

METHODOLOGY REPORT FOR THE IDENTIFICATION OF 2019 MID-TERM NEEDS

Culpeper Construction District



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FOR MORE INFORMATION

Visit www.vtrans.org at any time for additional documentation, details, and updates about the VTrans development process.

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PREPARED BY THE OFFICE OF INTERMODAL
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CONTENTS

Purpose of this Report	05
Process for Identification of Mid-term Needs	06
VTrans Travel Markets	08
VTrans Vision, Guiding Principles, Goals, and Objectives	10
Developing Analysis Measures Connected to VTrans Goals and Objectives	11
Engaging Stakeholders and the Public in Developing the Needs	13
Collaboration with VDOT and DRPT	13
Performance Measures	14

LIST OF APPENDICES	
Appendix A: Changes to Mid-term Needs Measures Methodology Post-Regional Workshops	68
Appendix B: VTrans Steering Committee	71
Appendix C: Changes Made Based on Feedback Received on Draft Mid-term Needs	72
Appendix D: Definitions of VTrans Travel Markets	73

MID-TERM TRANSPORTATION MEASURES MAPS

1A: PECC: Congestion Measure for Interstates and Select Limited Access Facilities (Culpeper District)	18	6A: Transit Access to Activity Centers for Workers (Culpeper District)	37
1B: PECC: Congestion Measure for Interstates and Select Limited Access Facilities (Charlottesville)	19	6B: Transit Access to Activity Centers for Workers (Charlottesville)	38
2A: TTI – Congestion Measure for Non-Limited Access COSS and Regional Networks (Culpeper District)	22	7A: Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers (Culpeper District)	43
2B: TTI – Congestion Measure for Non-Limited Access COSS and Regional Networks (Charlottesville)	23	7B: Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers (Charlottesville)	44
3A: LOTTR – Reliability Measure for COSS and Regional Networks (Culpeper District)	27	8A: Transit Access for Equity Emphasis Areas (Culpeper District)	50
3B: LOTTR – Reliability Measure for COSS and Regional Networks (Charlottesville)	28	8B: Transit Access for Equity Emphasis Areas (Charlottesville)	51
4: Passenger and Intercity Rail On-Time Performance - Amtrak	31	9A: Pedestrian Safety Improvement Locations (Culpeper District)	61
5: Passenger and Intercity Rail On-Time Performance - Virginia Railway Express	32	9B: Pedestrian Safety Improvement Locations (Charlottesville)	62
		10A: Capacity Preservation for COSS and Regional Networks (Culpeper District)	64
		10B: Capacity Preservation for COSS and Regional Networks (Charlottesville)	65



VTrans is the foundation for performance-based connections among planning, programming, and project development.

PURPOSE OF THIS REPORT

VTrans is Virginia's statewide transportation plan. VTrans comprises a long-term vision for the future of transportation in the Commonwealth, and a Mid-term component, which identifies specific transportation needs that move Virginia towards achieving the long-term vision. VTrans Mid-term Needs are location-specific, data-driven and linked to a distinct time frame (0-10 years). Regardless of time frame, VTrans is built around achieving excellence in:

- economic development
- accessibility
- safety
- proactive system management,
- and sustainable and healthy communities

This methodology report is a technical resource for the 2019 VTrans Mid-term transportation Needs. It describes and documents:

- the performance measures and associated data sources, processes, calculations and tools developed and deployed to produce the VTrans Mid-term transportation Needs; and,
- how the goals, objectives, performance measures, thresholds for determination of needs, and stakeholder interactions informed this assessment of Virginia's surface transportation system.

Virginia is diverse in its geography, demographics and economy, and the specific transportation needs of its many communities are diverse as well. In seeking to be sensitive to local conditions and priorities, VTrans has developed an expansive set of transportation needs that reflect conditions throughout Virginia. The underlying planning process has been the product of rigorous analysis and of multiple stakeholder engagements, which have influenced and improved the performance measures ultimately developed.

The 2019 VTrans Mid-term Transportation Needs are also a product of definitions and performance thresholds that are consistently applied to evaluate transportation needs throughout the Commonwealth. The thresholds determine whether a particular performance or physical condition become a transportation Need. VTrans produced these definitions and thresholds after extensive testing, analysis and consultation with stakeholders and internal review committees. In developing and applying consistent standards, VTrans has sought to produce needs from a process that is transparent, objective and balanced.

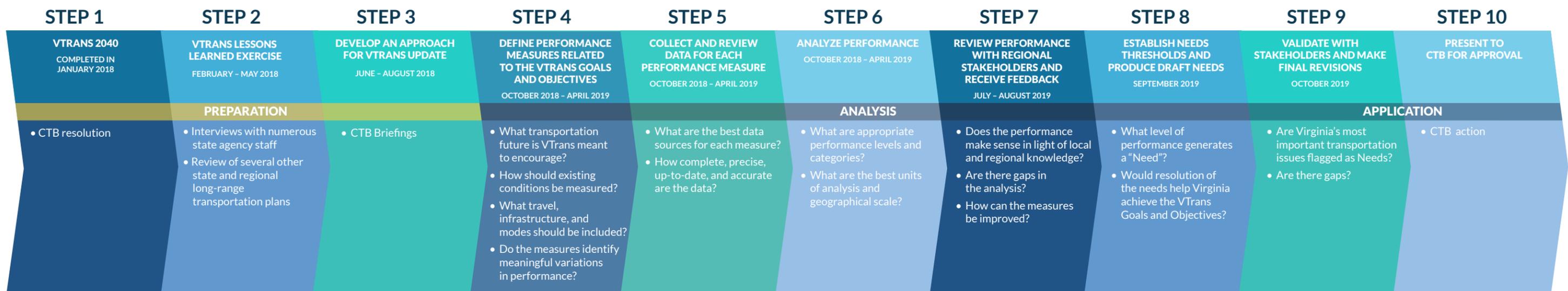
The following sections in this report describe each of the steps in the 2019 Update of the VTrans Mid-term Needs. While the outcomes of the analysis are unique to each district, the methods and data used are the same throughout the state. The maps that appear in this report portray transportation performance in a single district.



PROCESS FOR IDENTIFICATION OF MID-TERM NEEDS

Transportation performance measures gauge and monitor the progress of the state transportation system towards meeting transportation goals and an overarching vision. In developing the 2019 VTrans Mid-term Needs, a greater emphasis was placed on linking the goals and overarching vision with quantitative targets or thresholds and soliciting feedback from the public and transportation stakeholders, so that a transportation need would be defined clearly and unambiguously. This was done through an iterative process, as outlined below.

VTrans Mid-term Needs Development, Step by Step



• [CTB Resolution](#)

- Interviews with 19 state agency staff
- Review of 15 other state and regional long-range transportation plans

• CTB Briefings

- [VTrans Update Kick-off Presentation to the CTB](#)
- [Presentations to MPOs in early and late spring](#)
- [Webinar—VTrans Needs Assessment Overview](#)

- [Webinar—VTrans Urban Development Area Needs Assessment](#)
- [Presentations during CTB Spring Transportation Meetings](#)
- [VTrans Methodology Presentation to the CTB](#)

• [13 Regional Workshops](#)

- [Documentation of changes to Mid-term Needs Identification Methodology and thresholds](#)

- CTB Briefings
- [Webinar—Draft VTrans Mid-term Needs](#)

- [Presentation to the CTB \(December\)](#)
- [Presentation to the CTB \(January\)](#)
- [CTB Action](#)



Increasingly, transportation agencies use performance-based planning to guide investment decisions. Performance-based planning relies on data analytics, stakeholder consultation and a clear, consistent and understandable decision-making process to improve transportation to achieve statewide goals and objectives. Well-designed and comprehensive performance measures are an outgrowth of a successful process. Part of that process, which VTrans has embraced, involves learning from prior experience and the best practices of other transportation agencies from around the nation.

The 2019 VTrans Mid-term Needs and the planning process around it are notable in two respects:

- First, VTrans derives performance measures from the highest level of detail that the data will allow. This means that the measures will be sensitive to future investments or changes in the way that the underlying transportation system is managed or used by travelers, and
- Second, The VTrans process is legislatively linked to two competitive funding programs: (1) SMART SCALE — a competitive multimodal funding program; and, (2) VDOT's Revenue Sharing Program.

VTrans travel markets

Consistent with Virginia State Code § 33.2-353, the 2019 VTrans Mid-term Needs were identified for three distinct travel markets: Corridors of Statewide Significance (CoSS), Regional Networks (RN), and Urban Development Areas (UDAs).

Additionally, per the policy adopted by the Commonwealth Transportation Board (CTB), VTrans also identifies statewide safety needs. Each travel market is associated with unique characteristics, system users, and travel patterns. Please refer to Appendix D for a more detailed description of the CoSS and RN travel markets.

As part of the 2019 VTrans Update, Industrial and Economic Development Areas (IEDA) were included under the Urban Development Area (UDA) travel market.

