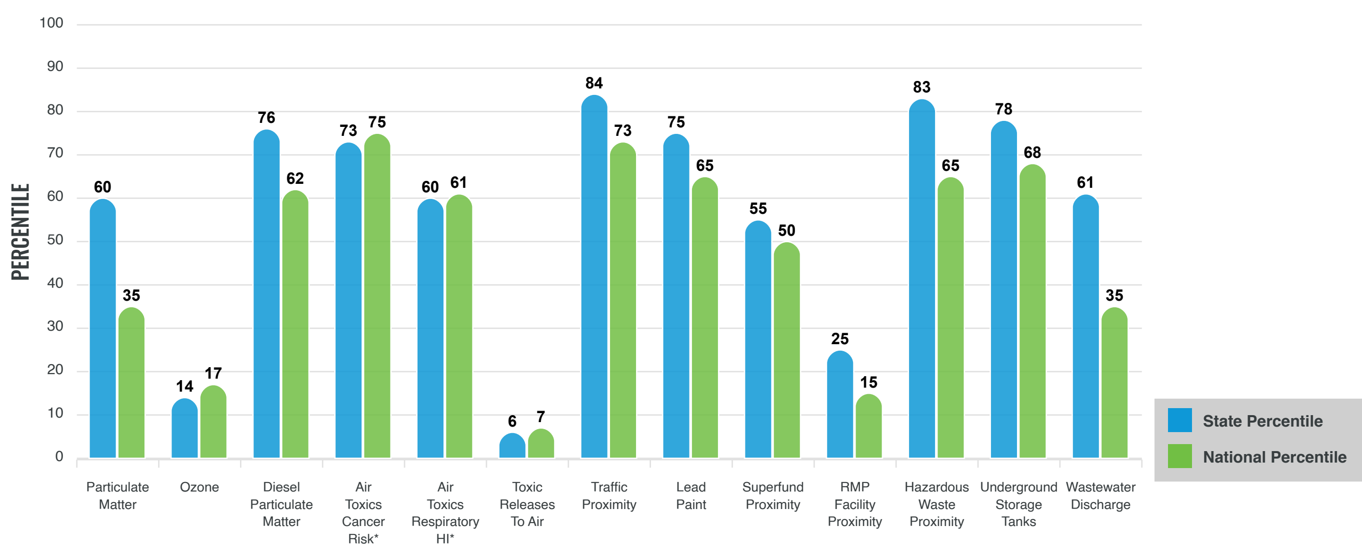
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for City: Charlottesville

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (μg/m^3)	7.21	7.53	37	8.08	25
Ozone (ppb)	55.9	59.1	9	61.6	12
Diesel Particulate Matter (μg/m^3)	0.21	0.209	55	0.261	48
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	26	25	52
Air Toxics Respiratory HI*	0.31	0.33	9	0.31	31
Toxic Releases to Air	2	4,300	3	4,600	5
Traffic Proximity (daily traffic count/distance to road)	200	150	79	210	74
Lead Paint (% Pre-1960 Housing)	0.39	0.22	79	0.3	65
Superfund Proximity (site count/km distance)	0.038	0.11	32	0.13	35
RMP Facility Proximity (facility count/km distance)	0.049	0.21	13	0.43	10
Hazardous Waste Proximity (facility count/km distance)	0.65	0.61	75	1.9	54
Underground Storage Tanks (count/km^2)	4.6	1.9	87	3.9	76
Wastewater Discharge (toxicity-weighted concentration/m distance)	5.6E-05	7.2	45	22	27
SOCIOECONOMIC INDICATORS					
Demographic Index	37%	31%	68	35%	61
Supplemental Demographic Index	15%	12%	69	14%	60
People of Color	35%	38%	51	39%	54
Low Income	38%	25%	76	31%	67
Unemployment Rate	4%	5%	60	6%	53
Limited English Speaking Households	2%	2%	71	5%	63
Less Than High School Education	8%	10%	52	12%	48
Under Age 5	5%	6%	55	6%	54
Over Age 64	12%	17%	37	17%	35
Low Life Expectancy	15%	20%	13	20%	14

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

- Superfund 0
- Hazardous Waste, Treatment, Storage, and Disposal Facilities 0
- Water Dischargers 8
- Air Pollution 39
- Brownfields 0
- Toxic Release Inventory 4

Other community features within defined area:

- Schools 13
- Hospitals 6
- Places of Worship 45

Other environmental data:

- Air Non-attainment .... No
- Impaired Waters .... Yes

Selected location contains American Indian Reservation Lands* .... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community .... Yes
Selected location contains an EPA IRA disadvantaged community .... Yes

Report for City: Charlottesville

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	15%	20%	13	20%	14
Heart Disease	4.1	5.5	24	6.1	12
Asthma	10.3	9.6	72	10	61
Cancer	4.5	6.1	21	6.1	18
Persons with Disabilities	8.6%	12.6%	30	13.4%	22

CLIMATE INDICATORS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	9%	9%	72	12%	64
Wildfire Risk	0%	2%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	12%	13%	57	14%	54
Lack of Health Insurance	7%	8%	51	9%	52
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Report for City: Charlottesville

CHARLOTTESVILLE-ALBEMARLE MPO PERFORMANCE-BASED PLANNING PROCESS

Thomas Jefferson Planning District Commission
Charlottesville/Albemarle MPO

Prepared for Charlottesville-Albemarle MPO

DRAFT JANUARY 2023

CHARLOTTESVILLE-ALBEMARLE MPO PERFORMANCE-BASED PLANNING PROCESS

Process for Identification of Needs and Process for Project Prioritization

ACKNOWLEDGMENTS

Christine Jacobs, Executive Director, Thomas Jefferson PDC
Sandy Shackelford, Director of Planning and Transportation, Thomas Jefferson PDC

ABOUT GAP-TA

Visit vtrans.org/about/GAP-TA for information about the Growth and Accessibility Planning Technical Assistance program.
OIPI will provide a blurb describing the GAP-TA program

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GLOSSARY OR LIST OF ACRONYMS

CTB	Commonwealth Transportation Board
DRPT	Department of Rail and Public Transportation
EEA	Equity Emphasis Area
GAP	Growth and Accessibility Program
GIS	Geographic Information System
LRTP	Long Range Transportation Plan
MPO	Metropolitan Planning Organization
OIPI	Office of Intermodal Planning and Investment
PDC	Planning District Commission
TDM	Travel Demand Management
VDOT	Virginia Department of Transportation
VEDP	Virginia Economic Development Partnership
CMAQ	Congestion Mitigation and Air Quality
RSTP	Regional Surface Transportation Program
PSI	Potential for Safety Improvement
EPDO	Equivalent Property Damage Only

1 - INTRODUCTION

In 2021, the Charlottesville-Albemarle Metropolitan Planning Organization (CAMPO) was awarded a grant through the Virginia Office of Intermodal Planning and Investment (OIPI) Growth and Accessibility Planning (GAP) Technical Assistance program to develop a performance-based planning process that identifies transportation needs and prioritizes transportation projects for its Long Range Transportation Plan. Additionally, this process is intended to be managed and maintained over time within the constraints of CAMPO's limited staffing resources. The process resulting from this study is transparent, repeatable, and flexible to accommodate additional measures, new or updated data sources, and alternative analysis parameters, such as needs thresholds and weighting schemes. This data-driven performance-based planning process includes two parts:

1. Process for the Identification of Transportation Needs – This process involves a system evaluation of needs based on performance measures that address goals and objectives in the CAMPO's long range plan including safety, access and equity, mobility and system efficiency, and economic development.

2. Process for the Prioritization of Transportation Projects – This process involves a project-level evaluation of the benefits and costs associated with projects. Project benefits are evaluated based on each project's expected improvements related to safety, accessibility, congestion mitigation, environmental impacts, and economic development. While the prioritization of transportation projects is closely related to the identification of needs and there is a common set of metrics used by both, the analytical processes and combinations of metrics may differ between project prioritization and needs analyses. For example, an important difference is that while needs analysis focuses on existing or forecasted system-level conditions, project prioritization considers a particular project's impacts in its specific location.

This report is divided into four chapters, including this introduction explaining the purpose and organization of the report. Chapter 2 starts by outlining the dimensions of transportation needs indicated in CAMPO's policies and ongoing planning activities. These inform the metrics included in the needs analysis and project prioritization processes. As CAMPO's policies evolve, the performance-based planning process can be updated, extended, or modified accordingly. In addition to presenting the overall process for identifying transportation needs, Chapter 3 discusses the methodologies applied to evaluating needs for each performance measure and the steps for weighting and aggregating across need categories. Chapter 4 presents the process for the prioritization of transportation projects, including the methodologies for evaluating the benefits of all surface transportation improvements, including highway and roadway, transit, active transportation (i.e., bicycle and pedestrian), and transportation demand management (TDM) projects. Chapter 4 also presents the methodology for normalizing benefit scores across measures, assessing the costs of projects, and developing a single project score that can be used to rank projects across project types. These methodologies were tested on a variety of project types including roadway widenings, bicycle and pedestrian improvements, and transit projects.

2 - CAMPO'S PLANNING PRIORITIES

Through coordination with CAMPO staff and the CAMPO Technical Committee, the technical work group developed metrics that focus on five need categories: Safety, Accessibility and Equity, Mobility and System Efficiency, Environment, and Economic Development. These five need categories align with CAMPO's 2045 Long Range Transportation Plan (LRTP) vision, goals, and objectives while providing sufficient nuance in supportive measures to evaluate a project's competitiveness for a variety of funding opportunities including SMART SCALE, Congestion Mitigation and Air Quality (CMAQ), and the Regional Surface Transportation Program (RSTP).

The five need categories include:

Safety –the aim of the safety category is to identify intersections and segments where safety improvements are needed and prioritize projects that can reduce crashes and/or exposure to risk.

Accessibility and Equity – the aim of the accessibility and equity category is to identify areas where the design and/or performance of the transportation system degrades travelers' ability to reach key destinations, like jobs, especially for disadvantaged users; and prioritize projects that are likely to enhance accessibility through improved connectivity, reduction in delay, more frequent transit services, and/or improved bicycle and pedestrian facilities.

Mobility and System Efficiency – the aim of the mobility and system efficiency category is to identify segments where congestion-related delay degrades travel time and travel time reliability for automobiles and transit vehicles and to prioritize projects that will alleviate delay and/or enhance person throughput throughout the region. This category also includes a measure which considers the on-time performance of the bus system.

Environmental – the aim of the environmental category is to identify resiliency needs, especially where infrastructure is exposed to inland flooding and to prioritize projects that pose no environmental impacts, mitigate impacts, or offer environmental services.

Land Use and Economic Development – the aim of the land use and economic development category is to identify areas where there is access to non-work destinations to stimulate local economic activity or to create transportation choices for disadvantaged people and to prioritize projects that connect to areas of local economic development activity.

The technical team for the study conducted an internal capacity assessment to establish the technologies and staff capabilities available to CAMPO for the implementation and maintenance of this process in diverse planning applications. That assessment is summarized in detail in Appendix A. It informed the development of the needs analysis and project prioritization processes by focusing on measures that are supported by readily available data and implementable in commonly used software, like Microsoft Excel or ArcMap, with no specialized expertise required. The measures described in the remaining chapters of this report are, therefore, accompanied by step-by-step instructions for their production in the appropriate software.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

A critical component of the transportation planning process is the identification of needs for future transportation improvements. Traditional needs assessments have focused on evaluating highway system performance including standard infrastructure condition deficiencies, crash hot spots, and network operational performance. Needs analysis methods have relied on these performance measures due to inadequate data for transit and active transportation modes. This process expands the needs analysis to consider transit and active transportation as part of a holistic multimodal needs assessment.

Figure 1 illustrates the general process for the identification of needs. The first step of this process is establishing the need categories and performance measures that align the scoring factors with the MPO's goals and objectives. The needs addressed in the process developed for this study are organized into the planning priorities described above. A total of 11 performance measures are defined with each measure assigned to one of the four factors, meaning some factors are defined by combinations of several metrics. For example, safety needs are identified through three metrics: PSI ranking, EPDO crash frequency, and pedestrian safety. The confluence of PSI segments and segments with high crash density and segments with high pedestrian safety priorities will have the highest overall safety need.

The first part of step two is the identification of needs. This step screens the full street network to determine segments that are eligible for scoring. Eligibility is determined by using one of the two threshold options discussed in the following sections within each need category. After eligibility is determined, raw scores are calculated for all performance measures within each need category. The specific steps in calculating metrics are often complex, involving multiple input datasets, spatial analysis, computation, summarization, etc. When describing the metrics used in the needs analysis and project prioritization processes, follow the step-by-step instructions for transparency and replicability. However, most metrics can also be processed using automated procedures developed for this study, usually in custom geoprocessors that can be run in ArcGIS or Microsoft Excel spreadsheet tools. Table 1 illustrates a roles and responsibility matrix that indicates agencies that are responsible for different elements of the process.

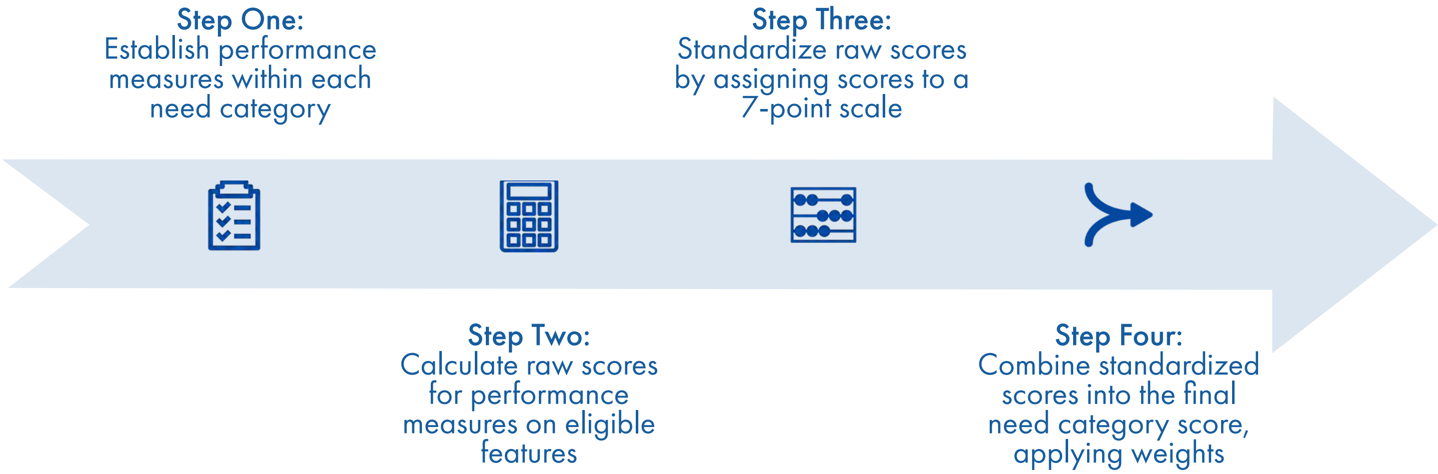

Figure 1 Process for the identification of needs

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Table 1 Roles and Responsibility Matrix

Agency	Role
OIPI	▪ Provide technical help with data from VTrans Web Map ▪ Update VTrans data as needed
VDOT	▪ Provide technical help with VDOT data ▪ Update VDOT data as needed
CAMPO	▪ Develop planning goals and objectives for the performance-based planning process ▪ Collect and manage data from other agencies ▪ Run the performance-based planning processes
City of Charlottesville and Albemarle County	▪ Coordinate with CAMPO to develop goals and objectives ▪ Update local data as needed
Charlottesville Area Transit	▪ Update transit data as needed

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Since each factor is composed of several performance measures, the measures need to be standardized and combined. In Step 3, all measures are expressed on a consistent seven-point scale, with a value of 1 indicating "Very Low" relative need and a value of 7 indicating "Very High" relative need. As shown by **Table 2**, raw metric values are translated into the seven-point scale based on thresholds that organize similar values into bins reflecting similar levels of need.

***Table 2** Need categories and need scores*

Need Category	Need Score
Very Low	1
Low	2
Medium Low	3
Medium	4
Medium High	5
High	6
Very High	7

After metrics are standardized, they are combined into a need score for the need category they support (Step 4). In the combination step, all standardized values are summarized into a single score through a weighted-average score. For example, roadway safety needs may be given greater or lower weight than pedestrian safety needs in the safety analysis. This process allows different weights to be assigned to each metric in the scoring process for each factor. The result is that need category scores are combined into an aggregate needs score that reflects total need based on all five need categories. An example of how scores are combined across all needs categories is provided in **Table 3**.

Since project location is a critical component of environmental impacts, the Environment and Sustainability need category is applied after aggregating need scores. An environmental factor is applied to the overall score as an adjustment to roadway segments that are exposed to projected sea level rise, storm surge, or inland/riverine flooding and whether the segment is within an economically distressed community.

***Table 3** Example of aggregate need score based on weighted category need scores*

Need Category	Performance Measure	Weight	Need Score	Weighted Need Score
Safety (30%)	Roadway Safety	15%	4	0.6
	Pedestrian Safety	15%	6	0.9
Accessibility and Equity (30%)	Bicycle Access to Jobs	8%	6	0.48
	Transit Access to Jobs	8%	4	0.32
	Automobile Access to Jobs	6%	6	0.36
	Access to Jobs by Disadvantaged Populations	8%	5	0.4
Mobility and System Efficiency (20%)	Congestion Mitigation	5%	0	0
	Travel Time Reliability	5%	0	0
	Bus Transit On-Time Performance	10%	1	0.1
Land Use & Economic Development (20%)	Access to Non-Work Destinations	10%	5	0.5
	Access to Non-Work Destinations by Disadvantaged Populations	10%	5	0.5
Overall		100%	-	4.16 (Medium)

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Details of each need category and supporting measures are provided in the sections the follow. The measures presented are applicable to all roadway segments. This process does not identify priorities for recreational trails that are not aligned with a public street, although the impacts of these facilities are accounted for in the bicycle access to jobs metric supporting the Accessibility and Equity need category. Similarly, segments where bicycles and pedestrians are not permitted, such as Interstates and other limited access facilities, are excluded from the bicycle access to jobs and pedestrian safety needs measures.