Travel Market	Number	Definition	Purpose	Established	Characteristics
Corridors of Statewide Significance (CoSS)	12	An integrated, multimodal network of transportation facilities that connect major centers of activity within and through the Commonwealth and promote the movement of people and goods essential to the economic prosperity of the state. These corridors include highways, rail lines, seaports, and airport facilities.	Focus on inter-regional and inter-state travel: Connect major centers of activity within and through the Commonwealth and promote the movement of people and goods essential to the economic prosperity of the state	December 17, 2009 - 11 CoSS established as part of VTrans2035 May 28, 2011 - 12th corridor added	<ul style="list-style-type: none"> ▪ Multimodal - must involve multiple modes of travel or must be an extended freight corridor ▪ Connectivity - must connect regions, states, and/or major activity centers ▪ High volume - must involve a high volume of travel ▪ Function - must provide a unique statewide function and/or address statewide goals
Regional Networks (RN)	15	Based on designated Metropolitan Planning Organizations (MPO) within the Commonwealth. If an MPO boundary includes only a portion of a county, the entire county will be included in the needs analysis area.	Focus on intra-regional travel: bridges the gap between existing conditions and the desired future for the state's economy	December 9, 2015	<ul style="list-style-type: none"> ▪ At least 50,000 people across the space of at least two jurisdictions ▪ Per 2017 American Community Survey (ACS) Five-year Estimate, 87% of Virginia's population is in the 15 RNs.
Urban Development Areas (UDAs) and Industrial and Economic Development Areas (IEDAs)	230, including pending (as of November 2019)	Designated growth areas based on local initiatives pursuant to § 15.2-2223.1 ²	To the extent possible, to direct federal, state and local transportation, housing, water and sewer facility, economic development, and other public infrastructure funding to designated UDAs or to such similar areas	Ongoing, per local government designation in Comprehensive Plan	<ul style="list-style-type: none"> ▪ Pedestrian-friendly road design ▪ Interconnection of new local streets with existing local streets and roads ▪ Connectivity of road and pedestrian networks ▪ Preservation of natural areas ▪ Mixed-use neighborhoods, including mixed housing types, with affordable housing to meet the projected family income distributions of future residential growth ▪ Reduction of front and side yard building setbacks ▪ Reduction of subdivision street widths and turning radii at subdivision street intersections
	535 (as of November 2019)	Industrial and Economic Development Areas (IEDA): Locally-identified industrial and economic development sites.		The 2019 VTrans Update	<p>Pursuant to § 2.2-2238 and consistent with Virginia Economic Development Partnership (VEDP)'s Business Ready Sites Program (VBRSP)</p> <ul style="list-style-type: none"> ▪ Minimum of 100 contiguous acres (statutory); VEDP accept sites of 25+ acres ▪ Allows for industrial and research parks ▪ Applicants to program must be political subdivisions of the Commonwealth of Virginia, including counties, cities, towns, industrial/economic development authorities
Safety	N/A	Safety analysis for the entire roadway network in the Commonwealth	All travel markets considered	December 9, 2015	Risk and evidence based safety assessment

²UDAs are not required to be urban in terms of development density or development character. Their design and development can reflect local policies and preferences (e.g., Village Center, Community Development Area, etc) as long as their characteristics are consistent with [§ 15.2-2223.1](#)

VTrans Travel Markets

Corridors of Statewide Significance (CoSS)

- Serve inter-regional travel.

Regional Networks (RN)

- Serve commuters, intra-regional, and local travel.

Urban Development Areas (UDA)

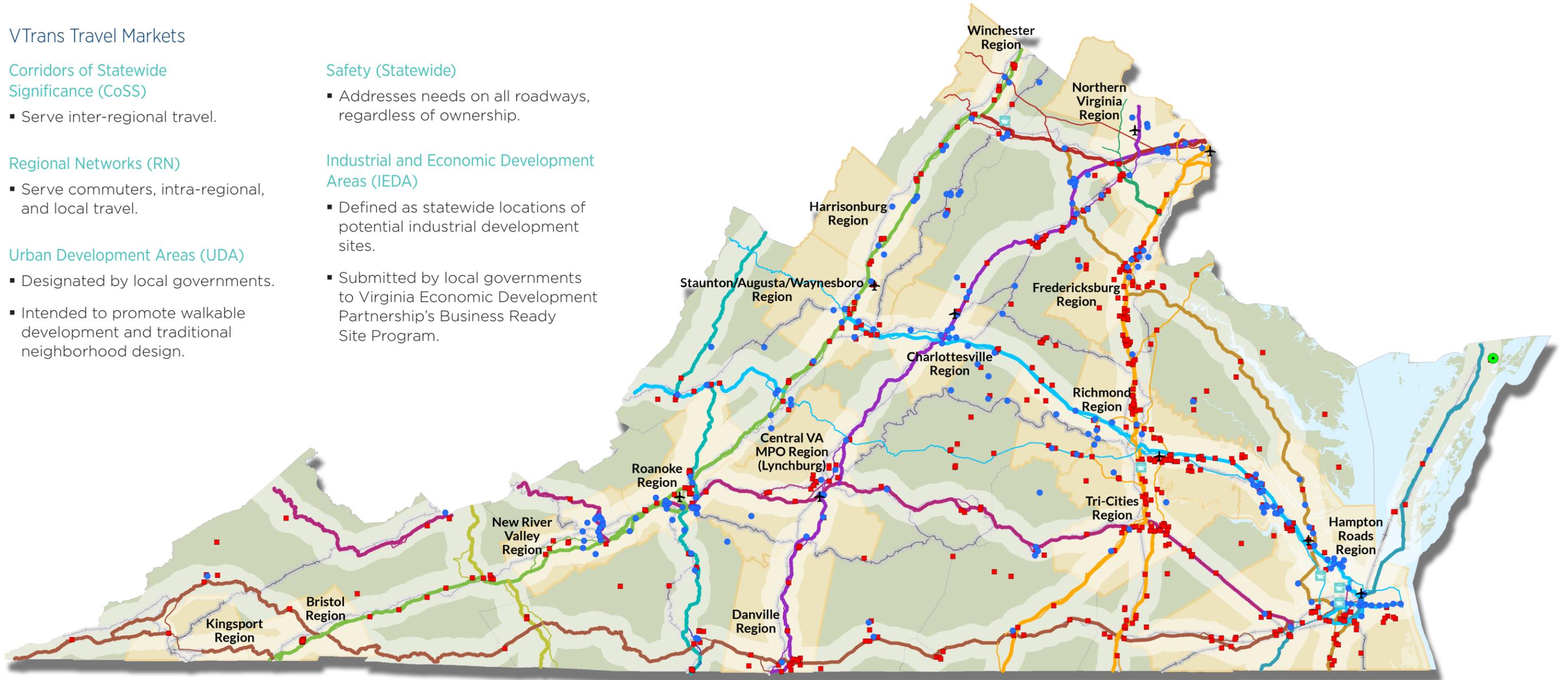
- Designated by local governments.
- Intended to promote walkable development and traditional neighborhood design.

Safety (Statewide)

- Addresses needs on all roadways, regardless of ownership.

Industrial and Economic Development Areas (IEDA)

- Defined as statewide locations of potential industrial development sites.
- Submitted by local governments to Virginia Economic Development Partnership's Business Ready Site Program.



Corridors of Statewide Significance

- | | | |
|--------------------------------|---------------------------------------------------|----------------------------------------------|
| Coastal Corridor (US-17) | Heartland Corridor (US-460) | Seminole Corridor (US-29) |
| Crescent Corridor (I-81) | North Carolina to West Virginia Corridor (US-220) | Southside Corridor (US-58) |
| East-West Corridor (I-64) | North-South Corridor (RT-234) | Washington to North Carolina Corridor (I-95) |
| Eastern Shore Corridor (US-13) | Northern Virginia Corridor (I-66) | Western Mountain Corridor (I-77) |

**Thin lines of same color represent Corridor Component Facilities*

- Regional Networks ● Urban Development Areas (as of Nov. 2019) ■ Industrial and Economic Development Areas (IEDA)

Key

- | | | |
|-----------------|-----------|-----------------------|
| Port Facilities | Airport | Construction District |
| Rail Network | Spaceport | Water |

VTrans Vision, Guiding Principles, Goals, and Objectives

The VTrans Vision expresses a desire for a transportation system that works for everyone. The Vision is the starting point for the entire VTrans process. It is also a framework for collaboration as the Commonwealth's transportation agencies expand, operate and maintain their multimodal systems. Alignment around a transportation vision ultimately improves opportunities for integrating separate transportation systems, realizing synergies from pooled resources and building a better transportation system for everybody.



Vision

Virginia's multimodal transportation system will be Good for Business, Good for Communities, and Good to Go. Virginians will benefit from a sustainable, reliable transportation system that advances Virginia businesses, attracts a 21st century workforce, and promotes healthy communities where Virginians of all ages and abilities can thrive.

Guiding Principles

- GP 1: Optimize Return on Investments** Implement the right solution at the right price, striving to meet current needs while advancing long-term prosperity and livability.
- GP 2: Ensure Safety, Security, and Resiliency** Provide a transportation system that is safe for all users, responds immediately to short-term shocks such as weather events or security emergencies, and adapts effectively to long-term stressors such as sea level rise.
- GP 3: Efficiently Deliver Programs** Deliver high-quality projects and programs in a cost-effective and timely manner.
- GP4: Consider Operational Improvements and Demand Management First** Maximize capacity of the transportation network through increased use of technology and operational improvements as well as managing demand for the system before investing in major capacity expansions.
- GP5: Ensure Transparency and Accountability, and Promote Performance Management** Work openly with partners and engage stakeholders in project development and implementation. Establish performance targets that consider the needs of all communities, measure progress towards targets. Adjust programs and policies as necessary to achieve the established targets.
- GP6: Improve Coordination Between Transportation and Land Use** Encourage local governments to plan and manage transportation-efficient land development by providing incentives, technical support, and collaborative initiatives.
- GP7: Ensure Efficient Intermodal Connections** Provide seamless connections between modes of transportation to harness synergies.

Goals

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

Objectives

- Objectives:**
 - A.1. Reduce the amount of travel that takes place in severe congestion
 - A.2. Reduce the number and severity of freight bottlenecks
 - A.3. Improve reliability on key corridors for all modes
- Objectives:**
 - B.1. Reduce average peak-period travel times in metropolitan areas
 - B.2. Reduce average daily trip lengths in metropolitan areas
 - B.3. Increase the accessibility to jobs via transit, walking, and driving in metropolitan areas
- Objectives:**
 - C.1. Reduce the number and rate of motorized fatalities and serious injuries
 - C.2. Reduce the number of non-motorized fatalities and serious injuries
- Objectives:**
 - D.1. Improve the condition of all bridges based on deck area
 - D.2. Increase the lane miles of pavement in good or fair condition
 - D.3. Increase percent of transit vehicles and facilities in good or fair condition
- Objectives:**
 - E.1. Reduce per-capita vehicle miles traveled
 - E.2. Reduce transportation related NOX, VOC, PM, and CO emissions
 - E.3. Increase the number of trips traveled by active transportation (bicycling and walking)

Developing Analysis Measures Connected to VTrans Goals and Objectives

VTrans assesses the performance of each travel market, using different measures to produce as accurate a representation of VTrans Goals and Objectives as possible. The performance measures are the basis for identifying Needs associated with congestion, reliability, accessibility, safety, capacity preservation, and transportation demand management (TDM).

The process started with selecting data and performance measures that are consistent with VTrans Goals and Objectives, and for which reliable data were available for assessing the existing conditions of the Commonwealth's transportation systems.

Performance Measures by VTrans Goals and Travel Markets

Goal	Measure	What it Measures	CoSS	RN	UDA	Statewide
A. Economic Competitiveness and Prosperity 	PECC: Percent of Person Miles Traveled in Excessively Congested Conditions	Percent of total vehicle miles travel at speeds significantly slower than posted speed limit	● (limited access)	● (limited access)*		
	TTI: Travel Time Index	Intensity of congestion	● (non-limited access)	●		
	LOTTR: Level of Travel Time Reliability	Travel in unreliable conditions	●	●		
	Intercity and Commuter Rail On-time Performance	Amtrak: Average on-time (per the established schedule) arrival at station Virginia Railway Express (VRE): Average on-time (per the established schedule) performance of rail line	●			
B. Accessible and Connected Places 	Transit Access to Activity Centers for Workers	Transit access deficit which is defined as the difference between number of workers that can access an Activity Center within 45 minutes by bus or rail transit compared to auto.		●		
	Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers	Bike-and walk-sheds around local-serving and knowledge-based Activity Centers, fixed-guideway transit, and bus rapid transit (BRT)		●		
	Transit Access for Equity Emphasis Areas	Communities with higher concentrations of the elderly (age 75 or older), persons with low income, disabilities, minorities, and limited English proficiency, where transit access needs to be provided based on population density		●		

Performance Measures by VTrans Goals and Travel Markets (continued)

Goal	Measure	What it Measures	CoSS	RN	UDA	Statewide
B. Accessible and Connected Places	Access to Industrial and Economic Development Areas	Access to the nearest Corridor of Statewide Significance (CoSS) from sites included in Virginia Economic Development Partnership's Business Ready Site Program				●
	Locally-determined transportation Needs within UDAs	Transportation infrastructure improvements required to support projected residential and commercial growth in the locality for an ensuing period of at least 10 but not more than 20 years			●	
C. Safety for All Users 	Locations with high number of crashes and high crash severity	Roadway intersections and roadway segments with higher risk or frequency and number of serious injuries and fatalities				●
	Pedestrian Safety Improvement Locations	Corridors with high risk characteristics (volume, number of lanes, speed, history of pedestrian crashes) and high demand for walk trips				●
D. Proactive System Management 	Capacity Preservation	Locations that require a balance between mobility and accessibility	●	●		
E. Healthy Communities/Sustainable Transportation Communities 	Transportation Demand Management	Locations where Transportation Demand Management strategies and improvements can reduce vehicle miles traveled	●	●		

* **Other [RN] Select Limited Access Facilities** - In addition to the CoSS, many portions of Virginia's regional roadway networks also provide mobility for inter-regional traffic, and are designed to accommodate the types of higher-speed traffic that is common on the Interstate System. The measures and needs analyses that apply to the Interstate System apply to these roadway segments as well.

The criteria are: (1) are part of the National Highway System (NHS), and, (2) are greater than 10 miles in length, OR, are at least 5 miles in length and connect to another limited access segment to total at least 10 miles in length, OR, is less than 5 miles in length but connects on each end to limited access facilities to total at least 10 miles in length.

****Activity Centers** Activity Centers are the focal point for assessing accessibility Needs within RNs. Working collaboratively with local and regional planners and stakeholders, OIPI identified locations of concentrated employment and economic activity, and sorted them into three broad categories based on predominant economic generators and associated types of accessibility Needs. Some primarily serve customers in the local community or region with retail shopping, real estate services, healthcare, recreation, or pre-K through 12 education among other local-serving activities. Other activity centers export knowledge-based services and products to the rest of the state, country, or world through activities like corporate management, information-based industries, and higher education. The third type of activity centers contain enterprises that rely upon good freight access in order to create, process, and/or transport goods and materials such as agriculture, mining, utilities, construction, and logistics. Activity Centers in this VTrans Update are based on the set of activity centers that were identified in VTrans2040, supplemented by new locations identified by regional stakeholders.

Some regional stakeholders identified specific locations that are economically important in those regions, while others identified categories of locations, like commercial service airports and regional hospitals.



Engaging Stakeholders and the Public in Developing the Needs

In developing the 2019 Mid-term Needs, VTrans acknowledged local and regional transportation plans, MPO priorities, and local needs within a technically robust context of data-driven decision making.

First, preliminary analyses were conducted to ensure progress towards the achievement of VTrans Vision, Goals, and Objectives by identifying potential needs associated with congestion, reliability, accessibility, safety, capacity preservation and transportation demand management (TDM).

The results were then presented to local and regional stakeholders through a series of two webinars and 13 half-day Regional Workshops, as well as ongoing individual communication.

OIPI used the local and regional input to fine-tune the interpretation of the data and adjust the analysis methods and thresholds. Changes made based on the stakeholder input received at the 13 Regional Workshops are included in Appendix A.

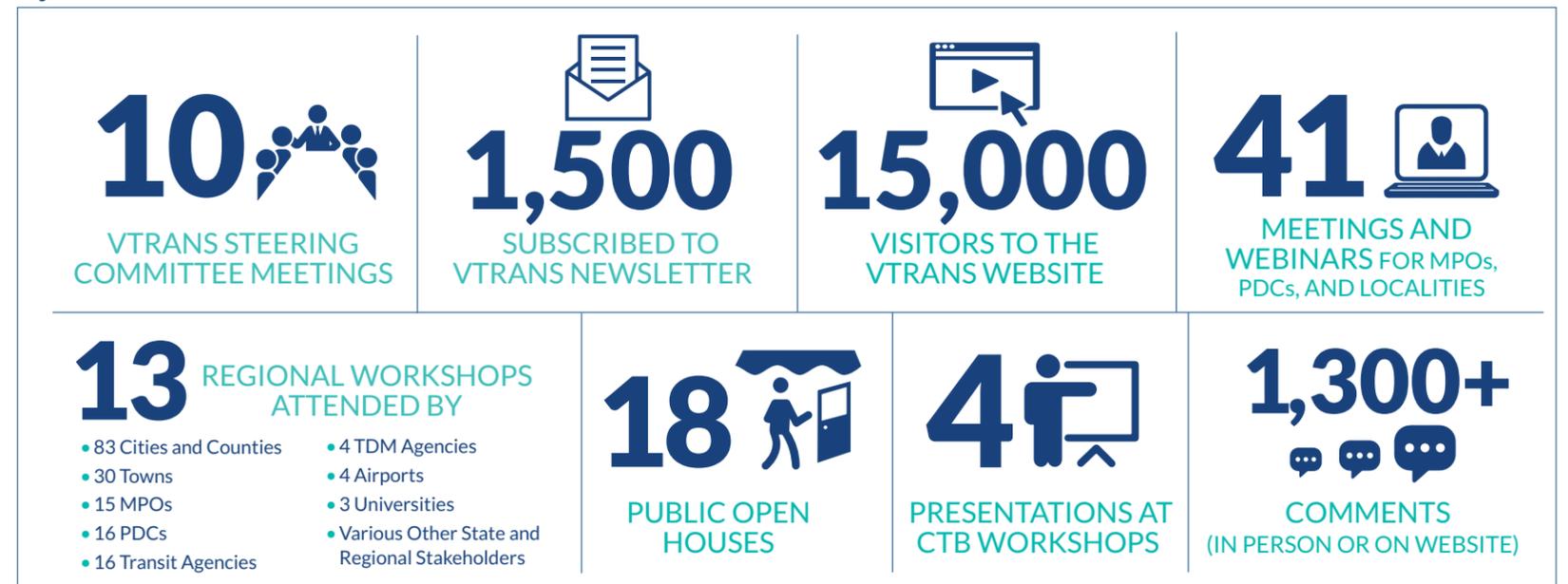
A draft set of 2019 Mid-term Needs were made available for review and comment in October. Additional changes were made based on the input received. Please refer to Appendix C.