Need Category: Safety

The aim of the safety category is to identify intersections and segments where safety improvements are needed and prioritize projects that can reduce crashes and/or exposure to risk. Safety needs are assessed based on three supporting measures. Two measures: Potential for Safety Improvement (PSI) ranking, and equivalent property damage only (EPDO) crash frequency are blended into a roadway safety score. This is complemented by a pedestrian safety score based on VDOT's current Pedestrian Safety Action Plan.

Roadway Safety

Roadway safety needs are evaluated based on the combination of two separate performance measures: Potential for Safety Improvement (PSI) ranking and equivalent property damage only (EPDO) crash frequency. The analysis of EPDO crash frequency is limited to segments that are eligible for scoring based on PSI ranking criteria.

PSI is identified by a data-driven safety analysis by VDOT for its Highway Safety Improve Plan (HSIP) that ranks locations by their potential for safety improvement. Locations are ranked within VDOT Construction Districts and statewide. A location's PSI ranking is an estimate of the extent to which the number of crashes observed at an intersection or along a segment is higher than would be expected based on the facility type, traffic volume, and other factors. The PSI ranking is determined by its excess expected crash frequency, which is the number of observed or "expected" crashes modified by the Empirical Bayes (EB) adjustment method minus the number of typical or "predicted" crashes for the location based on state-specific safety performance functions (SPF). EB accounts for yearly variations and regression to the mean (RTM). SPFs are a mathematical relationship between the frequency of crashes and causal characteristics for a specific highway, including roadway facility type and traffic volume. A positive PSI value indicates a segment or intersection where the number of expected crashes exceeds the number of predicted crashes. Locations with a greater number of excess expected crashes receive a higher ranking.

The PSI ranking is used to determine segments that are eligible for roadway safety scoring, including the EPDO crash frequency analysis. Segments that do not meet the PSI-based criteria are deemed to have no safety needs, while those that do qualify are differentiated based on their PSI ranking and/or their EPDO crash frequency. The following threshold options were tested to determine scoring eligibility:

1. All PSI Intersections and PSI Segments with three or more crashes in a five-year analysis period.
2. Top ten miles of PSI Segments and top twenty PSI intersections within CAMPO boundaries.

If the first threshold is selected, any feature that has a potential for safety improvement according to VDOT's PSI analysis is eligible for *roadway safety* scoring. Alternatively, if the second option is selected, features eligible for scoring are limited to the top ranked segments PSI locations in the study area.

The EPDO crash frequency performance measure identifies locations that have a combined greater severity and frequency of crashes than other locations. It assigns weighting factors to fatal and injury crashes relative to PDO crashes, giving more weight to locations where more severe crashes have occurred. The weighting factors in **Table 4** are used for the identification of roadway safety needs. These values are based on VDOT's crash costs by severity used for SMART SCALE.

Table 4 *Crash value conversion table*

Crash Severity	Rounded Value	Weight
Fatal (F) + Severe Injury (A)	$2,200,000	160
Moderate Injury	$260,000	20
Minor Injury	$140,000	10

Source: VDOT EPDO Crash Value Conversion Table (SMART SCALE Technical Guide, 2022)

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Calculation Steps

The following steps outline the process for evaluating the level of roadway safety needs by segments:

1. Assign District-level PSI rankings to segments that are eligible for roadway safety scoring.
   - Create route events for PSI segments based on the direction indicated in the PSI segment tabular data. If the direction of the PSI segment applies to both sides of a divided roadway, ensure that route events are created for the opposite route name (WB and SB) in addition the route events created for the prime direction (NB and EB). Use the stated direction only for PSI segments where directionality is limited to eastbound, northbound, southbound, or westbound.
   - Convert PSI Intersections to segments using tabular data to identify the routes that approach PSI intersections. Assign node-based district PSI rankings to segments within a 250 feet influence area around the intersections.
   - Merge segments identified in steps 1a and 1b above into a single collection of segment features with PSI ranking values. If the merged segments needs layer contains both segment-based and intersection-based rankings, retain the higher of the two district PSI rankings.

2. Calculate EPDO crash frequency for segments that are eligible for roadway safety scoring.
   - Assign EPDO weighting factors (**Table 3**) to all crashes for the most recent five-year analysis period.
   - Assign crash events to segments using a spatial join and sum EPDO-weighted crashes along each segment.

Scoring of Roadway Safety Needs

Roadway safety is assessed as each segment's average standardized score from the PSI ranking and EPDO crash frequency analyses described above. District PSI ranking standardization thresholds are shown in **Table 5**. EPDO crash frequency standardization is based on the distribution of raw results over the entire collection of segments scored, as shown in **Table 6**. This requires sorting segments based on their EPDO crash frequency in descending order, then assigning the need score based on the percentile ranking (in terms of total scored mileage) of each segment. For example, the segments representing the top five percent of scored mileage have "very high" need, while segments representing the bottom fifty percent of scored mileage have "very low" need.

Table 5 *Roadway safety need scores applied to District PSI ranks*

Need Category	Need Score	District PSI Rank
Very High	7	Rank <= 20
High	6	40 >= Rank > 20
Medium High	5	60 >= Rank > 40
Medium	4	80 >= Rank > 60
Medium Low	3	100 >= Rank > 80
Low	2	150 >= Rank > 100
Very Low	1	Rank > 150

Table 6 *Roadway safety need scores applied to EPDO*

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Finally, calculate the overall roadway safety need score by averaging the PSI ranking and the EPDO crash frequency standardized scores. Recall that segments that are not ranked in terms of PSI are assumed not to be roadway safety needs, regardless of underlying EPDO crash frequency. Therefore, they are not part of the target layer that is joined with crashes for calculating EPDO crash frequency. Accordingly, although certain segments may have recorded crashes during a five-year period, the overall score may be zero because they are unranked in terms of district PSI ranking.

Data Requirements

- PSI Locations (source: 2016-2020 Top Potential Safety Improvement Segments and Intersections Web Map)
- 5 year crash data (source: InteractVTrans Map Explorer)
- VDOT Linear Reference System (LRS) Overlap Routes (source: VDOT)

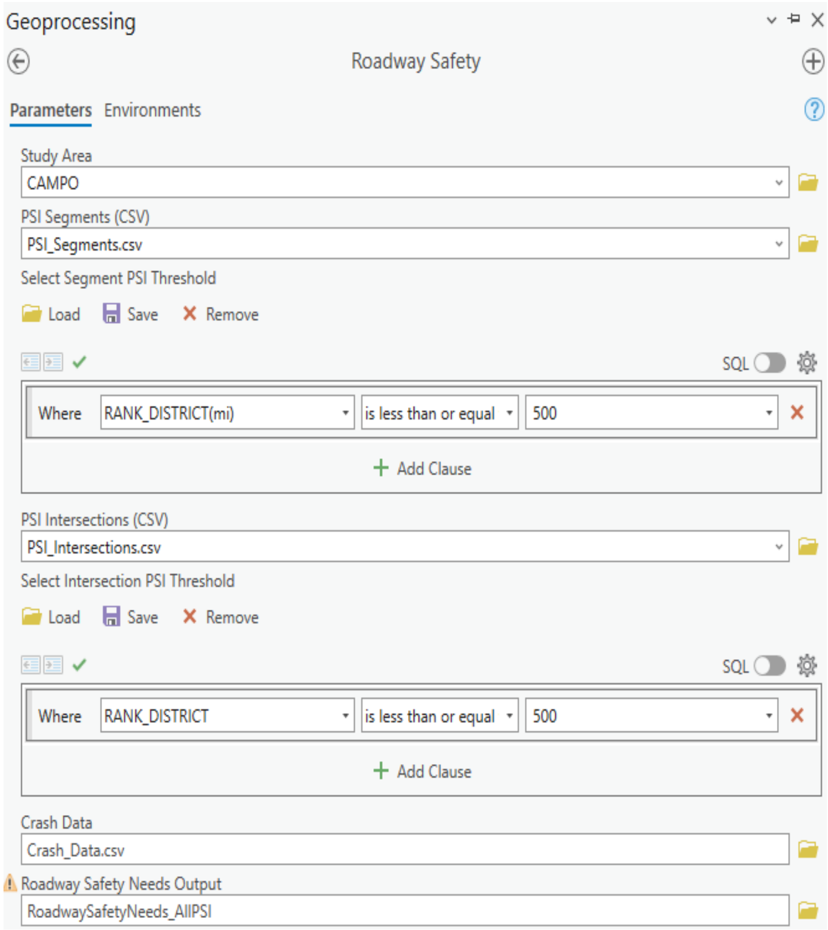

Figure 2 Roadway Safety Geoprocessing Tool

Geoprocessing Tool Overview

Set parameters in the *Roadway Safety* geoprocessing tool exactly as shown in the above figure with input data saved in the following Input geodatabase and csv folder. Save outputs with a descriptive name in the following output geodatabase.

Input Location:

- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb
- C:\PerformanceBasedPlanningProcess\Inputs\csv\Safety

Output Location:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Safety Feature Dataset)

The *Roadway Safety* geoprocessing tool requires one input from the 'Inputs' geodatabase, Study Area (CAMPO), and three inputs from the 'Inputs\csv\Safety' directory: PSI Intersections, PSI Segments, and Crash Data which contains five years of crash history for all crash types. To limit the analysis to PSI locations above a certain ranking, change the 'Select Intersection PSI Threshold' and 'Select Segment PSI Threshold' parameters to the desired values. To include all locations from the PSI analysis, set the threshold to greater than or equal the lowest ranked location in the study area.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Pedestrian Safety

Pedestrian safety needs are evaluated based on VDOT's Pedestrian Safety Action Plan (PSAP) priority corridors. The PSAP corridors indicate locations where facility design, operations, context, performance, or other issues are likely to lead to pedestrian crashes. Priority corridors are identified through a systematic analysis of statewide data that includes crash history, design speed, number of lanes, traffic volume, demographics and land uses in the vicinity, and other factors. The PSAP process relies on these factors because pedestrian crash events are relatively rare, and the conditions that elevate pedestrian crash risk may be present on numerous facilities even if pedestrian crashes have not been observed in recent years. The PSAP process generates a score for highway segments across the state. The top scoring segments are mapped and made available for download via a web map

Eligibility for pedestrian safety scoring may be determined by one of the following threshold options, based on a segment's PSAP score relative to other segments in the region:

1. Regional (District) Top 1% Corridors
2. Regional (District) Top 5% Corridor

The above threshold options reflect the available collections of segments generated by the PSAP process (i.e., scores for all segments are not available for download, and other percentile thresholds would require coordination with VDOT to obtain). The top 1% of corridors tend to emphasize major highways, while the top 5% also includes more local roads and may be more appropriate for MPO-scale applications.

Calculation Steps

The following steps outline the process for prioritization within the pedestrian safety need category.

1. Download the most recent PSAP Priority Corridors to identify segments eligible for pedestrian safety scoring, selecting the top 1% or top 5%. The PSAP analysis is conducted approximately every three years.
2. Identify the PSAP Score in the PSAP Priority Corridors. In VDOT's Pedestrian Safety Action Plan 3.0, segments' PSAP Scores are in the "MAX_TOT_SCORE" field.

Scoring of Pedestrian Safety Needs

Sort the raw pedestrian safety need score (i.e., PSAP Score) in descending order. Then, using **Table 7**, assign the need score based on the segments' cumulative length percentage of the combined mileage of all segments that have a need for pedestrian safety.

Table 7 *Pedestrian safety need scores*

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Data Requirements

- PSAP 3.0 Regional Priorities (source: VDOT Pedestrian Safety Action Plan Map Viewer, retrieved from: (source: https://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=02a155fedefa4e71bdb8c0cf524b636f)

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

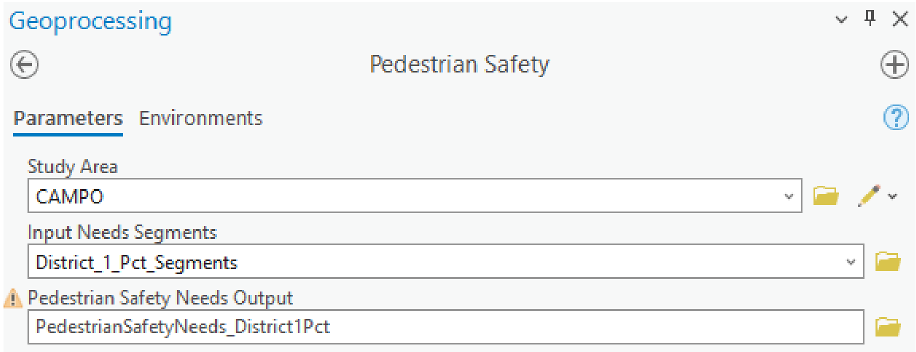

Figure 3 *Pedestrian Safety Geoprocessing Tool*

Geoprocessing Tool Overview

Set parameters in the *Pedestrian Safety* geoprocessing tool exactly as shown in the above figure with input data saved in the following Input geodatabase. Save outputs with a descriptive name in the following output geodatabase.

Input Geodatabase:

- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb (Pedestrian Safety Feature Dataset)

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Pedestrian Safety Feature Dataset)

The Pedestrian Safety geoprocessing tool requires two inputs from the 'Inputs' geodatabase: Study Area (CAMPO) and the Input Needs Segments from the Pedestrian Safety Feature Dataset which may be one of the following:

- District_1_Pct_Segments
- District_5_Pct_Segments

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Need Category: Accessibility and Equity

The aim of the accessibility and equity category is to identify areas where the design and/or performance of the transportation system degrades travelers' ability to reach key destinations, like jobs, especially for disadvantaged users; and prioritize projects that are likely to enhance accessibility through improved connectivity, reduction in delay, more frequent transit services, and/or improved bicycle and pedestrian facilities. Accessibility and equity needs are assessed based on four supporting measures: bicycle access to jobs, transit access to jobs, automobile access to jobs, and access to jobs by disadvantaged populations. These measures combine to provide a holistic, multimodal assessment of needs that accounts for different needs and abilities among travelers throughout the region.

Many of these supporting measures rely on several key concepts, described in general terms here and applied with specific parameters for each measure. Broadly, accessibility is analyzed on a zone basis and describes the ease with which destinations in other zones can be reached from each origin zone. Accessibility scores can be sensitive to the connectivity provided by the current network, its design and performance, traveler characteristics/preferences, and the number of activities (jobs, e.g.) in destination zones. Maps of accessibility scores show which zones can get to the higher or lower levels of activity in other zones. Since the scores derive from activities in other zones, projects to enhance accessibility may be displaced from the zone where need is indicated, as long as the project enhances the connectivity from the zone having the need to one or more other zones where activities are concentrated.

In this process, the identification of accessibility needs by mode is based on the "potential for accessibility improvement" (PAI), which is estimated as the difference between the "current" accessibility offered and a "reference" condition. The "current" condition refers to the cumulative number of activities (jobs in the case of all metrics generated in this process) accessible from a given location applying parameters, such as level of traffic stress (LTS) or average travel speed, that influence the estimated travel times among zones. The "reference" condition refers to the cumulative number of jobs accessible from the same location but with hypothetical parameters that yield an estimated maximum level of job accessibility. Details regarding the current and reference conditions for each mode are discussed in the subsequent sections on mode-specific accessibility performance measures.

The concepts of "maximum travel time" and "decay function" also determine the cumulative number of jobs that are accessible from a given location. In this analysis, maximum travel time defines the maximum amount of time for traveling from an origin census block to a destination census block. This maximum travel time parameter may reflect, for example, the idea that walking trips longer than 30 minutes are uncommon. Under this assumption, activities in blocks beyond a 30-minute walk would be ignored in a pedestrian accessibility analysis. Decay functions are commonly used in accessibility analyses to provide more weight to jobs that are closer to origin census blocks than jobs that are located further away. Decay functions are applied in the Access Across America data used in the accessibility metrics described below to reflect the tendency for travelers to choose destinations that are nearby, all else being equal.

The accessibility measures described below also employ the concept of a "catchment area." This refers to the area around a zone that is likely to contribute most substantially to its accessibility score, based on the maximum travel time associated with the mode of travel being analyzed. Catchment areas are included in this analysis primarily because project opportunities to enhance accessibility can be displaced from the zone of need and because the Access Across America data that support the analysis do not include underlying data (such as block-to-block travel time estimates) but only the current and reference accessibility conditions. Thus, the catchment area is used to calculate areawide PAI averages around street segments to rank segments according to the PAI in its surrounding travel shed.

Lastly, functional classification is used to scale the weighted average PAI for each segment by the volume of trips the street is expected to carry. Functional classification refers to the grouping of streets and highways into various classes based on the services they provide. This analysis assumes higher classified streets are more heavily utilized than lower classified streets. Therefore, road segments with a higher functional classification are weighted higher than road segments with a lower function classification as opportunities to provide accessibility enhancements.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Bicycle Access to Jobs

Bicycle access to jobs needs are based on the Access Across America study by the Accessibility Observatory at the University of Minnesota Center for Transportation Studies. This study estimates the number of destinations reachable by bicycle within a given travel time for all census blocks in the United States. In brief, the accessibility calculations performed in the Access Across America study are as follows:

- Calculate travel times by biking from each census block to all other blocks within 20 km using detailed bicycling and walking networks based on OpenStreetMap (OSM) data.
- Calculate cumulative opportunity accessibility to jobs for each block and Level of Traffic Stress score using travel time thresholds of five minutes to one hour. A destination decay function is used to weight the number of jobs reachable such that nearby jobs contribute more to the access score than jobs that are farther away.