The entire process was documented in real time on the VTrans website, and the public was kept informed through frequent email blasts and social media posts, and direct communications.

Collaboration with VDOT and DRPT

VTrans' development is the product of a collaborative process that has relied on the input and active participation of VDOT and DRPT. A steering committee composed of management-level representatives of key divisions within VDOT and DRPT was formed. VTrans Steering Committee members had direct responsibilities over or influence on issues that affect mid- and long-range planning, including the identification of Mid-term Needs. A list of VSC members is included in Appendix B.

By the Numbers: VTrans Feedback and Outreach*



*Through December 2019



CTB Action

On January 15, 2020 the CTB took action to approve the 2019 Mid-term Needs Identification Methodology and accept the 2019 Mid-term Needs.

The CTB also resolved that for the purposes of screening for the statewide prioritization process, SMART SCALE, that the identified UDA Needs shall also be considered RN Needs if RN congestion Needs are 20 miles or fewer. For the 2019 Update of the VTrans Mid-Term Needs, this applies to the following Regional Networks: Bristol Region, Charlottesville Region, Danville Region, Harrisonburg Region, Kingsport Region, New River Valley Region, Staunton-Augusta-Waynesboro Region, and Winchester Region.

Additionally, the CTB resolved that for SMART SCALE, the identified safety Needs on CoSS roadways shall also be considered CoSS Need.

The pages that follow describe how the VTrans Mid-term Needs performance measures were developed and how they evolved through stakeholder review and additional analysis to produce final thresholds and 2019 Mid-term Needs.

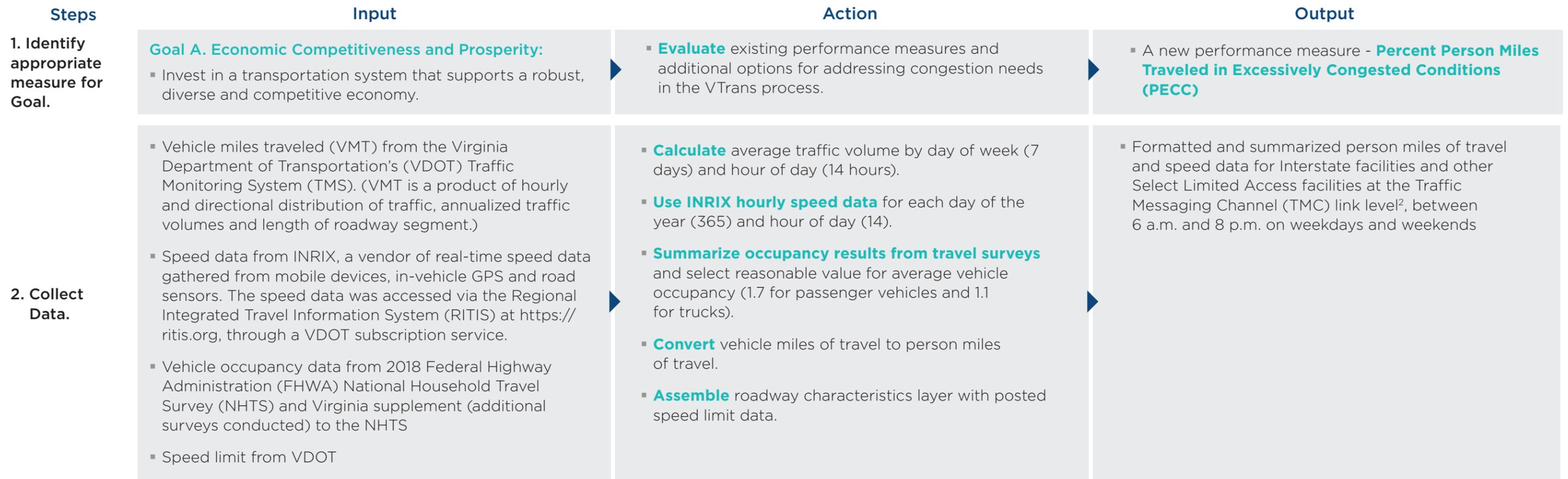
Sequential steps and maps depicting results of the following performance measures are included.

Goal	Mid-term Transportation Need to Address VTrans Goal	Map # Depicting Underlying Performance Measures
A	Congestion Mitigation and Travel Time Reliability Improvement	Measure 1A - 1B (PECC), Measure 2A - 2B (TTI), Measure 3A - 3B (LOTTR)
A	Intercity and Passenger Rail On-time Performance Improvement	Measure 4, Measure 5
B	Transit and Non-motorized Accessibility Improvement for Workers	Measure 6A - 6B, Measure 7A - 7B
B	Transit Accessibility Improvement for Equity Emphasis Areas	Measure 8A - 8B
B	Accessibility and Mobility Improvements - UDAs and IEDAs	
C	Safety Improvements	Measure 9A - 9B (Pedestrian Safety Improvement Locations)
D	Capacity Preservation	Measure 10A - 10B
E	Transportation Demand Management	



Goal A: Methodology for Identification of Congestion Mitigation Needs

Performance Measure:	Percent Person Miles Traveled in Excessively Congested Conditions (PECC)	Time periods:	All calendar year 2018 weekdays and weekend days in a 14-hour period between 6 a.m. and 8 p.m., which correspond to times of the day when congestion caused by travel demand is most likely to occur
What it tells us:	Share of total travel under excessively congested conditions		
What it measures:	Percent of total person travel that is significantly slower than the speed limit	Unit of Analysis for Performance Measures:	Roadway segment
Where it applies:	Interstate Facilities within CoSS and other Select Limited Access Facility (LAF) which are non-Interstate roadway segments that are part of or provide access to the National Highway System within a Regional Network ¹	Unit of Reporting for Mid-Term Needs:	Roadway segment



¹**Other [RN] Select Limited Access Facilities** - In addition to the CoSS, many portions of Virginia's regional roadway networks also provide mobility for inter-regional traffic, and are designed to accommodate the higher-speed, longer-distance traffic that is common on the Interstate System. The measures and needs analyses that apply to the Interstate System apply to these roadway segments as well.

The criteria are: (1) are part of the National Highway System (NHS), and, (2) are greater than 10 miles in length, OR, are at least 5 miles in length and connect to another limited access segment to total at least 10 miles in length, OR, is less than 5 miles in length but connects on each end to limited access facilities to total at least 10 miles in length."

²Traffic Messaging Channels are a standard technology for delivering traffic information electronically to motorists and others. For the purpose of calculating the PECC need, it corresponds to a segment of roadway with a specific location and length that can be associated with VDOT's geospatial representation of the highway network.

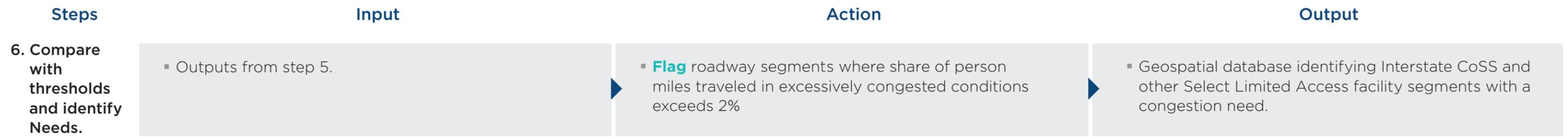


Goal A: Methodology for Identification of Congestion Mitigation Needs *(continued)*

Steps	Input	Action	Output
3. Calculate measures.	Output from steps 1 and 2	<ul style="list-style-type: none"> ▪ Identify average speeds in each of the 14 hourly time periods per day that fall below the posted speed limit. ▪ Compare measured travel speeds to alternative percentages of the speed limit (the “threshold”) for each weekday and weekend period and report the corresponding person miles of travel that occurred at speeds below the established threshold. ▪ Divide the amount of travel that exceeds the threshold by the total amount of person miles of travel for that time period. ▪ Report the ratio of excessively congested person miles of travel to total person miles of travel for weekdays and the weekend. (Thresholds are 60%, 75% and 90% of the posted speed limit.) 	<ul style="list-style-type: none"> ▪ Total average weekday person-miles of travel and percentage of total travel below 60%, 75%, and 90% of speed limit <ul style="list-style-type: none"> -Information was compiled and presented separately for weekdays and weekends -Information is stored in geographic information system (GIS) database
4. Consider stakeholder input.	<ul style="list-style-type: none"> ▪ Support for 75% threshold ▪ Clarify criteria for selecting LAF ▪ Request to consider weekend travel, in addition to weekday travel 	<ul style="list-style-type: none"> ▪ Review results of alternative thresholds. ▪ Review location of other Select Limited Access Facilities relative to CoSS, Interstates and NHS. 	<ul style="list-style-type: none"> ▪ Adopted 75% threshold ▪ Weekdays and weekends included ▪ Updated LAF list to include more segments (used a logic that allowed shorter segments of less than 10 miles if they connected to another LAF)
5. Identify performance thresholds.	Output from steps 3 and 4	<ul style="list-style-type: none"> ▪ Calculate total person miles of travel below 75% of the posted speed limit into three weekday time periods: 6 a.m.- 10 a.m.; 10 a.m.- 4 p.m. and 4 p.m.-8 p.m. ▪ Select the one of the three weekday time periods with the highest percentage of person miles traveled in excessively congested conditions (Output X) ▪ Perform the same calculations for weekends, using a single 6 a.m. - 8 p.m. period (Output Y). ▪ Identify share of person miles traveled that occurs in excessively congested condition by performing the following: $[(\text{Output X} \times 5 \text{ weekdays}) + (\text{Output Y} \times 2 \text{ weekend days})] / 7 \text{ days}$. 	<ul style="list-style-type: none"> ▪ Threshold – Average share of person miles traveled that occurs in excessively congested conditions be at least 2% or higher

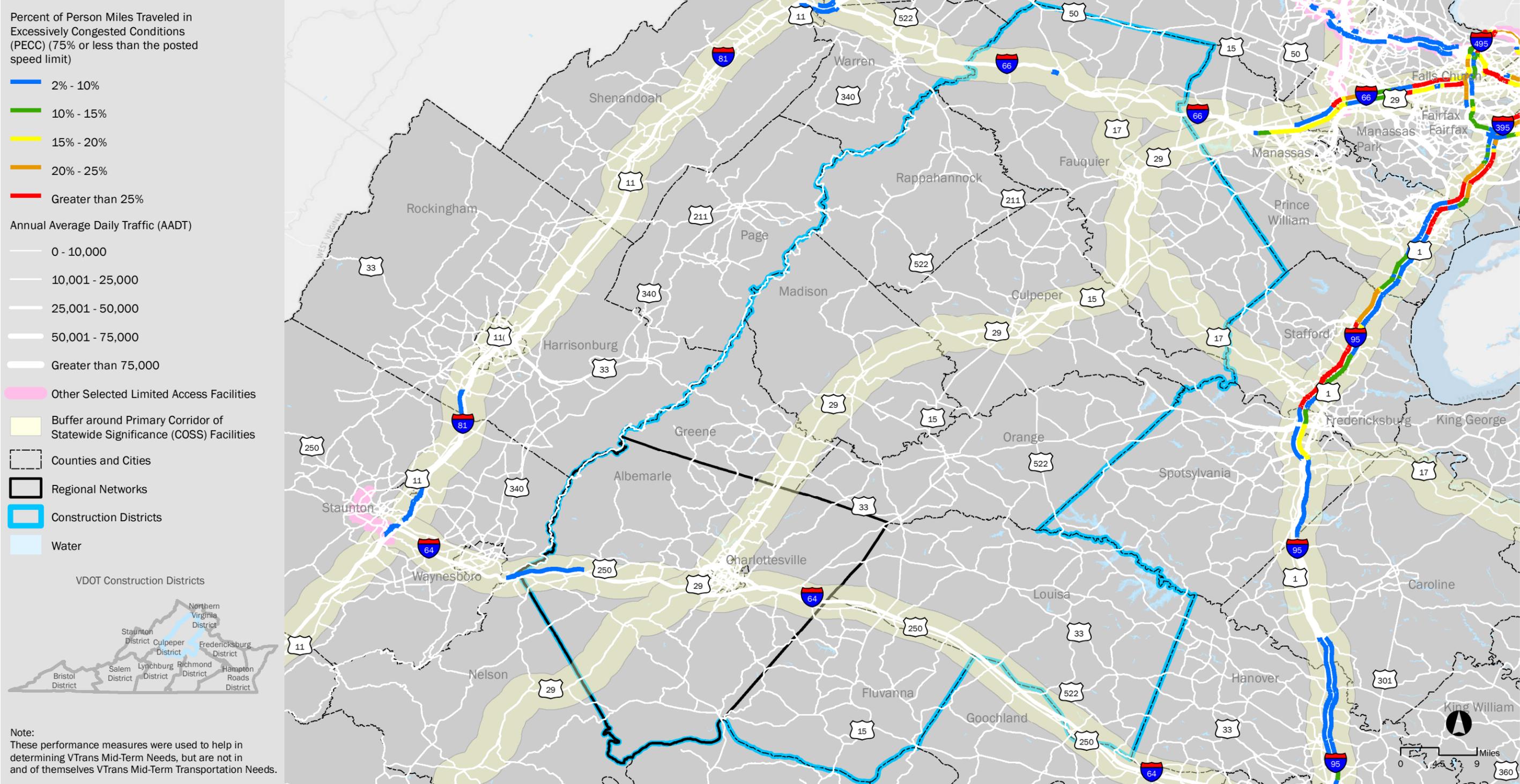


Goal A: Methodology for Identification of Congestion Mitigation Needs *(continued)*



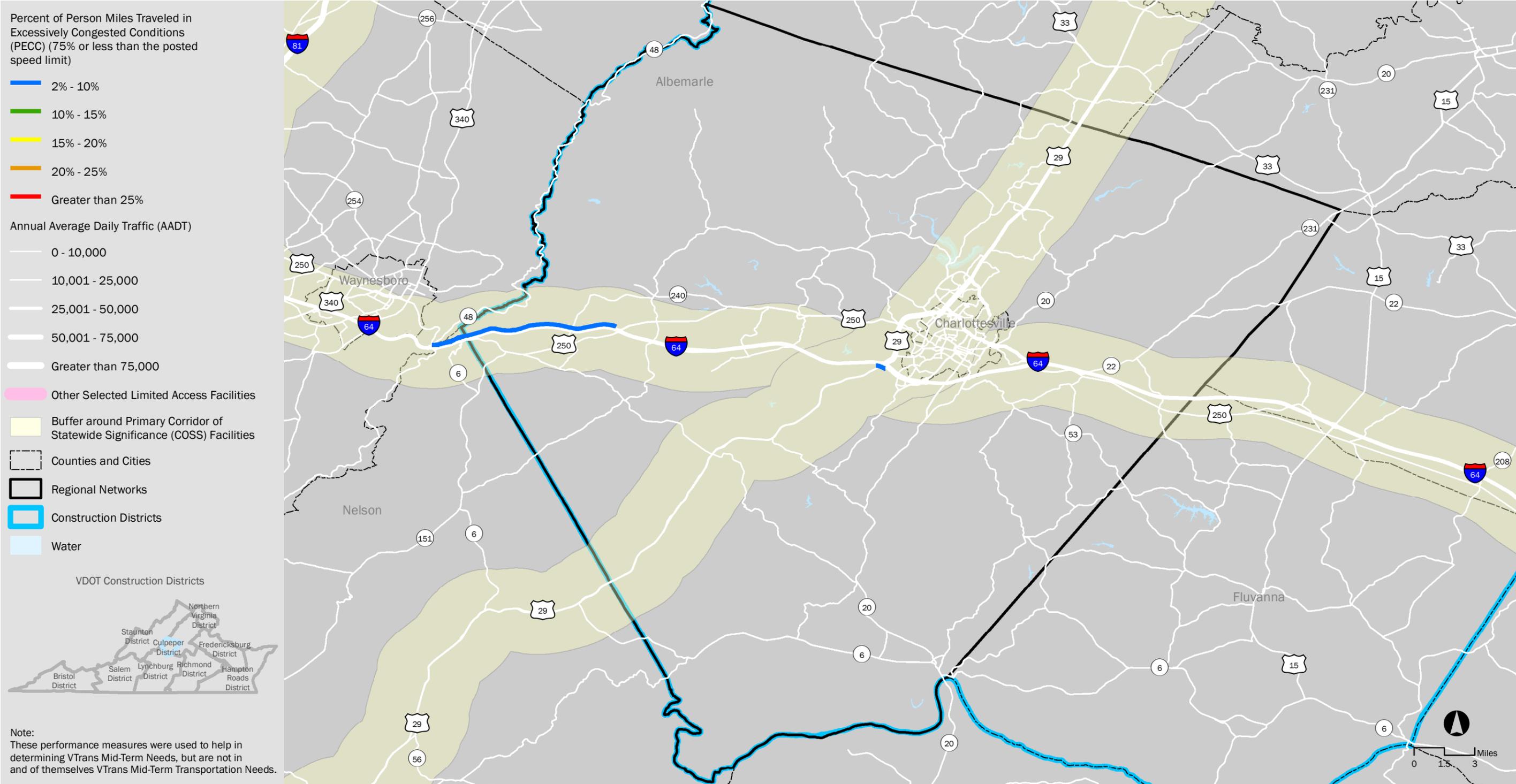
Map 1A: PECC – Congestion Measure for Interstates and Select Limited Access Facilities (Culpeper District)

This performance measure identifies locations where speed is significantly slower than the posted speed limit.