Level of Traffic Stress (LTS) is a metric used to evaluate the perception of safety by quantifying the level of discomfort people feel when they bicycle next to traffic. The LTS process assigns numerical values to segments based on OSM tags that indicate the presence or absence of bicycle facilities, number of lanes, and posted roadway posted, and assigns a numerical value of 1 (lowest stress) to 4 (highest stress) to street segments based on these characteristics. For the purposes of applying LTS parameters to the estimation of travel times by biking, LTS values determine segments' traversability. In this case, the tolerance is set to the maximal LTS value. For example, the LTS 3 analysis allows bike trips along facilities classified as LTS 1, 2, or 3, while the LTS 1 analysis only allows bike trips along the LTS 1 facilities. These tolerances reflect the preferences and abilities of different types of users, where LTS 1 is the most inclusive of all users while LTS 4 represents avid cyclists who may tolerate conditions (heavy mixed traffic, e.g.) that are deemed intolerable by other cyclists.

The Access Across America analysis calculates bicycle travel times using an assumed travel speed of 18 kph (approximately 11 mph), while travel times associated with walking portions of trip, including initial access time to reach the nearest network link by foot, barrier-crossing time for segments with a higher stress level than the trip's maximal LRS tolerance, and destination access time, take place at a speed of 5 kph (approximately 3 mph). While bicycle travel time on a network without bicycle infrastructure would be negatively impacted by automobile congestion, this analysis is not sensitive to congestion effects at certain times of the day. The data generated by the study are estimates for each census block of the number of jobs reachable by cycling.

In this analysis, the "current condition" is access to jobs by bicycle along low stress (LTS1) segments and the "reference condition" is access to jobs by bicycling along high stress (LTS4) segments. The reference condition approximates the jobs accessible by cycling assuming all facilities were comfortable for all users rather than only the most avid and experienced cyclists (i.e., how many jobs could be reached by cycling if all facilities were LTS1 facilities?). The deficit that results from subtracting the current condition from the reference condition is the potential accessibility increase (PAI).

The zone (block) data from Access Across America are intersected with 3-mile buffers defining each segment's catchment area. Within each catchment area, the population weighted average PAI is calculated, and the result is multiplied by the segment's functional classification weight. This elevates facilities that are likely to carry relatively high volumes of person trips and that are in areas where bicycle access to jobs could be improved. The segments identified in this process do not necessarily lack suitable facilities for cyclists, so the results should be compared with available inventories of bicycle facilities to determine what projects or investments may be appropriate to enhance bicycle accessibility.

Eligibility for bicycle access to jobs scoring is determined by population weighted PAI for each segment and may be determined by one of the following optional thresholds:

1. All segments where population weighted PAI is greater than zero.
2. All segments where population weighted PAI is greater than the region's median population weighted PAI.

The first option acknowledges all opportunities for potential accessibility enhancements while the second option focuses on the most acute needs. Note that functional classification weightings apply after eligibility is determined.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Calculation Steps

The following steps outline the process for prioritization within the *access to jobs by bicycle need* category.

1. Obtain the Access Across America datasets given the following parameters:
   - Current Condition: Bicycle LTS 1 (Lowest Stress)
   - Reference Condition: Bicycle LTS 4 (Highest Stress)
   - Maximum Travel Time: 20 minutes
   - Maximum Travel Distanace: 3 miles
2. For each census block, calculate PAI as the difference between the reference condition and current condition, or the accessibility deficit between the current condition and the reference condition.

$$\text{Bike PAI} = \textit{Reference} - \textit{Current}$$

3. Calculate the population weighted PAI for each census block by multiplying PAI by the population of the census block in which the segment is located.

$$\textit{Population Weighted PAI} = \textit{Population} \times \textit{PAI}$$

4. Sum the population weighted PAI and total population in the catchment area around each segment. Next, divide the summed population-weighted PAI by the total population in the catchment area to yield the population-weighted average PAI.

$$\textit{Weighted Average PAI} = \frac{\textit{Population Weighted PAI}_i}{\textit{Catchment Population}_i}$$

5. Calculate the *bicycle access to jobs* performance measure
   - Assign a functional classification (FC) score to all road segments. Segments where cyclists are not permitted such as Interstates and other limited-access facilities are ignored (receive a score of zero) since they are not relevant to bicycle accessibility.
   - Calculate the raw score for bicycle access to jobs performance measure by multiplying segments' weighted average accessibility improvement by its FC score (see **Table 8**).

$$\textit{Raw Need Score} = \textit{Weighted Average PAI} \times \textit{FC Score}$$

Table 8 *Bicycle access to jobs functional classification score*

Functional Class	FC Score
Other Principal Arterial	4
Minor Arterial	3
Major Collector	2
Minor Collector	1
Interstates, Other Freeways & Expressways	0

Scoring of Bicycle Access to Jobs Needs

Sort the raw bicycle need score in descending order for all eligible segments. Then, using **Table 9** assign the need score based on the segments' cumulative length percentage of the combined mileage of all segments that have a need for *bicycle access to jobs.*

Table 9 *Bicycle access to jobs need scores*

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Data Requirements

- Block-Level Access to Jobs (source: Access Across America analysis by the Accessibility Observatory)
- Functional Classification (source: InteractVTrans Map Explorer)

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

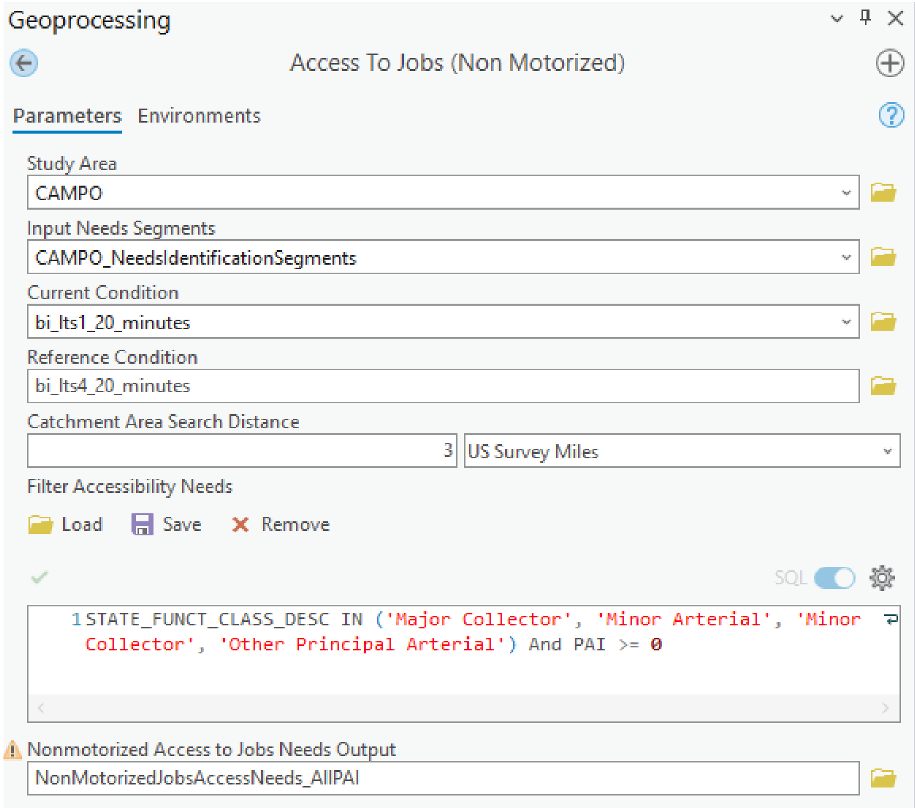

Figure 4 Access to Jobs (Non-Motorized) Geoprocessing Tool

Geoprocessing Tool Overview

Set parameters in the *Access to Jobs (Non-Motorized)* geoprocessing tool exactly as shown in the above figure with input data saved in the following Input geodatabases. Save outputs with a descriptive name in the following output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\NAE_Tables.gdb
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Accessibility Feature Dataset)

The Access to Jobs (Non-Motorized) geoprocessing tool requires one input from the 'Inputs' geodatabase: Study Area (CAMPO) The geoprocessing tool also needs the current and reference condition accessibility tables from the 'NAE_Tables' geodatabase.

Edit the 'Filter Accessibility Needs' parameter to filter which segments are included in the output. The Bicycle Access to Jobs performance measure excludes features with the functional classification attribute 'Interstate' or 'Other Freeways and Expressways' functional classification because bus bus stops do not exist on these facilities. To limit the Bicycle Access to Jobs needs analysis to segments that are greater than the region's average PAI, change the PAI value in the 'Filter Accessibility Needs' parameter.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Transit Access to Jobs

Transit access to jobs needs are based on the Access Across America study by the Accessibility Observatory at the University of Minnesota Center for Transportation Studies. This study estimates the number of destinations reachable by transit and by automobile (see Automobile Access to Jobs) within a given travel time for all census blocks in the United States. In brief, the accessibility calculations performed in the Access Across America study are as follows:

- Calculate travel times by transit from each census block to all other blocks within 60km using transit schedules for the 7:00 – 9:00 AM period and detailed walking networks based on OpenStreetMap (OSM) data.
- Calculate cumulative opportunity accessibility to jobs for each block and departure time using travel time thresholds of five minutes to one hour. A destination decay function is used to weight the number of jobs reachable such that nearby jobs contribute more to the access score than jobs that are farther away

In the Access Across America data, the time cost of travel by transit includes all components of a transit journey, including initial access time, initial wait time, on-vehicle time, transfer access time, transfer wait time, and destination access time. On-vehicle travel time, which is derived from GTFS transit schedules, accounts for variations in service frequency by time of day. Access and egress components of trips (i.e., initial, transfer, and access) are assumed to be made by walking at a speed of 5 kph (3 mph). There is no constraint on the number of transfers required, and it is possible for a block-to-block path to be found that does not use a transit vehicle (i.e., the shortest path from an origin block to a destination block requires walking only).

In the Access Across America data, the time cost of travel by transit includes all components of a transit journey, including initial access time, initial wait time, on-vehicle time, transfer access time, transfer wait time, and destination access time. On-vehicle travel time, which is derived from GTFS transit schedules, accounts for variations in service frequency by time of day. Access and egress components of trips (i.e., initial, transfer, and access) are assumed to be made by walking at a speed of 5 kph (3 mph). There is no constraint on the number of transfers required, and it is possible for a block-to-block path to be found that does not use a transit vehicle (i.e., the shortest path from an origin block to a destination block requires walking only).

In the CAMPO needs analysis, the magnitude of need arising from transit access to jobs performance is determined by the difference in block-level access to jobs between the current condition and the reference condition. The current condition is access to jobs by transit during the 7:00 – 9:00 AM period and the reference condition is access to jobs by automobile during 8:00 – 9:00 AM period. This elevates areas where jobs access by car is significantly higher than by transit, suggesting an opportunity to enhance transit service to make it more competitive with driving. The deficit that results from subtracting the current condition from the reference condition is the potential accessibility increase (PAI).

The zone (block) data from Access Across America are intersected with 5-mile buffers defining each segment's catchment area. Within each catchment area, the population weighted average PAI is calculated, and the result is multiplied by the segment's functional classification weight. This elevates facilities that are likely to carry relatively high volumes of person trips and that are in areas where transit access to jobs could be improved. The segments identified in this process do not necessarily lack existing transit service, so the results should be compared with current transit routes and schedules to determine what projects or investments may be appropriate to enhance transit accessibility.

Eligibility for transit access to jobs scoring is determined by population weighted PAI for each segment and may be determined by one of the following optional thresholds:

1. All segments where population weighted PAI is greater than zero.
2. All segments where population weighted PAI is greater than the region's median population weighted PAI.

The first option acknowledges all opportunities for potential accessibility enhancements while the second option focuses on the most acute needs. Note that functional classification weightings apply after eligibility is determined.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Calculation Steps

The following steps outline the process for estimating the magnitude of need under the *access to jobs by transit score*:

1. Obtain the Access Across America datasets given the following parameters:
   - Current Condition: Transit
   - Reference Condition: Automobile (8 AM)
   - Maximum Travel Time: 45 minutes
   - Maximum Travel Distanace: 5 miles

2. For each census block, calculate PAI as the difference between the reference condition and current condition, or the accessibility deficit between the current condition and the reference condition.

$$\text{Transit PAI} = \textit{Reference} - \textit{Current}$$

3. Calculate the population weighted PAI for each census block by multiplying PAI by the population of the census block in which the segment is located.

$$\textit{Population Weighted PAI} = \textit{Population} \times \textit{PAI}$$

4. Sum the population weighted PAI and total population in the catchment area around each segment. Next, divide the summed population-weighted PAI by the total population in the catchment area to yield the population-weighted average PAI.

$$\textit{Weighted Average PAI} = \frac{\textit{Population Weighted PAI}_i}{\textit{Catchment Population}_i}$$

5. Calculate the *transit access to jobs* performance measure
   - Assign a functional classification (FC) score to all road segments.
   - Calculate the raw score for *transit access to jobs* performance measure by multiplying segments' weighted average accessibility improvement by its FC score (see **Table 10**).

$$\textit{Raw Need Score} = \textit{Weighted Average PAI x FC Score}$$

Table 10 *Transit access to jobs functional classification score*

Functional Class	FC Score
Other Principal Arterial	4
Minor Arterial	3
Major Collector	2
Minor Collector	1

Scoring of Transit Access to Jobs Needs

Sort the raw transit need score in descending order. Then, using **Table 11**, assign the need score based on the segments' cumulative length percentage of the combined mileage of all segments that have a need for *transit access to jobs*.

Table 11 *Transit access to jobs need scores*

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Data Requirements

- Block-Level Access to Jobs (source: Access Across America analysis by the Accessibility Observatory)
- Functional Classification (source: InteractVTrans Map Explorer)

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

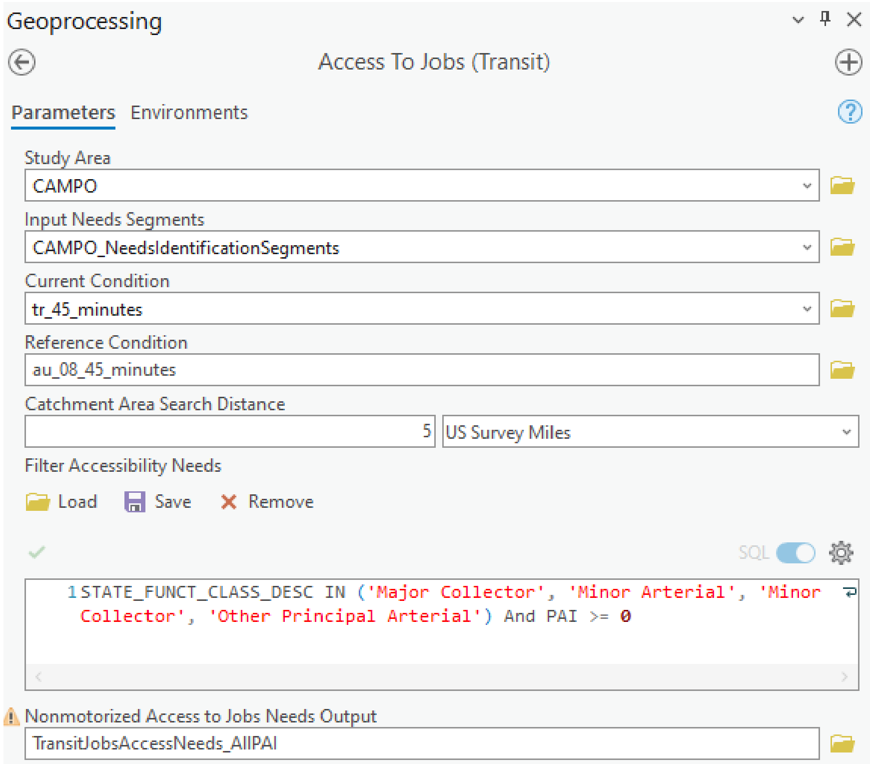

Figure 5 Access to Jobs (Transit) Geoprocessing Tool

Geoprocessing Tool Overview

Set parameters in the *Access to Jobs (Transit)* geoprocessing tool exactly as shown in the above figure with input data saved in the following Input geodatabases. Save outputs with a descriptive name in the following output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\NAE_Tables.gdb
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Accessibility Feature Dataset)

The Access to Jobs (Transit) geoprocessing tool requires one input from the 'Inputs' geodatabase: Study Area (CAMPO) The geoprocessing tool also needs the current and reference condition accessibility tables from the 'NAE_Tables' geodatabase.

Edit the 'Filter Accessibility Needs' parameter to filter which segments are included in the output. The Transit Access to Jobs performance measure excludes features with the functional classification attribute 'Interstate' or 'Other Freeways and Expressways' functional classification because bus bus stops do not exist on these facilities. To limit the Transit Access to Jobs needs analysis to segments that are greater than the region's average PAI, change the PAI value in the 'Filter Accessibility Needs' parameter.

Automobile Access to Jobs

Automobile access to jobs needs are based on the Access Across America study by the Accessibility Observatory at the University of Minnesota Center for Transportation Studies. This study estimates the number of destinations reachable by automobile within a given travel time for all census blocks in the United States. In brief, the accessibility calculations performed in the Access Across America study are as follows:

- Calculate travel times by car from each census block to all other blocks within 120km for each departure time at 1-hour intervals over the 24-hour period. Block-Level Access to Jobs (source: Access Across America
- Calculate cumulative opportunity accessibility to jobs for each block and departure time using travel time thresholds of five minutes to one hour. A destination decay function is used to weight the number of jobs reachable such that nearby jobs contribute more to the access score than jobs that are farther away.