Map 1B: PECC - Congestion Measure for Interstates and Select Limited Access Facilities (Charlottesville)

This performance measure identifies locations where speed is significantly slower than the posted speed limit.





Goal A: Methodology for Identification of Congestion Mitigation Needs

Performance Measure:	Travel Time Index (TTI)	Time periods:	The time period considered for weekdays and weekends is 6 a.m. – 8 p.m for calendar year 2018
What it tells us:	The intensity of congestion	Unit of Analysis for Performance Measures:	Roadway segment
What it measures:	How slow speeds are compared to the reference speed (the speed under ideal conditions). If the TTI=2.0, it takes twice as long to travel the road segment during the peak time than at the reference speed (free flow traffic conditions).	Unit of Reporting for Mid-Term Needs:	Roadway segment
Where it applies:	Non-Limited Access Facilities on the CoSS, and all other roadways within Regional Networks for which data is available		



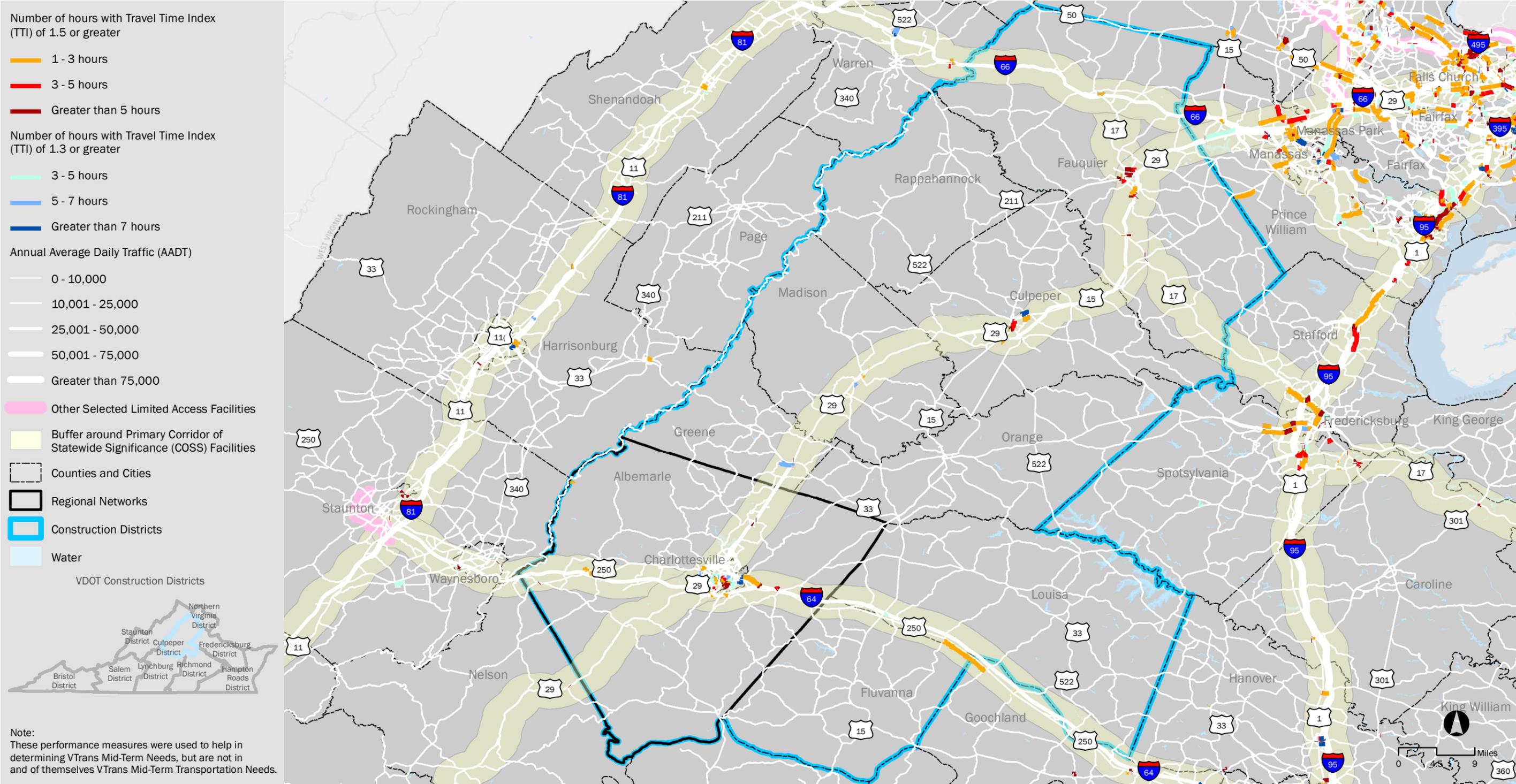


Goal A: Methodology for Identification of Congestion Mitigation Needs *(continued)*

Steps	Input	Action	Output
4. Consider stakeholder input.	<ul style="list-style-type: none"> TTI threshold of 1.5 is too high. Weekday average does not reflect peak period conditions. Request to consider weekend travel, in addition to weekday travel 	<ul style="list-style-type: none"> Converted threshold to TTI 1.5 or above for 1+ hour OR TTI 1.3 or above for 3+ hours, both for weekdays and weekends. Review implications of moving to a count of the number of hours threshold is exceeded. 	<ul style="list-style-type: none"> Congestion-related needs defined by intensity (one hour at or above 1.5 TTI) or duration (three hours at or above 1.3 TTI or more) Weekdays and weekends included Modified measure to reflect the number of hours of congestion Revised method reflects peak and non-peak conditions
5. Identify performance thresholds.	Output from steps 3-4	<ul style="list-style-type: none"> Calculate the number of hours for weekdays between 6 a.m. and 8 p.m. for which hourly TTI exceeds 1.5. Calculate the number of hours for weekdays between 6 a.m. and 8 p.m. for which hourly TTI exceeds 1.3. Repeat the first two calculations for weekends. Calculate the weighted average of weekday and weekend TTI. First, multiply weekday TTI by 5/7 (i.e. weekdays/ all days). Second, multiply weekend TTI by 2/7 (i.e. weekend days/ all days). Sum the two figures. 	<ul style="list-style-type: none"> Threshold - TTI greater than 1.5 for one hour or more, or 1.3 for 3+ hours.
6. Compare with thresholds and identify Needs.	Outputs from step 5	<ul style="list-style-type: none"> Identify roads exceeding threshold, and tag as having a congestion Need. 	<ul style="list-style-type: none"> Geospatial database identifying Non-Limited Access Facilities on the CoSS and all other roadways not part of the CoSS within Regional Network facility segments with a Need for Congestion Mitigation