In the Access Across America data, the time cost of travel by automobile is evaluated by time of day with average link speeds estimated from TomTom, which reports typical speeds based on data collected from GPS devices. Average speed data reflect conditions on Wednesdays (representing a typical weekday) during the June 2017 to June 2019 period.

In the CAMPO needs analysis, the magnitude of need arising from automobile access to jobs performance is determined by the difference in block-level access to jobs between the current condition and the reference condition. The current condition is access to jobs by automobile during the 8:00 – 9:00 AM period and the reference condition is access to jobs by automobile during the 12:00 – 1:00 AM period. This elevates areas where jobs access by car is significantly lower during the morning commute period than it would be under a free flow condition, suggesting an opportunity to enhance highway operations and/or capacity to offer greater access to destinations when highway demand is highest. The deficit that results from subtracting the current condition from the reference condition is the potential accessibility increase (PAI).

The zone (block) data from Access Across America are intersected with 10-mile buffers defining each segment's catchment area. Within each catchment area, the population weighted average PAI is calculated, and the result is multiplied by the segment's functional classification weight. This elevates facilities that are likely to carry relatively high volumes of person trips and that are in areas where automobile access to jobs could be improved. The segments identified in this process do not necessarily experience acute congestion-related delays, so the results should be compared with measures of delay and reliability to determine what projects or investments may be appropriate to enhance automobile accessibility.

Eligibility for automobile access to jobs scoring is determined by population weighted PAI for each segment and may be determined by one of the following optional thresholds:

1. All segments where PAI deficit is greater than zero
2. All segments where PAI deficit is greater than the region's median PAI deficit

The first option acknowledges all opportunities for potential accessibility enhancements while the second option focuses on the most acute needs. Note that functional classification weightings apply after eligibility is determined.

Calculation Steps

The following steps outline the process for estimating the magnitude of need under the *access to jobs by automobile* score:

1. Obtain the Access Across America datasets given the following parameters:
   - Current Condition: Auto (8 AM - 9AM, Peak Period)
   - Reference Condition: Automobile (12 AM - 1 AM, Off Peak Period)
   - Maximum Travel Time: 45 minutesMaximum Travel Distanace: 10 miles

2. For each census block, calculate PAI as the difference between the reference condition and current condition, or the accessibility deficit between the current condition and the reference condition.

$$\text{Auto PAI} = \textit{Reference} - \textit{Current}$$

3. Calculate the population weighted PAI for each census block by multiplying PAI by the population of the census block in which the segment is located.

$$\textit{Population Weighted PAI} = \textit{Population} \times \textit{PAI}$$

4. Sum the population in the catchment area around each segment. Next, divide the population weighted PAI by the population in the catchment area to yield the population-weighted average PAI.

$$\textit{Weighted Average PAI} = \frac{\textit{Population Weighted PAI}_i}{\textit{Catchment Population}_i}$$

4. Calculate the *automobile access to jobs* performance measure
   - Assign a functional classification (FC) score to all road segments.
   - Calculate the raw score for automobile access to jobs performance measure by multiplying segments' weighted average accessibility improvement by its FC score (see **Table 12**).

$$\textit{Raw Need Score} = \textit{Weighted Average PAI} \times \textit{FC Score}$$

Table 12 Automobile access to jobs functional classification score standardization

Functional Class	FC Score
Interstates, Other Freeways & Express, and Other Principal Arterial	4
Minor Arterial	3
Major Collector	2
Minor Collector	1

Scoring of Automobile Access to Jobs Needs

Sort the raw automobile need score in descending order. Then, using **Table 13**, assign the need score based on the segments' cumulative length percentage of the combined mileage of all segments that have a need for *automobile access to jobs*.

Table 13 Automobile access to jobs need scores

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Data Requirements

- Block-Level Access to Jobs (source: National Accessibility Evaluation, retrieved through VTRC)
- Functional Classification (source: InteractVTrans Map Explorer)

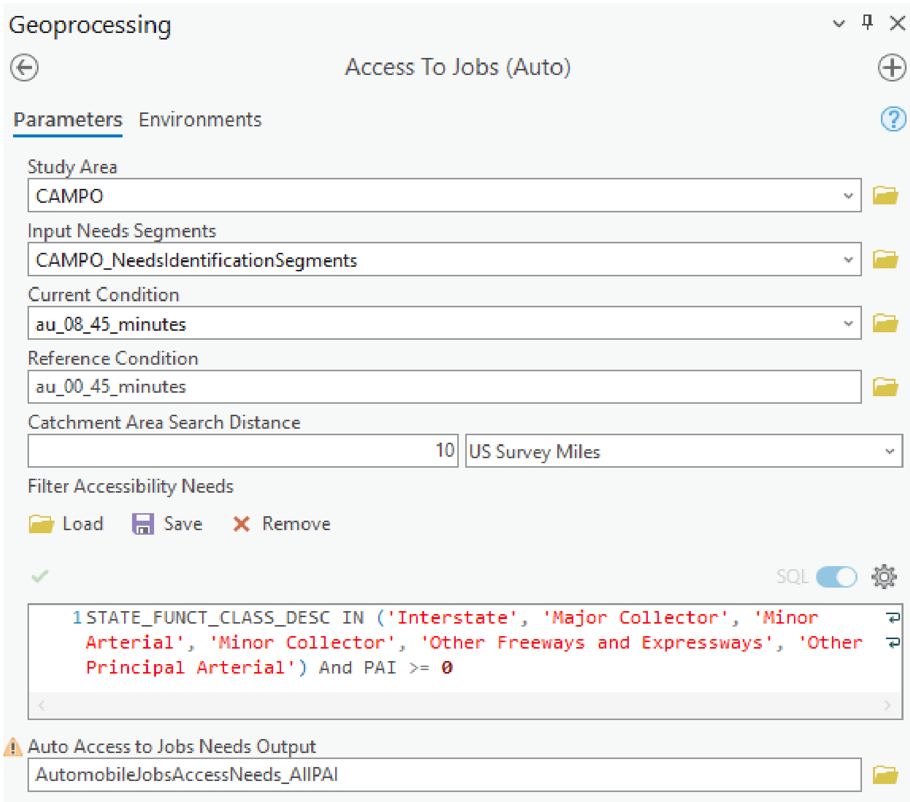

Figure 6 *Access to Jobs (Auto) Geoprocessing Tool*

Geoprocessing Tool Overview

Set parameters in the *Access to Jobs (Auto)* geoprocessing tool exactly as shown in the above figure with input data saved in the following Input geodatabases. Save outputs with a descriptive name in the following output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\NAE_Tables.gdb
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Accessibility Feature Dataset)

The Access to Jobs (Transit) geoprocessing tool requires one input from the 'Inputs' geodatabase: Study Area (CAMPO) The geoprocessing tool also needs the current and reference condition accessibility tables from the 'NAE_Tables' geodatabase.

Edit the 'Filter Accessibility Needs' parameter to filter which segments are included in the output. The Automobile Access to Jobs performance measure includes all functional classification types. To limit the Automobile Access to Jobs needs analysis to segments that are greater than the region's average PAI, change the PAI value in the 'Filter Accessibility Needs' parameter.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Access to Jobs by Disadvantaged Populations

Access to jobs by disadvantaged populations needs are based on the analysis of transit access to jobs. However, transit access to jobs results are filtered to segments within areas that are identified as Equity Emphasis Areas (EEA) where transit is available. EEA is an existing dataset provided by OIPI, so no additional calculations are necessary. The full process and data needs are discussed in the Technical Guide for the Identification and Prioritization of the VTrans Mid-Term Needs.

In the CAMPO needs analysis, the magnitude of need arising from access to job for disadvantaged populations is assessed in the same way that transit access to jobs needs are assessed, except that the population weighting is based on populations in EEAs only.

Eligibility for access to jobs for disadvantaged populations scoring is limited to segments within EEAs and determined by population weighted PAI for each segment and may be determined by one of the following optional thresholds:

1. All segments in EEAs where transit is available and where PAI is greater than zero.
2. All segments in EEAs where population weighted PAI is greater than the region's median population weighted PAI.

Calculation Steps

The following steps outline the process for prioritization within the Access to Jobs by Disadvantaged Populations need category:

3. Obtain the NAE datasets given the following parameters:
   - Current Condition: Transit
   - Reference Condition: Automobile (8 AM)
   - Maximum Travel Time: 45 minutes
   - Maximum Travel Distance: 5 miles

4. For each census block, calculate PAI as the difference between the reference condition and current condition, or the accessibility deficit between the current condition and the reference condition.

$$\text{Transit PAI} = \textit{Reference} - \textit{Current}$$

5. Calculate the disadvantaged population (DP) weighted PAI for each census block by multiplying PAI by the disadvantaged population of the census block in which the segment is located.

$$\textit{DP Weighted PAI} = \textit{Population} \times \textit{PAI}$$

4. Sum the disadvantaged population in the catchment area around each segment. Next, divide the population-weighted PAI by the disadvantaged population in the catchment area to yield the population-weighted average PAI.

$$\textit{DP Weighted Average PAI} = \frac{\textit{DP Weighted PAI}_i}{\textit{Catchment DP}_i}$$

5. Calculate the transit access to jobs performance measure
   - Assign a functional classification (FC) score to all road segments.
   - Calculate the raw score for transit access to jobs performance measure by multiplying segments' weighted average accessibility improvement by its FC score (see **Table 14**).

$$\textit{Raw Need Score} = \textit{Weighted Average PAI} \times \textit{FC Score}$$

Table 14 Access to jobs for disadvantaged populations functional classification score

Functional Class	FC Score
Other Principal Arterial	4
Minor Arterial	3
Major Collector	2
Minor Collector	1

Scoring of Access to Jobs by Disadvantaged Populations Needs

Sort the raw automobile need score in descending order. Then, using **Table 15**, assign the need score based on the segments' cumulative length percentage of the combined mileage of all segments that have a need for Access to Jobs by Disadvantaged Populations.

Table 15 Access to jobs by disadvantaged populations need scores

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Data Requirements

- Block-Level Access to Jobs (source: National Accessibility Evaluation, retrieved through VTRC)
- Equity Emphasis Areas (source: InteractVTrans Map Explorer)
- Functional Classification (source: InteractVTrans Map Explorer)

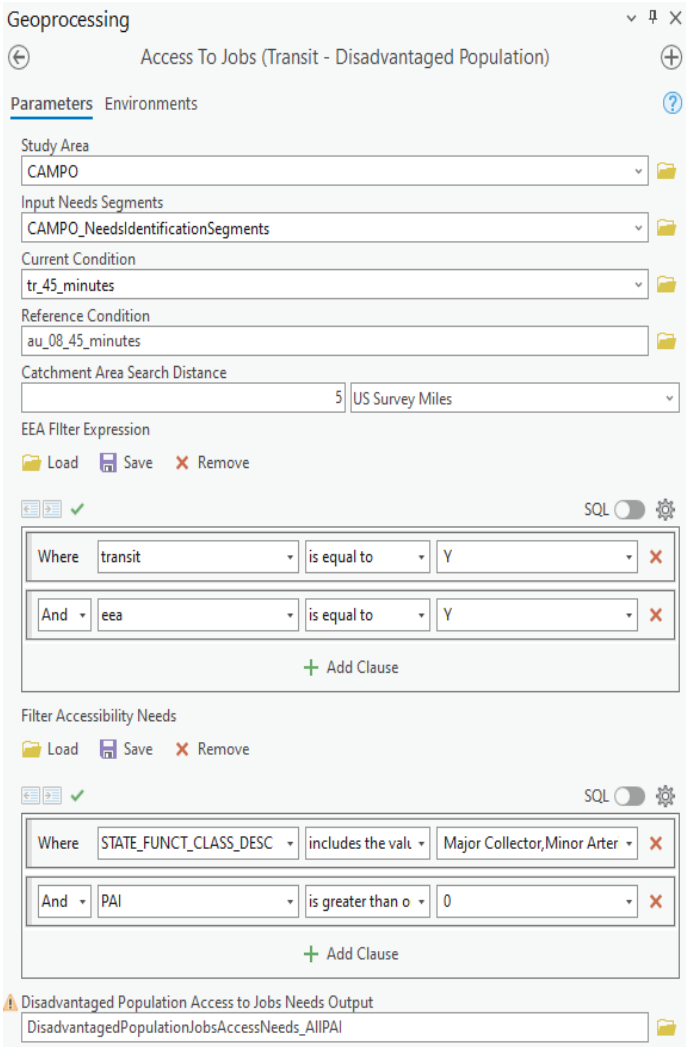

Figure 7 Access to Jobs (Transit - Disadvantaged Population) Geoprocessing Tool

Geoprocessing Tool Overview

Set parameters in the *Access to Jobs (Transit - Disadvantaged Population)* geoprocessing tool exactly as shown in the above figure with input data saved in the following Input geodatabases. Save outputs with a descriptive name in the following output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\NAE_Tables.gdb
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Accessibility Feature Dataset)

The Access to Jobs (Transit - Disadvantaged Population) geoprocessing tool requires one input from the 'Inputs' geodatabase: Study Area (CAMPO) The geoprocessing tool also needs the current and reference condition accessibility tables from the 'NAE_Tables' geodatabase.

The Disadvantaged Population Access to Jobs performance measure excludes features with the functional classification attribute 'Interstate' or 'Other Freeways and Expressways' functional classification because bus bus stops do not exist on these facilities. Edit the 'Filter Accessibility Needs' parameter to filter which segments are included in the output. To limit the Access to Jobs by Disadvantaged Populations needs analysis to segments that are greater than the region's average PAI, change the PAI value in the 'Filter Accessibility Needs' parameter. Additionally, the EEA Filter Expression limits the analysis to segments in Equity Emphasis Areas (EEA = 'Y') where transit is available (transit = 'Y').

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Need Category: Mobility and System Efficiency

The aim of the mobility and system efficiency category is to identify segments where congestion-related delay degrades travel time and travel time reliability for automobiles and transit vehicles and to prioritize projects that will alleviate delay and/or enhance person throughput throughout the region. Mobility needs are assessed using two measures: congestion mitigation and travel time reliability. Both measures compare congested travel conditions to free flow conditions, assessing the severity of congestion under typical and extreme conditions, respectively.

Congestion Mitigation

Congestion mitigation needs are identified through Travel Time Index (TTI), which is the ratio of a segment's typical travel time during an observed period (such as the morning or evening peak commuting period) to the time required to travel the same distance in a reference period (under free-flow conditions, e.g.). A TTI value greater than one indicates there is delay during the observation period, and higher numbers indicate increasingly severe delay due to congestion. TTI is usually measured at a segment level. For example, a TTI of 1.3 indicates typical travel times along a particular segment are 30% longer. If it would take 2 minutes to traverse the segment under free-flow conditions, the TTI of 1.3 would imply it typically takes 2 minutes and 40 seconds during congested conditions.

The dataset used for this analysis contains TTI measures by segment that cover a 14-hour period from 6 AM to 8 PM on weekdays and weekends for multiple years (i.e., TTI for weekdays and weekends in 2018, 2019, 2020, and 2021 for each hour from 6 AM to 8 PM). The TTI measures, which are calculated by OIPI using INRIX TMC data from the Regional Integrated Transportation System (RITIS), can be obtained from the InteractVTrans Map Explorer, and reflect the ratio of the 50th percentile travel time to the estimated free flow time.

The identification of qualifying segments requires that a given segment at any time in the previous four years exceeds the congestion mitigation need threshold discussed in the following sections.

The following steps outline the process for identifying congestion mitigation needs. In this process the focus is on weekday and weekend TTI from 6 AM to 8 PM analysis periods.

1. For each segment and each year, calculate the weeklong average TTI for each hour in the analysis period by combining the separate estimates of weekday TTI and weekend TTI as follows:
   - Multiply weekday TTI values by 5/7 (five of seven days)
   - Multiply weekend TTI values by 2/7 (two of seven days)
   - Sum the results of 1a and 1b to obtain weeklong average TTI
2. For each segment, tally the number of hours in the analysis period where the weeklong average TTI in any year is above the eligibility threshold. Select eligible segments where the thresholds are satisfied.

Eligibility for congestion mitigation scoring may be determined by one of the following alternative thresholds:

1. Average weeklong TTI in any year is greater than 1.3 for three or more hours or average weeklong TTI is greater than 1.5 for one or more hours.
2. Average weeklong TTI in any year is greater than 1.5 for three or more hours or average weeklong TTI is greater than 1.7 for one more hours.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Calculation Steps

The following steps outline the process for assessing the magnitude of the congestion mitigation need:

1. Calculate the daily cumulative TTI values from 6 AM to 8 PM. This step accumulates over all qualifying hours in a single year to a calculate a "daily cumulative TTI" value.

$$\text{Daily Cumulative TTI} = \frac{5}{7}\left(\sum_{\text{Weekday TTI} > T} \text{Weekday TTI}\right) + \frac{2}{7}\left(\sum_{\text{Weekend TTI} > T} \text{Weekend TTI}\right)$$

Where:

T = TTI threshold (1.3, 1.5, 1.7, e.g.)

2. Adjust for magnitude of congestion by multiplying cumulative congested hours by traffic volume using length weighted Annual Average Daily Traffic (AADT)

$$\text{Normalized } TTI\_AADT_i = \frac{TTI\_AADT_i - TTI\_AADT_{min}}{TTI\_AADT_i - TTI\_AADT_{max}}$$

Where:

TTI_AADT_i = Cumulative TTI × AADT for segment i

TTI_AADT_{min} = Minimum Cumulative TTI × AADT for all segments

TTI_AADT_{max} = Maximum Cumulative TTI × AADT for all segments

Scoring of Congestion Mitigation Needs

Using **Table 18**, assign need scores based on segments' normalized volume adjusted weekly average TTI.

Table 16 *Congestion mitigation need scores*

Need Category	Need Score	Normalized Congestion Need Score
Very High	7	0.95 to 1
High	6	0.9 to 0.95
Medium High	5	0.85 to 0.9
Medium	4	0.8 to 0.85
Medium Low	3	0.75 to 0.8
Low	2	0.5 to 0.75
Very Low	1	0 to 0.5

Data Requirements

- Travel Time Index (source: INRIX provided by RITIS via InteractVTrans Map Explorer)
- AADT (source: InteractVTrans Map Explorer)

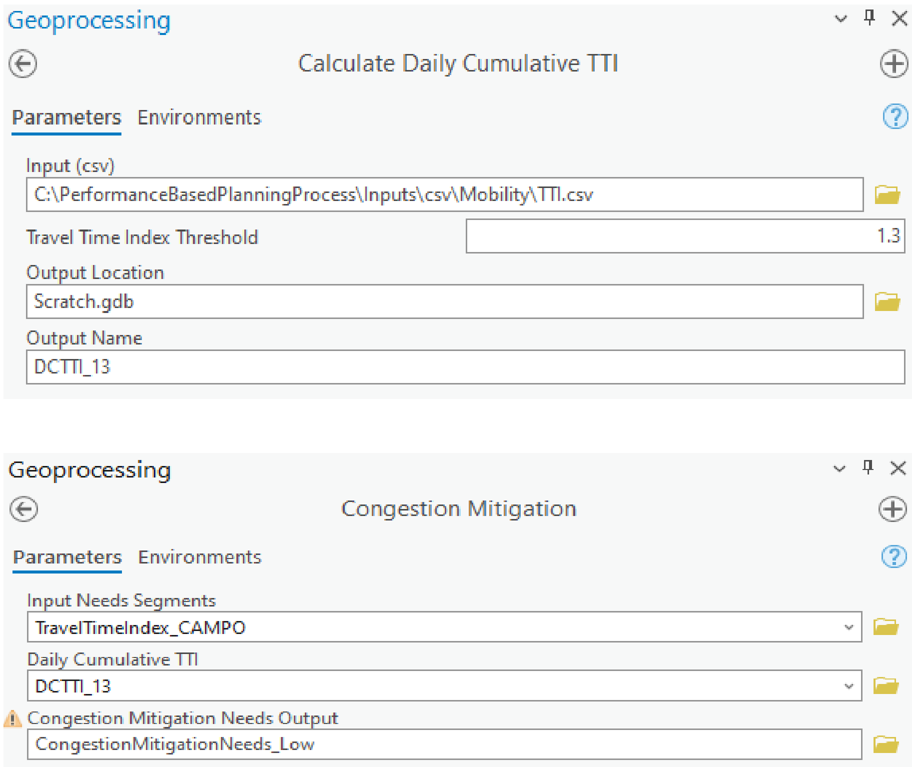

Figure 8 Congestion Mitigation Geoprocessing Tool

Geoprocessing Tool Overview

Set the parameters in the *Calculate Daily Cumulative TTI* and *Congestion Mitigation* geoprocessing tools exactly as shown in the above figures with input data saved in the following Input geodatabases. Then, run the Calculate Daily Cumulative Travel Time Index geoprocessing tool prior to running the Congestion Mitigtation geoprocessing too. Save outputs with a descriptive name in thfollowing output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\csv\Mobility
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb (Mobility Feature Dataset)

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Mobility Feature Dataset)

In the *Calculate Daily Cumulative TTI* geoprocessing tool, set the Travel Time Index Threshold equal to the desired value. This parameter limits the analysis to segments with TTI greater than the value set for the threshold.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Travel Time Reliability

Travel time reliability needs are identified through Planning Time Index (PTI), which is the ratio of a segment's 95th percentile travel time compared to the time needed to travel the same distance in a reference period (free-flow traffic, e.g.). PTI refers to the total planned duration of travel (expected delay plus unexpected delay) that is required for an on-time arrival for 95% of trips on a given segment. For example, a PTI of 1.5 at a given time indicates that a trip that normally takes 10 minutes in uncongested conditions should be planned to take 15 minutes to ensure that 95% of trips arrive on time. PTI is a measure of travel time reliability because it measures the extent of unexpected delay against free flow traffic and measures the consistency or dependability in travel times across different times of day.

The dataset used for this analysis contains PTI measures that cover a 14-hour period from 6 AM to 8 PM on weekdays and weekends for multiple years (i.e., PTI for weekdays and weekends in 2018, 2019, 2020, and 2021 for each hour from 6 AM to 8 PM). The PTI measures, which are calculated by OIPI using INRIX TMC data from the Regional Integrated Transportation System (RITIS), can be obtained from the InteractVTrans Map Explorer and reflect the ratio of the 95th percentile travel time to the estimated free flow time.

The identification of qualifying segments requires that a given segment at any time in the previous four years exceeds the congestion mitigation need threshold discussed in the following sections. The following steps outline the process for identifying travel time reliability needs. In this process the focus is on weekday and weekend PTI from 6 AM to 8 PM analysis periods.

1. For each segment and each year, calculate the PTI for each hour in the analysis period by combining the separate estimates of weekday PTI and weekend PTI as follows:
   - Multiply weekday PTI values by 5/7 (five of seven days)
   - Multiply weekend PTI values by 2/7 (two of seven days)
   - Sum the results of 1a and 1b to obtain weeklong average PTI
2. For each segment, tally the number of hours in the analysis period where the weeklong average PTI in any year is above the eligibility threshold. Select eligible segments where the thresholds are satisfied.

Eligibility for travel time reliability scoring may be determined by one of the following alternative thresholds::

1. Average weekday and weekend PTI is greater than 1.3 for three hours or greater than 1.5 for one hour.
2. Average weekday and weekend PTI is greater than 1.5 for three hours or greater than 1.7 for one hour.

Calculation Steps

The following steps outline the process for assessing the magnitude of the congestion mitigation need:

1. Calculate the daily cumulative PTI values from 6 AM to 8 PM. This step accumulates over all qualifying hours in a single year to a calculate a "daily cumulative PTI" value.

$$\text{Daily Cumulative PTI} = \frac{5}{7}\left(\sum_{\text{Weekday PTI} > T} \text{Weekday PTI}\right) + \frac{2}{7}\left(\sum_{\text{Weekend PTI} > T} \text{Weekend PTI}\right)$$

   Where:

   T = TTI threshold (1.3, 1.5, 1.7, e.g.)

2. Adjust for magnitude of congestion by multiplying cumulative congested hours by traffic volume using length weighted Annual Average Daily Traffic (AADT)
3. Repeat steps 1 and 2 for all years available in the PTI dataset to calculate AADT-weighted daily cumulative PTI for each year. Retain the maximum result across all years for each segment.
4. Normalize the AADT adjusted PTI for all years available in the dataset using the following equation. Normalization results in values ranging from 0.0 to 1.0, with the segment that has the lowest volume adjusted PTI receiving a score of 0.0 and the segment that has the highest volume adjusted PTI receiving a score of 1.0.

$$\text{Normalized TTI\_AADT}_i = \frac{\text{PTI\_AADT}_i - \text{PTI\_AADT}_{min}}{\text{PTI\_AADT}_i - \text{PTI\_AADT}_{max}}$$

   Where:

   PTI_AADTi = Cumulative PTI × AADT for segment i

   PTI_AADT_{min} = Minimum Cumulative PTI × AADT for all segments

   PTI_AADT_{max} = Maximum Cumulative PTI × AADT for all segments

Scoring of Travel Time Reliability Needs

Using **Table 17**, assign need scores based on segments' normalized volume adjusted weekly average PTI.

Table 17 Travel time reliability need scores

Need Category	Need Score	Normalized Congestion Need Score
Very High	7	0.95 to 1
High	6	0.9 to 0.95
Medium High	5	0.85 to 0.9
Medium	4	0.8 to 0.85
Medium Low	3	0.75 to 0.8
Low	2	0.5 to 0.75
Very Low	1	0 to 0.5

Data Requirements

- Planning Time Index (source: INRIX provided by RITIS via InteractVTrans Map Explorer)
- AADT (source: InteractVTrans Map Explorer)

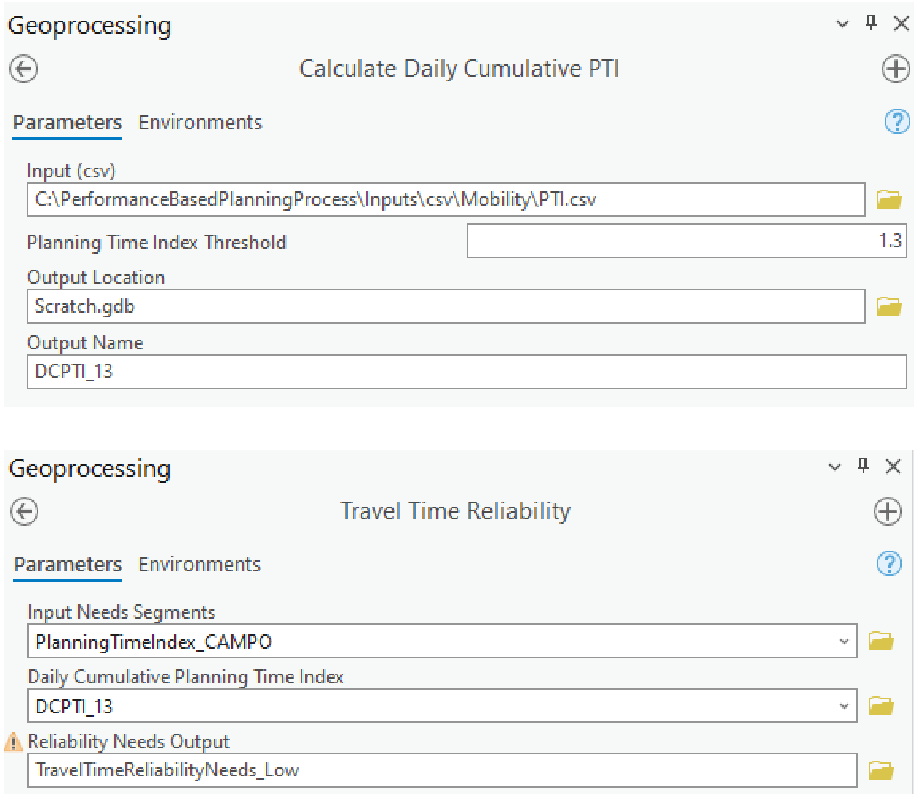

Figure 9 Travel Time Reliability Geoprocessing Tool

Geoprocessing Tool Overview

Set the parameters in the *Calculate Daily Cumulative PTI* and *Travel Time Reliability* geoprocessing tools exactly as shown in the above figures with input data saved in the following Input geodatabases. Then, run the Calculate Daily Cumulative Travel Time Index geoprocessing tool prior to running the Congestion Mitigtation geoprocessing too. Save outputs with a descriptive name in thfollowing output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\csv\Mobility
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb (Mobility Feature Dataset)

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Mobility Feature Dataset)

In the *Calculate Daily Cumulative PTI* geoprocessing tool, set the Travel Time Index Threshold equal to the desired value. This parameter limits the analysis to segments with PTI greater than the value set for the threshold.

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Bus Transit On-Time Performance

While there are multiple factors that influence people's decisions to use public transportation, one of the most important decision-making factors in low-frequency bus systems such as Charlottesville Area Transit (CAT) is passenger waiting time, which is influenced by the reliability of the transit service and adherence to published schedules. When buses regularly depart from stops at the scheduled time, passengers can time their arrival at the stop to minimize wait time. However, if the bus is not usually on time, passengers can face unpredictable wait times. Accordingly, one of the most common measures of the effectiveness of the bus transportation system is on-time performance (OTP).

For the purpose of this analysis, OTP measures how well transit vehicles adhere to the published schedule within an acceptable level of deviation measured in time and serves as an indicator of the attractiveness of bus transit as a travel option. OTP is expressed as a percentage and is calculated by the count of bus timepoint departures that are on time divided by the count of total departures multiplied by 100. Buses are considered "on-time" if they are no more than 30 seconds early and no more than 5 minutes late to the major stops on the route schedule.

Since OTP data is only collected at stops where departure times are scheduled (i.e., timepoints), this analysis does not include intermediate stops with scheduled departure times. Since stop locations may include bus stops for more than one route, the term "timepoint" refers to bus stops associated with a specific route (i.e., there may be multiple timepoint features at a single stop location). Additionally, this analysis does not consider reliability in terms of service consistency or the change in reliability over time. For example, a bus that is consistently six minutes late is not on time but is reliable. Furthermore, the analysis of OTP does not provide reasons for poor performance including predictable events such as traffic congestion, passenger loads, and delays due to at-grade railroad crossings or unexpected events like crashes, disabled buses, temporary detours, weather, and issues related to labor.

The following threshold options were tested to determine scoring eligibility:

1. Stops where OTP is less than the systemwide weekly average OTP from the previous year.
2. Stops where OTP is less than 85% or an alternative target value in accordance with CAMPO's transit performance goals.

Calculate OTP for all timepoints in the analysis period for weekdays and weekends separately.

1. Calculate OTP in two steps:
   - Find the percentage of on-time departures by dividing the sum of on-time departures by the sum of total departures, then multiply by 100.
   - Subtract the result from 100 to obtain the share of departures that are not on time.
2. Multiply timepoints' weekday OTP values by 5/7 (five of seven days)
3. Multiply timepoints' weekend OTP values by 2/7 (two of seven days)
4. Sum the results of step 2 and step 3 to obtain weeklong average OTP by timepoint

OTP is used in the identification of needs to determine if stops are eligible for bus transit on-time performance scoring. The first threshold option determines eligibility if OTP at a timepoint is worse than the systemwide weekly average OTP from the previous year or analysis period. Alternatively, if the second threshold option is selected, timepoints are eligible for scoring if OTP is less than a target value set by CAMPO (e.g., 85%). The second threshold option does not require computation of an average weeklong average OTP.

Calculation Steps

The following steps outline the process for assessing the magnitude of the *congestion mitigation* need:

1. Calculate the daily cumulative OTP values from 6 AM to 8 PM. This step accumulates over all qualifying hours in a single year to a calculate a "weeklong OTP" value.

$$\text{Weeklong OTP} = \frac{5}{7}\left(\sum_{\text{Weekday OTP} > T} \text{Weekday OTP}\right) + \frac{2}{7}\left(\sum_{\text{Weekend OTP} > T} \text{Weekend OTP}\right.$$

Where:

Weeklong OTP = Average OTP for each stop by route

T = OTP threshold (83%, 85%, 90%, e.g.)

2. Adjust Weeklong OTP by subtracting the on-time rate from 100%. This will ensure that the timepoints with greater needs receive a higher value. For example, a timepoint with an OTP of 80% will become 20%, while a timepoint with an OTP of 60% will become 40%.

3. Account for the magnitude of needs by multiplying the adjusted weeklong OTP by the number of daily boardings and alightings at each timepoint (boardings and alightings are treated as a proxy for ridership in this analysis).

$$OTP\_Ridership_i = Ridership_i \times \text{Adjusted Weeklong OTP}_i$$

Where,

$OTP\_Ridership_i$ = Ridership Adjusted OTP at timepoint i

$Ridership_i$ = Daily Ridership at timepoint i

Weeklong OTP_i = Adjusted Weeklong OTP at timepoint i

4. Normalize ridership adjusted OTP.

$$\text{Normalized } OTP\_Ridership_i = \frac{OTP\_Ridership_i - OTP\_Ridership_{min}}{OTP\_Ridership_i - OTP\_Ridership_{max}}$$

Where:

$OTP\_Ridership_{min}$ = Minimum ridership adjusted OTP across all timepoints

$OTP\_Ridership_{max}$ = Maximum ridership adjusted OTP across all timepoints

Scoring of Bus On Time Performance Needs

Using **Table 18**, assign need scores based on segments' normalized volume adjusted weekly average OTP.