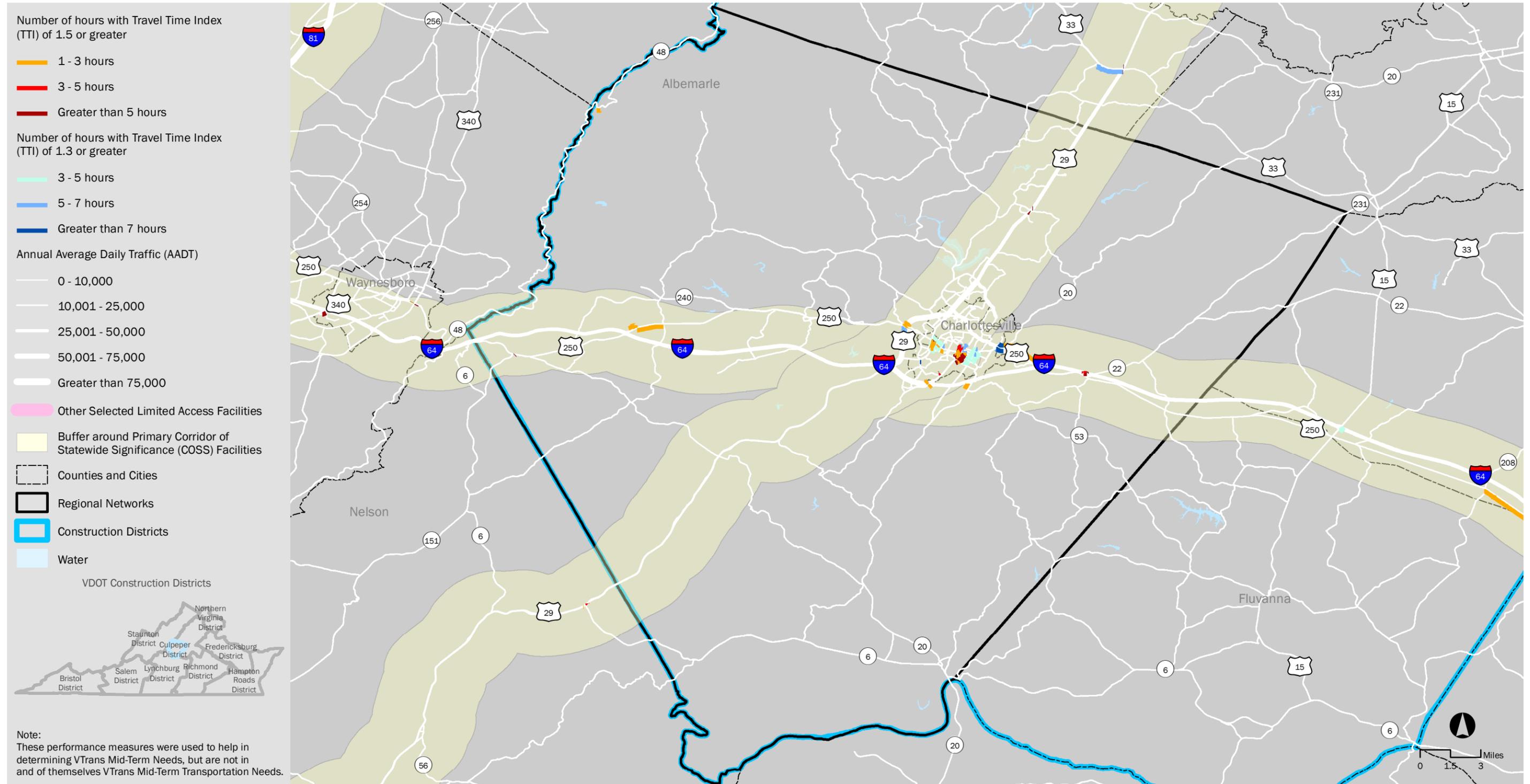
Map 2A: TTI - Congestion Measure for Non-Limited Access COSS and Regional Networks (Culpeper District)

This performance measure identifies locations where travel time is significantly slower than normal traffic conditions.



Map 2B: TTI – Congestion Measure for Non-Limited Access COSS and Regional Networks (Charlottesville)

This performance measure identifies locations where travel time is significantly slower than normal traffic conditions.





Goal A: Methodology for Identification of Travel Time Reliability Improvement Needs

Performance Measure: Level of Travel Time Reliability (LOTTR)

What it tells us: The amount of person delay associated with uncertain travel times, often caused by unexpected events, such as collisions, incidents, and weather events

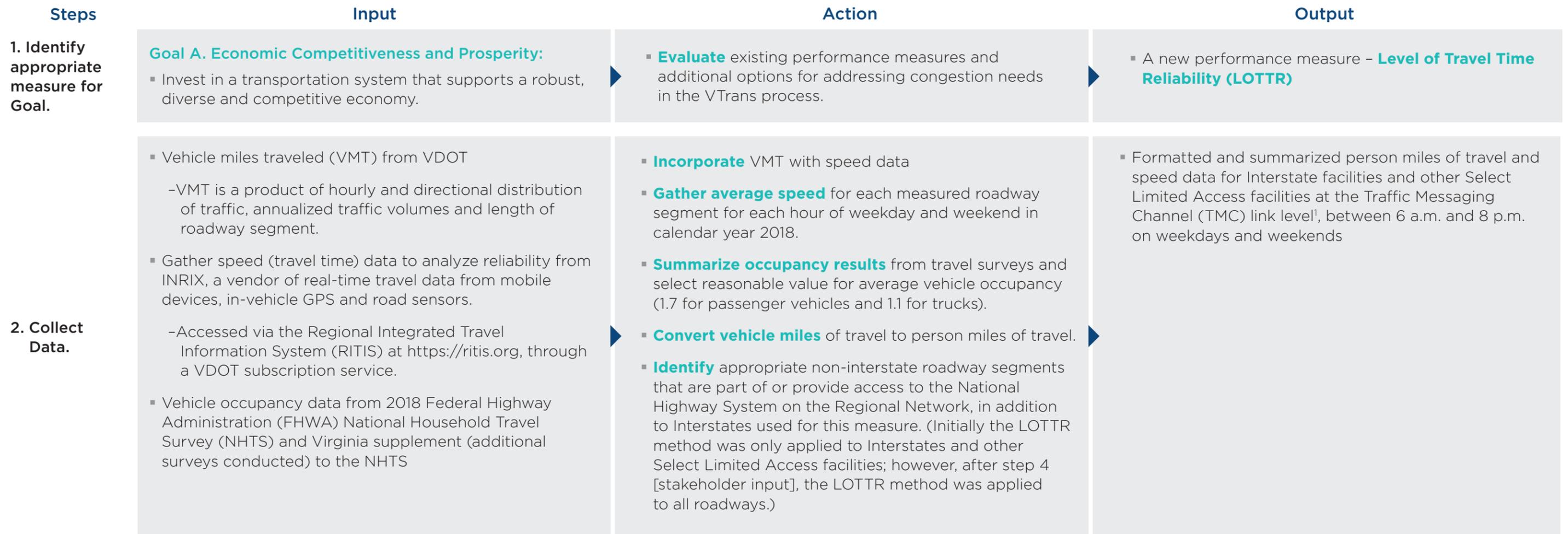
What it measures: Person hours of delay during periods with large travel time variability as measured by the LOTTR - 50th percentile speed/20th percentile speed, which is equivalent to 80th percentile travel time/50th percentile travel time

Where it applies: All measured roadways on the Corridors of Statewide Significance, other Select Limited Access facilities, and roads on the Regional Network

Time periods: All calendar year 2018 weekdays and weekend days in a 14-hour period between 6 a.m. and 8 p.m.

Unit of Analysis for Performance Measures: Roadway segment

Unit of Reporting for Mid-Term Needs: Roadway segment



¹Traffic Messaging Channels (TMCs) are a standard technology for delivering traffic information electronically to motorists and others. For the purpose of calculating the LOTTR, TMCs were used to correspond a segment of roadway with a specific location and length that can be associated with VDOT's geospatial representation of the highway network.