Table 18 Bus Transit On-Time Performance need scores

Need Category	Need Score	Normalized Reliability Need Score
Very High	7	0.95 to 1
High	6	0.9 to 0.95
Medium High	5	0.85 to 0.9
Medium	4	0.8 to 0.85
Medium Low	3	0.75 to 0.8
Low	2	0.5 to 0.75
Very Low	1	0 to 0.5

Data Requirements

- Charlottesville Area Transit On-Time Performance (source: CAT)
- Charlottesville Area Transit Daily Ridership (source: CAT)

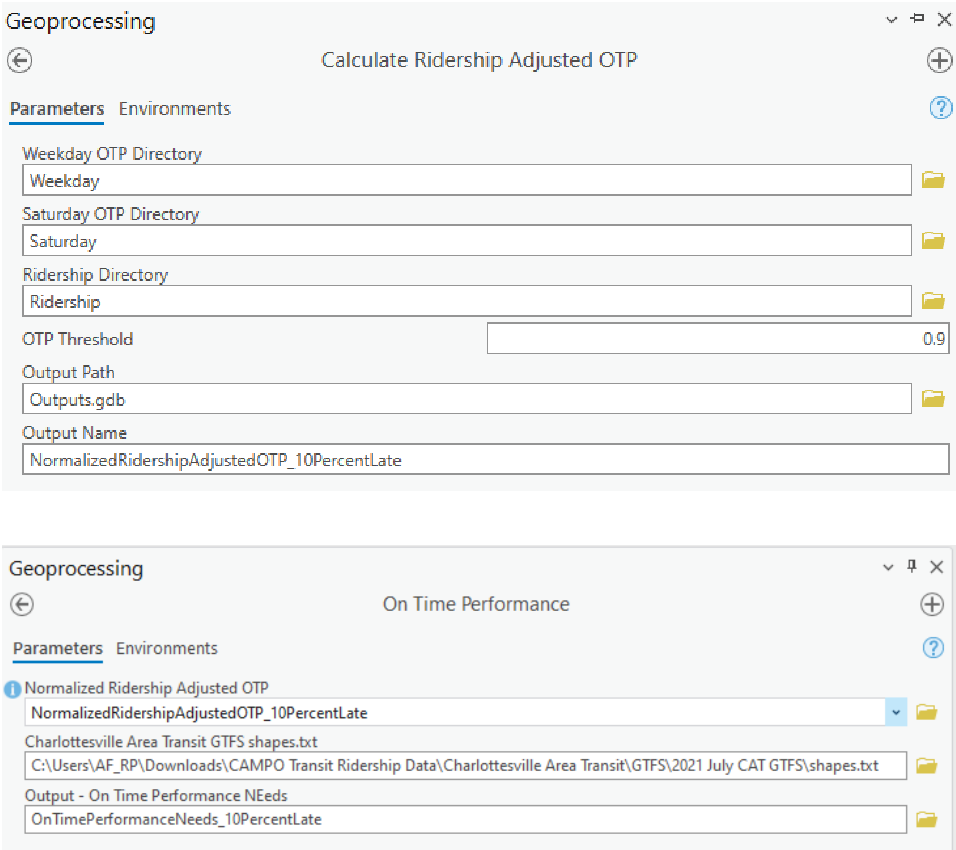

Figure 10 Bus On-Time Performance Geoprocessing Tool

Geoprocessing Tool Overview

Set the parameters in the *Calculate Ridership Adjusted OTP* and *On Time Performance* geoprocessing tools exactly as shown in the above figures with input data saved in the following Input geodatabases. Then, run the Calculate Daily Cumulative Travel Time Index geoprocessing tool prior to running the Congestion Mitigtation geoprocessing too. Save outputs with a descriptive name in thfollowing output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\csv\Mobility
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb (Mobility Feature Dataset)

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Mobility Feature Dataset)

In the *Caslculate Ridership Adjusted OTP* geoprocessing tool, set the On Time Performance Threshold equal to the desired value. This parameter limits the analysis to timepoints with on-time arrivals less than the value set for the threshold.

Need Category: Land Use and Economic Development

The aim of the land use and economic development category is to identify areas where there is access to non-work destinations to stimulate local economic activity or to create transportation choices for disadvantaged people and to prioritize projects that connect to areas of local economic development activity. Land use needs are assessed using two measures: walk access to *non-work destinations* and *walk access to non-work destinations by disadvantaged populations*. Both measures rely on WalkScore and BikeScore indices, focusing on the general population and disadvantaged populations, respectively.

Walk Access to Non-Work Destinations

The *need for walk access to non-work destinations* is determined by a segment's maximum of WalkScore and BikeScore and its future population and employment level (i.e., activity level). WalkScore3 measures walkability through measures of access to non-work destinations (cultural, restaurants, groceries, parks, errands) and roadway connectivity such as intersection density and average block length. In this needs assessment process, the maximum WalkScore or BikeScore is weighted by future activity level from the regional travel demand model. This performance measure shows locations that are in close proximity to non-work destinations, population and employment. Through the WalkScore component, the performance measures indicates where there is high network connectivity. However, these locations may have barriers to walking not accounted for in the WalkScore methodology including lack of sidewalks or crosswalks along existing facilities. Therefore, the walk *access to non-work destinations* performance measures indicates where investments in pedestrian improvements would likely yield the greatest benefits.

Segment eligibility for walk access to non-work destinations scoring may be determined by one of the following optional thresholds:

1. All segments in the City of Charlottesville and in Albemarle County Development Areas
2. All segments in "somewhat walkable" census tracts (i.e., WalkScores greater than 49)

If the first threshold option is selected, all segments in the City of Charlottesville or in one of Albemarle County's five Development Areas are eligible for *walk access to non-work destinations* scoring. Development areas, which are defined by the County's Comprehensive Plan, are intended "to focus development into the urban areas to create quality living areas, avoid sprawl, improve access to services, and protect the natural and agricultural resources and uses of the rural areas." Development areas include Crozet, Pantops, the US-29 corridor from Hydraulic Road to north of the airport, the Southern and Western neighborhoods adjacent to Charlottesville, and the Village of Rivanna. The effect of selecting this threshold option is that needs will be considered for all areas regardless of the current WalkScore.

Alternatively, if the second threshold option is selected, segments are eligible for *walk access to non-work destinations* scoring if they are in "somewhat walkable" census tracts which is defined by WalkScores that are greater than 49. The result of selecting this threshold option is that needs will be considered for all areas regardless of its designation as a Development Area (for Albemarle County only). However, given that WalkScores are higher in more urban areas due to better network connectivity and shorter distances to amenities, the more realistic outcome is that needs will be identified in areas within Development Areas where there is the greatest potential for improving access to non-work destinations.

Calculation Steps

The following steps outline the process for assessing the magnitude of the *walk access to non-work destinations* need:

1. Calculate segments' average WalkScore by performing a spatial join of segments that intersect the WalkScore feature layer.

2. Calculate segments' average activity level by performing a spatial join of segments that intersect the regional travel demand model's Traffic Analysis Zones (TAZ) layer that contains total population and all employment. Summarize the average activity level for segments that span two or more TAZs.

3. Calculate segments' activity weighted WalkScore by multiplying average WalkScore by average future activity level.

$$\text{Weighted Walk Score} = \text{Walk Score} \times (\text{Average Population} + \text{Average Jobs})$$

4. Normalize the weighted WalkScore using the following equation:

$$\text{Normalized Walk Score} = \frac{\text{Weighted Walk Score}_i - \text{Weighted Walk Score}_{min}}{\text{Weighted Walk Score}_i - \text{Weighted Walk Score}_{max}}$$

Where:

$\text{Weighted WalkScore}_i$ = WalkScore × Activity level for Segment i

$\text{Weighted WalkScore}_{min}$ = Minimum WalkScore × Activity level

$\text{Weighted WalkScore}_{max}$ = Maximum WalkScore × Activity level

Scoring of Walk Access to Non-Work Destinations Needs

Sort the normalized average WalkScore weighted by average activity level. Then, using **Table 19**, assign the need score based on the segments' cumulative length percentage of the combined mileage of all segments that have a need for *walk access to non-work destinations.*

Table 19 *Walk access to non-work destinations need scores applied to segments by population weighted WalkScore*

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Data Requirements

- WalkScore and BikeScore (source: InteractVTrans Map Explorer)
- Future population and employment (source: Charlottesville-Albemarle Regional Model)

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

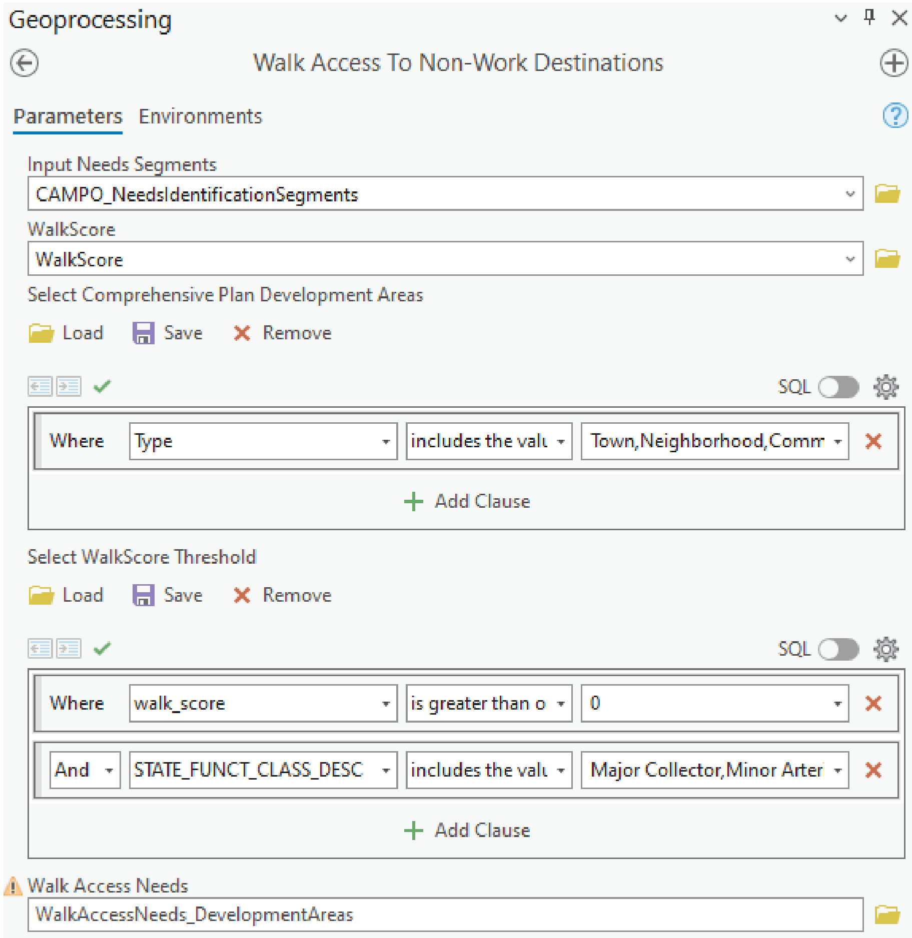

Figure 11 Walk Access to Non-Work Destinations Geoprocessing Tool

Geoprocessing Tool Overview

Set the parameters in the *Walk Access to Non-Work Destinations* geoprocessing tools exactly as shown in the above figures with input data saved in the following Input geodatabases. Save outputs with a descriptive name in thfollowing output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\csv\Mobility
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb (Land Use Feature Dataset)

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Land Use Feature Dataset)

The Walk Access to Non-Work Destinations performance measure excludes features with the functional classification attribute 'Interstate' or 'Other Freeways and Expressways' functional classification because pedestrians are not permitted on these facilities.

Edit the 'Select Comprehensive Plan Development Areas' parameter to filter segments by name or by type. Edit the 'Select WalkScore Threshold' parameter walk_score variable to limit the analysis to segments where the WalkScore is greater than or equal to 50 (i.e., 'Somewhat Walkable' according to WalkScore analysis).

Walk Access to Non-Work Destinations by Disadvantaged Populations

The need for walk access to non-work destinations by disadvantaged populations is similar to the performance measure described in the previous section but the combined WalkScore and BikeScore is weighted by disadvantaged population from Equity Emphasis Areas in the InteractVTrans Map Explorer instead of future activity level. Like walk access to non-work destinations, this performance measure shows locations that are in close proximity to non-work destinations and disadvantaged populations and where there is high network connectivity. However, these locations may still have barriers to walking not accounted for in the WalkScore methodology including lack of sidewalks or crosswalks along existing facilities. Therefore, the walk access to non-work destinations by disadvantaged populations performance measure indicates where investments in pedestrian improvements would likely yield the greatest benefits for disadvantaged residents.

Segment eligibility for walk access to non-work destinations for disadvantaged populations scoring may be determined by one of the following optional thresholds:

1. All segments in EEAs where transit is available
2. All segments in EEAs where transit is available and that are also in "somewhat walkable" census tracts (i.e., WalkScores of 50 or higher)

The implication of selecting all segments in transit EEAs for walk access to non-work destinations scoring is that the current WalkScore does not affect which segments are scored for walk access to jobs by disadvantaged populations. Conversely, the effect of choosing the threshold option that limits scoring to segments in "somewhat walkable" locations is that "car-dependent" EEAs which have a combined WalkScore and BikeScore of less than 50 will not be considered for scoring.

Calculation Steps

The following steps outline the process for assessing the magnitude of the walk access to non-work destinations need:

1. Calculate segments' average WalkScore by performing a spatial join of segments that intersect the WalkScore feature layer.
2. Calculate segments' disadvantaged population by performing a spatial join of segments that intersect the Equity Emphasis Areas (EEA) Census tract layer. Sum the low-income population, age 75-plus population, disabled population, limited English proficiency population, minority population, and Hispanic population for each segment.
3. Calculate segments' weighted WalkScore by multiplying average WalkScore by average disadvantaged populations in intersecting zones.

$$\textit{Weighted Walk Score} = \textit{Walk Score} \times \textit{Segment Disadvatnaged Population}$$

4. Normalize the weighted WalkScore using the following equation:

$$\textit{Normalized Walk Score} = \frac{\textit{Weighted Walk Score}_i - \textit{Weighted Walk Score}_{min}}{\textit{Weighted Walk Score}_i - \textit{Weighted Walk Score}_{max}}$$

Where:

Weighted WalkScore_i = WalkScore × disadvantaged population of Segment i

Weighted WalkScore_{min} = Minimum WalkScore × disadvantaged population of all segments

Weighted WalkScore_{max} = Maximum WalkScore × disadvantaged population of all segments

Scoring of Walk Access to Non-Work Destinations for Disadvantaged Populations Needs

Sort the normalized average WalkScore weighted by disadvantaged population. Then, using **Table 20**, assign the need score based on the segments' cumulative length percentage of the combined mileage of all segments that have a need for walk access to non-work destinations.

Table 20 *Walk access to non-work destinations for disadvantaged populations need scores*

Need Category	Need Score	Percent of Total Mileage
Very High	7	0% to 5%
High	6	5.001% to 10%
Medium High	5	10.001% to 15%
Medium	4	15.001% to 20%
Medium Low	3	20.001% to 25%
Low	2	25.001% to 50%
Very Low	1	50.001% to 100%

Data Requirements

- WalkScore and BikeScore (source: InteractVTrans)
- Equity Emphasis Areas (source: InteractVTrans Map Explorer)

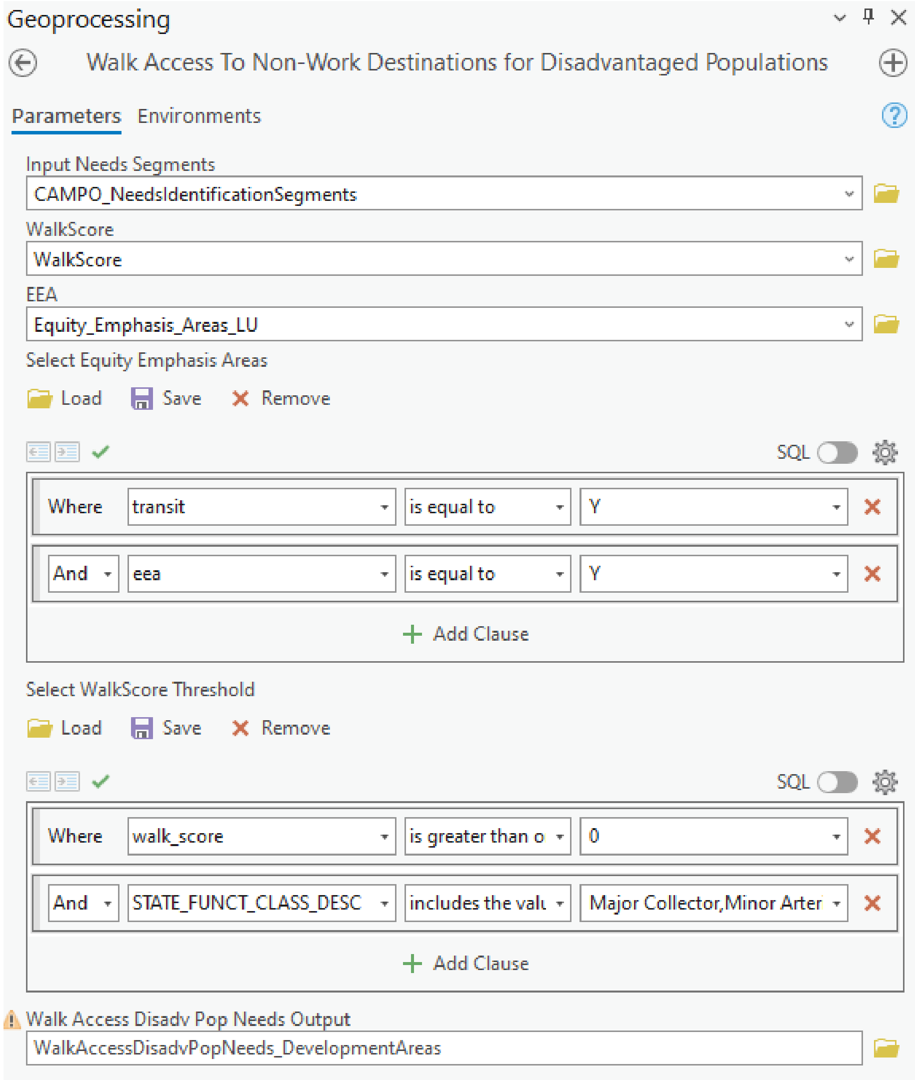

Figure 12 Walk Access to Non-Work Destinations for Disadvantaged Populations Geoprocessing Tool

Geoprocessing Tool Overview

Set the parameters in the *Walk Access to Non-Work Destinations* geoprocessing tools exactly as shown in the above figures with input data saved in the following Input geodatabases. Save outputs with a descriptive name in thfollowing output geodatabase.

Input Geodatabases:

- C:\PerformanceBasedPlanningProcess\Inputs\csv\Mobility
- C:\PerformanceBasedPlanningProcess\Inputs\Inputs.gdb (Land Use Feature Dataset)

Output Geodatabases:

- C:\PerformanceBasedPlanningProcess\Outputs\Outputs.gdb (Land Use Feature Dataset)

The Walk Access to Non-Work Destinations for Disadvantaged Populations performance measure excludes features with the functional classification attribute 'Interstate' or 'Other Freeways and Expressways' functional classification because pedestrians are not permitted on these facilities.

Edit the 'Select Comprehensive Plan Development Areas' parameter to filter segments by area name or by type (e.g., 'Community', 'Town', 'Village', or 'Neighborhood'). Edit the 'Select WalkScore Threshold' parameter walk_score variable to limit the analysis to segments where the WalkScore is greater than or equal to 50 (i.e., 'Somewhat Walkable' according to WalkScore analysis).

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Need Category: Environment and Resiliency

The aim of the environmental category is to identify resiliency needs, especially where infrastructure is exposed to inland flooding and to prioritize projects that pose no environmental impacts, mitigate impacts, or offer environmental services.

Exposure to Projected Sea Level Rise, Storm Surge, or Historical Inland/Riverine Flooding

Environmental and Resiliency needs are accounted for as an adjustment to combined needs scores for segments that are exposed to sea level rise, storm surge, or historical flooding and are within an Economically Distressed Community. This metric adjusts the aggregate scores of all roadway segments with a need based on Flooding Risk Assessment and the Distressed Communities Index (DCI).

OIPI's Flooding Risk Assessment is a system level analysis of the system's assets' (i.e., roads and bridges) vulnerability to climate change, including sea level rise, storm surge, and inland flooding. The components of vulnerability as defined by the Federal Highway Administration (FHWA) include exposure, sensitivity, and adaptive capacity. For the purposes of CAMPO's environmental needs analysis, only system exposure to inland flooding is considered. The following definitions, which are taken from the VTrans Vulnerability Assessment Tech Memo, reflect the components of vulnerability as defined by FHWA.

- Exposure determines whether the asset is experiencing the direct effects of climate change
- Sensitivity determines how well the system fares when exposed to climatic events
- Adaptive Capacity determines the system's ability to adjust with future climate impacts

The Distressed Communities Index (DCI), which derives data from the American Community Survey (ACS), sorts zip codes into quintiles of economic well-being: prosperous, comfortable, mid-tier, at risk, and distressed. The seven components of DCI is the share of residents who are 25 or older who do not have a high school diploma or equivalent, housing vacancy rate, unemployment rate for working-age adults (25-54), the share of the population living under the poverty line, median household income as a percent of metro area/state median household income, the percent change in employment from 2016 to 2020, and the percent change in the number of business establishments from 2016 to 2020. **Table 21** lists zip codes in the Charlottesville-Albemarle MPO area by DCI.

***Table 21** Distressed Communities Index for Zip Codes in the Charlottesville-Albemarle Area*

Zip Code	Post Office	Distressed Communities Index	Population (2021)
22901	Charlottesville	35.6 (Comfortable)	36,964
22902	Charlottesville	38.5 (Comfortable)	24,018
22903	Charlottesville	62.9 (At Risk)	44,101
22904[4]	Charlottesville	n/a	3,119
22911	Charlottesville	7.4 (Prosperous)	18,627
22923	Barboursville	9.4 (Prosperous)	6,004
22932	Crozet	15.3 (Prosperous)	10,102
22936	Earlysville	15.4 (Prosperous)	5,186
22947	Keswick	47.4 (Mid-Tier)	5,150
22959	North Garden	60.7 (At Risk)	1,932
22968	Ruckersville	21.9 (Comfortable)	11,239
22974	22974	34.5 (Comfortable)	5,441

3 – PROCESS FOR THE IDENTIFICATION OF NEEDS

Calculation Steps

Since project location is a critical component of environmental impacts, the Environment and Sustainability need category is applied after aggregating need scores across the other metrics described in previous sections. The adjustment factors apply to aggregate scores for road segments that are exposed to projected sea level rise, storm surge, or inland/riverine flooding and to segments in economically distressed communities.

- 5% adjustment for segments exposed to historical flooding in a 100-year flood zone
- Adjustments for economically distressed communities
  - 5.0% adjustment applied to aggregate score of road segments in a zip code that has a DCI index of 80 to 100 (i.e., distressed)
  - 3.5% adjustment applied to aggregate score of road segment in a zip code that has a DCI rating of 60 to 80 (i.e., at risk
  - Additional 2.0% if a roadway segment falls within a zip code that has a DCI rating of 40 to 60 (i.e., mid-tier)

Data Requirements

- VTrans Flood Risk Assessment (source: InteractVTrans Map Explorer)
- Distressed Communities Index (source: Economic Innovation Group)[5]

4 – PROCESS FOR THE PRIORITIZATION OF PROJECTS

This chapter describes the overall process, performance measures, and methodologies for evaluating and prioritizing surface transportation projects, including highway and roadway, active transportation (i.e., bicycle and pedestrian), transit, and travel demand management (TDM) improvements. While the project prioritization is separate from the process for identifying needs, the process includes the same goal categories.

In general, the project prioritization performance measures evaluate changes due to project implementation, or between the base year with existing conditions and the horizon year with future conditions. Project types that are not eligible for scoring under this process are standalone studies and the maintenance of existing facilities including bridge rehabilitation, pavement repair/replacement, guardrail repair/replacement, and other activities eligible for State of Good Repair funding.

- The Crash Frequency (S1) and Crash Rate (S2) performance measures within the Safety prioritization category indicate projects where there is the highest expected reduction in the annual number of crashes after the implementation a safety treatment, improvement, or countermeasure. Projects that are expected to reduce higher numbers of crashes receive higher scores.
- The Access to Jobs (A1) and Access to Jobs for Disadvantaged Populations (A2) performance measures in the Accessibility and Equity prioritization category indicate projects where there is the most potential for improving access to employment opportunities. Projects that have the greatest potential for accessibility improvement (i.e., constructing new bike and pedestrian facilities, increasing transit frequency, reducing vehicular delay) and are located near where people live will be assigned the highest scores. The Access to Multimodal Choices (A3) performance measure assigns points to projects for increasing multimodal transportation choices such as constructing new bicycle and pedestrian facilities, increasing transit frequency, or providing additional park and ride spaces. Projects that are likely to have the greatest impacts on improving access to multimodal choices and improving air quality will receive higher scores.
- The Demand (M1) performance measures in the Mobility and System Efficiency prioritization category identify projects in areas with the highest potential volume of users who are likely to benefit from the project. Likewise, the Congestion (M2) performance measure identifies projects located in areas with the most congestion. Projects in in areas with more traffic and congestion receive higher scores.
- The Access to Non-Work Destinations (L1) and Access to Non-Destinations for Disadvantaged Populations (L2) performance measures in the Land use and Economic Development prioritization categories identify high 'walkability' areas through the MPO and within equity emphasis areas. Projects that score highly in this measure are most likely to integrate into the existing bicycle and pedestrian network. The Proximity to Activity Centers (L3) and Job Growth (L4) performance measures identify projects which are closest to concentrations of regional economic activity. These projects are likely to have the greatest impact on economic development.
- The Sensitive Features (E1) performance measure within the Environmental Impacts prioritization category identify projects that the fewest environmental impacts. This measure in an inverse measure which means that projects with the fewest impacts will receive the highest score.

Prioritization Category: Safety

The Safety prioritization category is evaluated based on the performance measure weights shown **Table 22**.

Table 22 Safety Performance Measure Weights

Performance Measure	Weight
Crash Frequency (S1)	50%
Crash Rate (S2)	50%
Total	100%

These performance measures are appropriate for measuring the safety benefits of highway and roadway improvements at intersections, interchanges, bridges, freeway segments, and non-freeway segments, as well as bicycle and pedestrian related improvements such as new sidewalks, bicycle lanes, shared use paths, and crossing improvements.

Estimation of changes in crash frequency and rate relies on the use of Crash Modification Factors (CMF). The CMF is a multiplicative factor used to compute the expected reduction in the number of crashes after implementing a safety improvement, treatment, or countermeasure at a specific site. While the Crash Modification Factors Clearinghouse contains thousands of CMFs covering hundreds of treatment options for a variety of crash types, crash severities, and site locations, this process uses a simplified list of fatal and injury CMFs used for SMART SCALE. For example, the conversion of stop/yield control to a signal is expected to reduce the number of fatal and injury crashes by 35% because of a planning level CMF of 0.65 (1 – 0.65 = 0.35 x 100 = 35%)

Project types where CMFs are not available, including standalone transit and travel demand management (TDM) projects do not qualify for Safety scoring. **Table 23** lists the relationship between project type and the crash data needed for the safety analysis of highway and roadway projects and bicycle and pedestrian projects.

Table 23 Safety Project Prioritization Data by Project Type

Project Type	Crash Type	Crash Severity
Highway and Roadway	Motor vehicle	Fatal and Injury
Active Transportation	Bicycle and pedestrian	Fatal and Injury

Crash Frequency (S1)

This measure calculates the reduction in Equivalent Property Damage Only (EPDO) crash frequency. The expected change in crashes is calculated using simplified planning level crash modification factors (CMF) associated with the project improvement. The outcome of this measure is the annual change in the number of fatal and injury crashes due to project implementation.

Calculation Steps

1. Add the project limits layer to an ArcMap document and create 250 foot buffers around each project.
2. Add crash data to the map document, then calculate EPDO weights for each row in a new field using the crash severity conversion values in **Table 3**.
3. Use the 'Spatial Join' tool to join points in the crash layer that intersect the project limits buffer layer. Calculate the sum of crashes by EPDO that intersect the project limits buffer.
4. Calculate the average annual EPDO by dividing the sum of crashes in the project area weighted by EPDO by the number of years included in the analysis.
5. Calculate the Percent Expected Crash Reduction (PECR) using the appropriate CMF for the project improvements with the following equation:

$$PECR = 1 - CMF$$

6. Calculate the expected annual reduction in crashes by multiplying the annual average EPDO of fatal and injury crashes by PECR.

Data Requirements

- Project limits
- 5 year crash data (source: InteractVTrans Map Explorer)
- SMART SCALE Planning Level CMFs (source: https://smartscale.org/documents/cmf-list-smart-scale-rd4_fy2022.pdf)

Crash Rate (S2)

This measure calculates the annual reduction in EPDO of fatal and injury crashes (EPDOF+I) per Hundred Million Vehicle Miles Traveled (HMVMT) on a roadway segment or Million Entering Vehicles (MEV) for an intersection. Crash rate allows for better comparison between projects on routes with different traffic volumes. The outcome of this measure is the change in the annual rate of fatal and injury crashes weighted by severity (EPDOF+I) per HMVMT (segments) or MVE (intersections) due to project implementation.

Calculation Steps

1. Add the project limits layer to an ArcMap document and create 250 foot buffers around each project.
2. Add the AADT layer.
3. Use Select by Location to select segments in the AADT layer that intersect the project limits. Manually deselect segments in the buffer that are on roads not part of the project. For intersection improvements, include all segment approaches and exclude parallel segments. For highway and road projects that are not at an intersection, include the segments where the project is physically located and exclude side streets and parallel segments
4. Calculate the length of segments that intersect the project limits buffer layer using the 'Calculate Geometry' tool. Ensure that all other segments have a zero or null value
5. Use the 'Spatial Join' tool to join segments in the AADT layer that intersect the project limits buffer layer.
6. For segments (i.e., non-intersection projects), calculate the annual traffic volume in HMVMT. For projects that cross multiple segments, HMVMT is the cumulative annual VMT for all segments, calculated for each segment using its AADT and length. For intersections, calculate the annual traffic volume in Million Entering Vehicles (MEV)

$$HMVMT = \frac{\Sigma\, AADT_i \times Segment\ Length_i \times 365}{1{,}000{,}000}$$

$$MEV = \frac{\Sigma\, AADT_i \times 365}{1{,}000{,}000}$$

7. Calculate reduction in annual EPDO of fatal and injury crashes due to project implementation (measure S1)

$$Segment\ Crash\ Rate = \frac{EPDO_{K+I}}{HMVMT}$$

$$Intersection\ Crash\ Rate = \frac{EPDO_{K+I}}{MEV}$$

8. Convert reduction in annual EPDO of fatal and injury crashes into the reduced crash rate using the following formulas

Data Requirements

- Project Limits
- 5 year crash data (source: InteractVTrans Map Explorer)
- Planning Level Crash Modification Factors (CMF) (source: SMART SCALE Planning Level Crash Modification Factors)
- Average Annual Daily Traffic (source: InteractVTrans Map Explorer)

Prioritization Category: Accessibility and Equity

The Accessibility and Equity prioritization category is evaluated based on the performance measure weights shown **Table 24**.

***Table 24** Accessibility and Equity Performance Measure Weights*

Performance Measure	Weight
Access to Jobs (A1)	40%
Access to Jobs for Disadvantaged Populations (A2)	40%
Access to Multimodal Choices (A3)	20%
Total	100%

Access to Jobs (A1)

The Access to Jobs measure calculates a project's potential for improving access to job opportunities for all populations. Scores are determined by the project's weighted average Potential for Accessibility Improvement (PAI) within a buffer distance of the project limits. The buffer distance for evaluating the Census blocks impacted by project implementation is determined by project mode (auto, transit, non-motorized).

PAI is estimated as the difference between the "current" accessibility offered and a "reference" condition. The "current" condition refers to the cumulative number of activities (jobs in the case of all metrics generated in this process) accessible from a given location applying parameters, such as level of traffic stress (LTS) or average travel speed, that influence the estimated travel times among zones. The "reference" condition refers to the cumulative number of jobs accessible from the same location but with hypothetical parameters that yield an estimated maximum level of job accessibility. Refer to the chapter on the Process for the Identification of Needs for more information about terms referred to in the project prioritization process.

Calculation Steps

1. Add the project limits layer to an ArcMap document and create buffers to select Census blocks within a specified distance of the project (catchment area).
2. Add the Census blocks layer and block-level accessibility and population attribute data to an ArcMap document. See **Table 25** to determine data tables needed for each project type. Create buffers based on project type using the catchment area.

***Table 25** Accessibility and Equity Performance Measure Parameters*

Project Type	Current Condition	Reference Condition	Maximum Travel Time (minutes)	Catchment Area (miles)
Bicycle and Pedestrian	Bike LTS 1 (High Stress)	Bike LTS 4 (Low Stress)	20	3
Transit	Transit	Auto 8 AM (Off Peak)	45	5
Highway and Roadway	Auto 8 AM (Peak)	Auto 12 AM (Off Peak)	45	10

3. In the Census blocks layer, create four new fields (data type Long) named 'reference', 'current', 'PAI', and 'population'. Join the block-level accessibility and population attribute data to the Census block layer then calculate the 'current', 'reference', and 'population' fields from the joined data.
4. For each Census block, calculate 'PAI' as the difference between the reference condition and current condition, or the accessibility deficit between the current condition and the reference condition.

$$PAI = Reference - Current$$

5. Add the Functional Classification layer and then use the 'Spatial Join' tool to join the Census blocks that have their center within the catchment area. Sum the population of blocks within the catchment area.
6. Calculate the weighted average PAI for each functional classification segment by multiplying PAI by the total population of the census block in which the segment is located then divide by the total population of the catchment area.

$$\textit{Population Weighted PAI} = \textit{Population} \times PAI$$

$$\textit{Weighted Average PAI} = \frac{\textit{Population Weighted PAI}_i}{\textit{Catchment Population}_i}$$

7. Calculate the raw access score. First, assign a functional classification (FC) score to all road segments. Next, calculate the raw score for transit access to jobs performance measure by multiplying segments' weighted average accessibility improvement by its FC score. In Chapter 3 on the Process for the Identification of Needs, see **Table 9** for Functional Classification Value for Transit and Active Transportation Projects and **Table 11** for Highway and Roadway Projects.

Raw Score = Weighted Average PAI x FC Score

8. Calculate the project accessibility score with the following steps:
   - Intersect the Project Limits layer with the Census Block layer that contains population and Potential for Accessibility Improvement
   - Spatial Join the intersected Project Limits layher with the Census Census Block layer that contains population and sum the population in the catchment area
   - Calculate the raw score for the project's intersects with the Census Block layer using the raw need score equation from the Access to Jobs needs identification category
   - Calculate the length-weighted average for the project

Data Requirements

- Project Limits
- Census blocks
- NAE Current Condition and NAE Reference Condition
- Census block population
- Functional Classificaiton (source: InteracVTrans Map Explorer)

Access to Jobs for Disadvantaged Populations (A2)

The Access to Jobs measure calculates a project's potential for improving access to job opportunities for disadvantaged populations. Scores are determined by the project's weighted average Potential for Accessibility Improvement (PAI) in Equity Emphasis Areas (EEA) within a buffer distance of the project limits. The buffer distance for evaluating the Census blocks impacted by project implementation is determined by project mode (auto, transit, non-motorized).

PAI is estimated as the difference between the "current" accessibility offered and a "reference" condition. The "current" condition refers to the cumulative number of activities (jobs in the case of all metrics generated in this process) accessible from a given location applying parameters, such as level of traffic stress (LTS) or average travel speed, that influence the estimated travel times among zones. The "reference" condition refers to the cumulative number of jobs accessible from the same location but with hypothetical parameters that yield an estimated maximum level of job accessibility. Refer to the chapter on the Process for the Identification of Needs for more information about terms referred to in the project prioritization process.

Calculation Steps

1. Add the project limits layer to an ArcMap document and create buffers to select Census blocks within a specified distance of the project (catchment area).
2. Add the Census blocks layer and block-level accessibility and population attribute data to an ArcMap document. See **Table 25** to determine data tables needed for each project type. Create buffers based on project type using the maximum travel distance thresholds.
3. In the Census blocks layer, create four new fields (data type Long) named 'reference', 'current', 'PAI', and 'population'. Join the block-level accessibility and population attribute data to the Census block layer then calculate the 'current', 'reference', and 'population' fields from the joined data.
4. For each Census block, calculate 'PAI' as the difference between the reference condition and current condition, or the accessibility deficit between the current condition and the reference condition.

$$\text{PAI} = \textit{Reference} - \textit{Current}$$

5. Add the Functional Classification layer and then use the 'Spatial Join' tool to join the Census blocks that have their center within the catchment area. Sum the population of blocks within the catchment area.
6. Calculate the eligible disadvantaged population (EDP) weighted average PAI for each functional classification segment by multiplying PAI by the EDP of the census block in which the segment is located then divide by the EDP of the catchment area

$$\textit{Population Weighted PAI} = \textit{Population} \times \textit{PAI}$$

$$\textit{Weighted Average PAI} = \frac{\textit{Population Weighted PAI}_i}{\textit{Catchment Population}_i}$$

7. Calculate the raw access score. First, assign a functional classification (FC) score to all road segments. Next, calculate the raw score for transit access to jobs performance measure by multiplying segments' weighted average accessibility improvement by its FC score. In Chapter 3 on the Process for the Identification of Needs, see **Table 9** for Functional Classification Value for Transit and Active Transportation Projects and **Table 11** for Highway and Roadway Projects.

$$\textit{Raw Need Score} = \textit{Weighted Average PAI} \times \textit{FC Score}$$

8. Calculate the project accessibility score with the following steps:
   - Intersect the Project Limits layer with the Census Block layer that contains population and Potential for Accessibility Improvement
   - Spatial Join the intersected Project Limits layer with the Census Census Block layer that contains population and sum the population in the catchment area
   - Calculate the raw score for the project's intersects with the Census Block layer using the raw need score equation from the Access to Jobs needs identification category
   - Calculate the length-weighted average for the project

Data Requirements

- Project Limits
- Census blocks
- NAE Current Condition and NAE Reference Condition
- Census block population
- Functional Classificaiton (source: InteracVTrans Map Explorer)
- Equity Emphasis Areas (source: InteractVTrans Map Explorer)

Access to Multimodal Choices (A3)

This measure considers the degree to which a project can increase access to non-single occupant vehicle (SOV) travel options. The objective is to assign more points to projects that that promote multimodal transportation, enhance connections between modes or create new connections to travel destinations. The outcome of this measure is points assigned to projects for providing elements that increase access to multimodal transportation.

Calculation Steps

1. Assign total points to TDM projects that include the following active transportation and transit elements (maximum of five points):
   - Transit system improvements on a route with at least 1 transit vehicle per hour = 5 points
   - Improvements to an existing or proposed park-and-ride lot = 4 points
   - Construction, enhancement, or replacement of substandard bicycle facilities = 1.5 points
   - Construction, enhancement, or replacement of substandard pedestrian facilities = 1.5 points

Data Requirements

- Project Improvements

4 – PROCESS FOR THE PRIORITIZATION OF PROJECTS

Prioritization Category: Mobility and System Efficiency

The performance measures in the Mobility and System Efficiency prioritization category are evaluated based on the performance measure weights in **Table 26**.

Table 26 *Mobility and System Efficiency Performance Measure Weights*

Performance Measure	Weight
Demand (M1)	50%
Congestion (M2)	50%
Total	100%

Demand (M1)

This measure calculates the demand for the project based on existing traffic volumes around the project limits for highway and roadway projects. The demand measure uses Annual Average Daily Traffic (AADT) to identify the potential volume of users who are likely to benefit from the project.

Calculation Steps

1. Add the project limits and AADT layers to an ArcMap document and create quarter mile buffers around each project.
2. Use Select by Location to select segments in the AADT layer that intersect the project limits buffer. Manually deselect segments in the buffer that are on roads not part of the project. For intersection improvements, include all segment approaches and exclude parallel segments. For highway and road projects that are not at an intersection, include the segments where the project is physically located and exclude side streets and parallel segments.
3. If necessary, create a 'Mileage' field (data type Double), then calculate the length of the AADT segments that intersect the project limits buffer, then use the 'Calculate Geometry' tool to calculate the length of each segment.
4. Use the 'Spatial Join' tool to calculate the length sum of all AADT segments that intersect the project limits buffer.
5. Add a field named 'VMT' (data type Long) to the attribute table in which to calculate Vehicle Miles Traveled for each selected segment. Multiply the AADT field by 'Mileage' using the field calculator to calculate Vehicle Miles Traveled.
6. Calculate the weighted-average AADT for the project by dividing the total VMT of all segments by the total length of all segments: $$\overline{AADT} = \frac{\Sigma\ VMT_n}{\Sigma\ Length_n}$$

Data Requirements

- Project limits
- Average Annual Daily Traffic

Congestion (M2)

This measure estimates the level of traffic congestion around the project limits. Congestion is measured by the average Travel Time Index (TTI) of segments within a quarter mile of the project. TTI is the ratio of a segment's typical travel time during an observed period (such as the morning or evening peak commuting period) to the time required to travel the same distance in a reference period (under free-flow conditions, e.g.). For example, a value of 1.3 indicates a 20-minute trip during free-flow conditions requires 26 minutes to complete during the peak period.

Calculation Steps

1. Add the project limits and TTI layers to an ArcMap document and create quarter mile buffers around each project.
2. Identify the segment TTI as the maximum hourly travel time index across all hours in the most recent year for each segment.
3. Use Select by Location to select segments in the TTI layer that intersect the project limits buffer. Manually deselect segments in the buffer that are on roads not part of the project. For intersection improvements, include all segment approaches and exclude parallel segments. For highway and road projects that are not at an intersection, include the segments where the project is physically located and exclude side streets and parallel segments.
4. If necessary, create a 'Mileage' field (data type Double), then calculate the length of the TTI segments that intersect the project limits buffer, then use the 'Calculate Geometry' tool to calculate the length of each segment.
5. Use the 'Spatial Join' tool to calculate the length sum of all TTI segments that intersect the project limits buffer.
6. Add a field named 'WeightedTTI' (data type Double) to the attribute table in which to calculate weighted Travel Time Index for each selected segment. Multiply the TTI field by 'Mileage' using the field calculator to calculate weighted Travel Time Index.
7. Calculate the length weighted-average TTI for the project by dividing the cumulative TTI of all segments by the total length of all segments:

Data Requirements

- Project limits
- Travel Time Index (source: InteractVTrans Map Explorer)

Prioritization Category: Land Use and Economic Development

The performance measures in the Land Use and Economic Development prioritization category are evaluated based on the performance measure weights in **Table 27.**

Table 27 Land Use and Economic Development Performance Measure Weights

Performance Measure	Weight
Access to Non-Work Destinations (L1)	35%
Access to Non-Work Destinations for Disadvantaged Populations (L2)	35%
Proximity to Activity Centers (L3)	10%
Job Growth (L4)	20%
Total	100%

Access to Non-Work Destination (L1)

This measure combines Walk Score and Bike Score metrics with job growth to evaluate the ease of accessing non-work destinations on foot or bike at a given location. The outcome of this performance measure is the ability to access non-work destinations by bike or on foot and the potential of the project to improve network connectivity for travel by bike or pedestrian modes.

Factors that are considered in the Walk Score include population density, block length, intersection density, and proximity to amenities. Bike Score considers existing bike facilities, hills, road connectivity, and the share of bike commuters. The Access to Non-Work destinations measure is applied to active transportation, transit, and TDM projects only.

Calculation Steps

1. Add the Walk Score, Bike Score, and the project limits layers to an ArcMap document.
2. Use the 'Buffer' tool to create a quarter mile buffer around the project limits.
3. Intersect the project limits buffer with the Walk Score and Bike Score layers.
4. Recalculate the length of each segment resulting from the intersection.
5. Calculate what proportion of each Walk Score and Bike Score zone belongs to each segment.
   - For point or polygons projects (such as park-and-ride lots), assign the Walk Score and the Bike Score assign the point or polygon centroid is located.
   - For a transit project, if stops have been designated, assign the average of each of the stop's Walk Scores and Bike Scores to the project. If stops have not been designated yet, average Walk Scores and Bike Scores at regular intervals along the affected transit route.
6. Calculate the length weighted average Walk Score and Bike Score for each project.
7. Average the Walk Score and Bike Score together to create a single score for the project.

Data Requirements

- Project limits
- WalkScore (source: InteractVTrans Map Explorer)
- BikeScore (souce: InteractVTrans Map Explorer)

Access to Non-Work Destination for Disadvantaged Populations (L2)

This measure combines Walk Score and Bike Score metrics with job growth to evaluate the ease of accessing non-work destinations on foot or bike at a given location. The outcome of this performance measure is the ability to access non-work destinations by bike or on foot and the potential of the project to improve network connectivity for travel by bike or pedestrian modes for disadvantaged populations.

Factors that are considered in the Walk Score include population density, block length, intersection density, and proximity to amenities. Bike Score considers existing bike facilities, hills, road connectivity, and the share of bike commuters. The Access to Non-Work destinations measure is applied to active transportation, transit, and TDM projects only.

Calculation Steps

1. Add the Walk Score, Bike Score, and the project limits layers to an ArcMap document.
2. Use the 'Buffer' tool to create a quarter mile buffer around the project limits.
3. Intersect the project limits buffers within Equity Emphasis Areas with the Walk Score and Bike Score layers.
4. Recalculate the length of each segment resulting from the intersection.
5. Calculate what proportion of each Walk Score and Bike Score zone belongs to each segment.
    - For point or polygons projects (such as park-and-ride lots), assign the Walk Score and the Bike Score assign the point or polygon centroid is located.
    - For a transit project, if stops have been designated, assign the average of each of the stop's Walk Scores and Bike Scores to the project. If stops have not been designated yet, average Walk Scores and Bike Scores at regular intervals along the affected transit route.
6. Calculate the length weighted average Walk Score and Bike Score for each project.
7. Average the Walk Score and Bike Score together to create a single score for the project.

Data Requirements

- Project limits
- WalkScore (source: InteractVTrans Map Explorer)
- BikeScore (souce: InteractVTrans Map Explorer)
- Equity Emphasis Areas (source: InteractVTrans Map Explorer)

Proximity to Activity Centers (L3)

Activity centers are defined by OIPI as "areas of regional importance that have a high density of economic and social activity". This measure calculates the number of activity centers within a specified distance of the project based on functional classification or project type.

Calculation Steps

1. Add the project limits layer to an ArcMap document.
2. In a new 'buffer' field (data type Double), calculate buffer distance by functional classification with the values in the buffer size column in **Table 28**. For point or polygons projects (such as park-and-ride lots), assign the Walk Score and the Bike Score assign the point or polygon centroid is located.
3. Run the 'Buffer' tool, setting the buffer distance to values in the 'Buffer' field.

***Table 28** Functional Classification Buffer Size*

Project Type	Functional Class	Buffer Size (Miles)
Highway and Roadway Projects	Interstate Principal Arterial	10
	Minor Arterial	7.5
	Major Collector Minor Collector Local	5
Active Transportation, Transit, and TDM Projects	n/a	1

Data Requirements

- Project limits
- VTrans Activity Centers (source: InteractVTrans Map Explorer)
- Functional Classification (source: InteractVTrans Map Explorer)

Job Growth (L4)

This measure calculates the change in jobs in the vicinity of a project between a base year and a horizon year (e.g., from 2021 to 2045) using data found in the regional travel demand model. The change in jobs is evaluated using Traffic Analysis Zones (TAZ) within a specified distance of the project based on functional classification. The outcome of this measure is expected total number of new jobs that will be served by the project.

Calculation Steps

1. Add the project limits layer to an ArcMap document.
2. In a new 'Buffer' field (data type Long), calculate buffer distance by functional classification with the values in the buffer size column in **Table 28**.
3. Run the 'Buffer' tool, setting the buffer distance to the values in the 'Buffer' field.
4. Use the 'Spatial Join' tool to join TAZs that have their center in each project limits buffer. In the tool dialogue box, sum the 2021 jobs and 2045 jobs.
5. In a new 'growth' field (data type Long), calculate the total job growth for the project area by subtracting the total 2021 jobs from the total 2045 jobs.

Data Requirements

- Project limits
- Base Year (2021) and Horizon year (2045) total employment (source: VDOT Transportation and Modeling and Accessibility Program
- Functional Classification (source: InteractVTrans Map Explorer)

Prioritization Category: Environmental Impact

The performance measures in the Environmental Impact prioritization category are evaluated based on the performance measure weights in **Table 29**.

***Table 29** Environmental Impact Performance Measure Weights*

Performance Measure	Weight
Sensitive Features (E1)	100%
Total	100%

Sensitive Features (E1)

Some infrastructure projects have impacts on the natural environment, including watersheds, wetlands, and animal habits. Additionally, building areas that regularly flood can reduce the functionality of the infrastructure during severe storms. Furthermore, lands sets aside for public use, agricultural, or historic value may be impaired by nearby development. The sensitive features performance measure calculates the percentage of acres of environmentally sensitive areas, including wetlands, flood hazard zones, and conservation lands within a quarter mile of the project limits. This measure is an inverse measure which means that the project with the fewest impacts (i.e., lowest percentage of impacted land within project buffer) will receive the highest score.

Calculation Steps

1. Add the environmentally sensitive area layers and the project limits layer to an ArcMap document. Add a field named "tier" to the project limits attribute table. Project tier is determined by the type of environmental document required: a Categorial Exclusion (Tier 1), an Environmental Assessment (Tier 2), or an Environmental Impact Statement (Tier 3).
2. Use the 'Dissolve' tool to dissolve environmentally sensitive areas into one feature (DCR conservation lands, 'AE' Flood Hazard Zone, DCR Conservation Lands, Wetlands).
3. Use the 'Buffer' tool to create a quarter mile buffer around the project limits.
4. Run the 'Intersect' tool on the buffered project limits layer and the dissolved environmentally sensitive areas layer to determine the areas of overlap between the two layers.
5. Calculate the total areas of the quarter mile buffer layer around the project and the intersect layer with environmentally sensitive and conservation areas by adding a field named "SqMi" to the attribute tables of both layers. Then use 'Calculate Geometry' to calculate square mileage for all features of both layers
6. Adjust the intersect layer based on the following adjustment factors and the formula:
   - Tier 1 (Categorical Exclusion) - 10%
   - Tier 2 (Environmental Assessment) - 30%
   - Tier 3 (Environmental Impact Statement - 50%

   Impact Area = Overlap Area (mi^2) x Adjustment Factor
7. Sum the weighted intersection areas and divide the impact area by the project buffer to get the impacted percentage of land within the project limits.

Data Requirements

- Project limits
- Conservation Lands (source: Department of Conservation and Recreation. Retrieve from: https://www.dcr.virginia.gov/natural-heritage/cldownload)
- Wetlands (source: Virginia Fish and Wildlife Service. Retrieve from: https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/)
- Flood Hazard Zones (source: Federal Emergency Management Agency. Retrieve from: https://msc.fema.gov/portal/advanceSearch). To download Flood Hazard Zones:
  1. Enter product IDs and download flood hazard zones for Albemarle County and the City of Charlottesville ('NFHL_51003C').
  2. Export 'AE' flood zones to a new shapefile or polygon feature class in a file geodatabase. Zone 'AE' designates areas subject to inundation by the 100-year flood (i.e., a flood that statistically has a 1% chance of occurring in any given year).

4 – PROCESS FOR THE PRIORITIZATION OF PROJECTS

Project Scoring

1. Calculate the raw value for all performance measures within the five prioritization category for each project.
2. Normalize raw scores by performance measure (PM) to compare scores across multiple projects. The normalization procedure results in an unweighted project benefit score of 0 to 100. Use the following equation:

$$Normalized\ Score = \frac{Raw\ Score_i - RawScore_{min}}{Raw\ Score_{max} - RawScore_{min}}$$

   Where,

   $RawScore_i$ = Raw score for project i in each performance measure

   $RawScore_{min}$ = Minimum raw score for each performance measure

   $RawScore_{max}$ = Maximum raw score for each performance measure

3. Multiply the normalized performance measure score by their respective measure weights.
4. Sum the weighted normalize performance measure scores within each performance measure to produce the scoring value for each prioritization category.
5. Multiply the total prioritization category score by its respective weight to produce the weighted prioritization category scoring value. Choose one scenario weighting scheme from **Table 30** to determine the appropriate weights for each prioritization category. The Safety prioritization category weight is equivalent in the 'accessibility' and 'mobility' scenarios in recognition of the importance of safety throughout all scenarios
   - The 'Accessibility' scenario prioritizes projects that increase access to jobs, non-work destinations, and multimodal choices for bicycling, walking, and transit.
   - The 'Balanced' scenario prioritized each prioritization equally with an increased emphasis on limiting environmental impacts
   - The 'mobility' scenario prioritizes highway and roadway projects that reduce vehicular delay.
6. Sum the weighted prioritization category scoring value to produce the project benefit score.
7. If cost information is available for every project, divide each project's benefit score by its total project cost (per $10 million) to produce the project score. If cost is not available, record the project's benefit score as its project score.
8. Rank projects by project score in descending order (the project receiving the highest score will be ranked first).

***Table 30** Project Prioritization Category Weights*

	Prioritization Scenarios		
Prioritization Category	Accessibility	Balance	Mobility
Safety	25%	20%	25%
Accessibility and Equity	30%	20%	20%
Mobility and System Efficiency	10%	20%	30%
Land Use and Economic Development	25%	20%	10%
Environmental Impact	10%	20%	10%
Total	100%	100%	100%