 **Goal A: Methodology for Identification of Travel Time Reliability Improvement Needs** *(continued)*

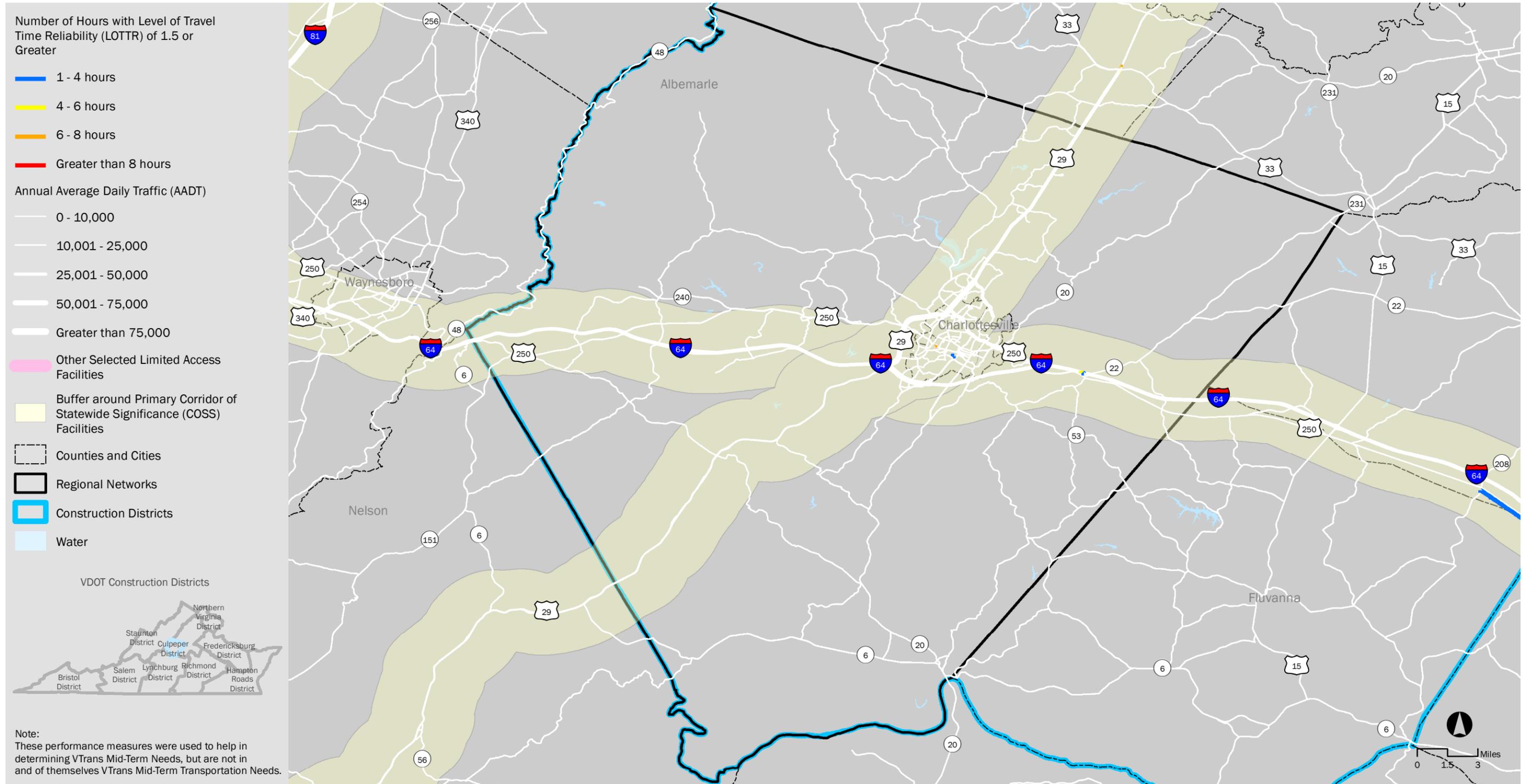
Steps	Input	Action	Output
3. Calculate measures.	<p>Output from step 2</p>	<ul style="list-style-type: none"> ▪ Calculate the 20th percentile slowest speeds (equivalent to the 80th percentile travel times) and the 50th percentile (median speed) for each day of the week (weekdays and weekends) and 14-hour period of each day (6 a.m. to 8 p.m.). ▪ Calculate the 50th/20th percentile speed ratio for each segment. ▪ Identify segments whose ratio exceeds 1.5. This ratio is called Level of Travel Time Reliability (LOTTR). ▪ Calculate the person hours traveled corresponding to the hours during which the (LOTTR) ratio exceeds 1.5. 	<ul style="list-style-type: none"> ▪ Maps and geospatial databases containing Level of Travel Time Reliability. LOTTR was reported separately for weekdays and weekends.
4. Consider Stakeholder Input and additional updates and modifications	<p>The method does not capture peak hour or peak period delay.</p> <p>Ensure that weekend travel is captured.</p> <p>Buffer Time Index (the measure presented originally) used for Non-CoSS and other non-Limited Access facilities does not capture unreliable conditions in several areas.</p>	<ul style="list-style-type: none"> ▪ Calculate 20th percentile speeds and median speeds by hour for weekdays (14 hours) and weekends (14 hours) from daily speeds recorded by hour. (Change from the total number of person hours of delay to number of hours that LOTTR at 1.5 ratio is exceeded on weekdays and weekends.) ▪ Expand measure from application to CoSS and other Select Limited Access facilities to include all roadways with the Regional Network for which data is available. ▪ Use same measure (LOTTR) for all roadways. 	<ul style="list-style-type: none"> ▪ Revised measure to portray number of hours of unreliable delay rather than person hours of delay ▪ LOTTR for all roadways

 **Goal A: Methodology for Identification of Travel Time Reliability Improvement Needs** *(continued)*

Steps	Input	Action	Output
5. Identify performance thresholds.	Outputs from steps 3 and 4	<ul style="list-style-type: none"> ▪ Review alternative targets and application methods and review distribution of needs that result. ▪ Count the number of hours (out of 14) that the LOTTR exceeds 1.5 for weekdays. ▪ Count the number of hours (out of 14) that the LOTTR exceeds 1.5 for weekends. ▪ Calculate the weighted average of weekday and weekend LOTTR. First, multiply weekday LOTTR by 5/7 (i.e. weekdays/ all days). Second, multiply weekend LOTTR by 2/7 (i.e. weekend days/ all days). Sum the two figures. 	<ul style="list-style-type: none"> ▪ Threshold - average number of hours when the LOTTR ratio exceeds 1.5 is greater than 1 hour.
6. Compare with thresholds and identify Needs.	Outputs from steps 4 and 5	<ul style="list-style-type: none"> ▪ Confirm that the results are reasonable. ▪ Identify roadway locations that exceed threshold and tag as having a reliability need. 	<ul style="list-style-type: none"> ▪ Geospatial database of roadways with Need for Improved Travel Time Reliability

Map 3B: LOTTR – Reliability Measure for COSS and Regional Networks (Charlottesville)

This performance measure pinpoints locations with high variability in travel time.





Goal A: Methodology for Identification of Travel Time Reliability Improvement Needs

Performance Measure: Intercity and Commuter Rail On-Time Performance

What it tells us: Reliability of intercity and commuter rail services

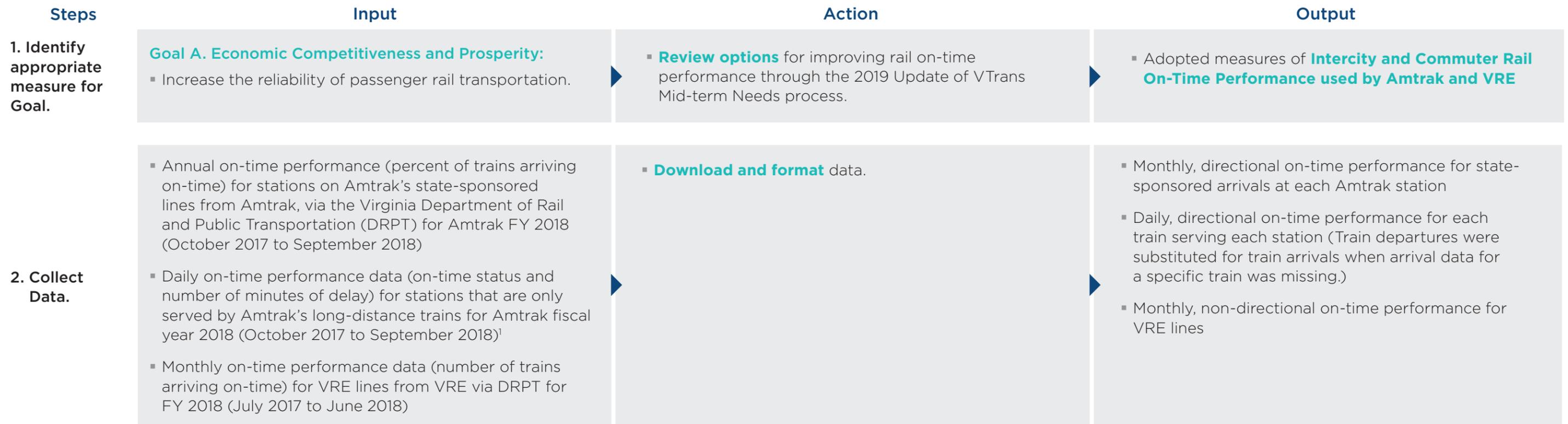
What it measures: Schedule adherence of passenger rail services per the published rail service schedule

Where it applies: All Amtrak stations and Virginia Railway Express (VRE) lines

Time periods: Amtrak's fiscal year (FY) for Amtrak stations (October 2017 to September 2018) and VRE's FY for VRE lines (July 2017 to June 2018)

Unit of Analysis for Performance Measures: Rail stations (Amtrak) and rail lines (VRE)

Unit of Reporting for Mid-Term Needs: Rail stations (Amtrak and VRE)



¹ Juckins, C. "Past Amtrak Delays - Specific Data by Train Number and Station." Available at https://juckins.net/amtrak_status/archive/html/historychart.php. FY 2018

 **Goal A: Methodology for Identification of Travel Time Reliability Improvement Needs** *(continued)*

Steps	Input	Action	Output
3. Calculate measures.	<ul style="list-style-type: none"> Monthly, directional on-time performance for each Amtrak station (output from step 2) Daily, directional on-time performance for each Amtrak long-distance train at stations not served by state-sponsored lines (output from step 2) Monthly, non-directional on-time performance at the level of VRE lines (output from step 2) 	<ul style="list-style-type: none"> Average northbound and southbound performance to generate average performance. Convert daily statistics to annual average by summing the number of trains delayed by 15 minutes or more per station and dividing by the total number of trains. Convert monthly statistics to annual average by summing the number of trains delayed by 5 minutes or more per line and dividing by the total number of trains per line. 	<ul style="list-style-type: none"> Annual on-time performance for stations on Amtrak's state-sponsored lines Annual on-time performance for stations served only by Amtrak's long-distance lines Annual on-time performance for the Fredericksburg and Manassas VRE lines (Stations serving both lines are attributed the performance for their least on-time line.)
4. Identify performance thresholds.	<ul style="list-style-type: none"> Amtrak (2019) Amtrak Host Railroad Report Card 2018² VRE Key Performance Metrics report. February 2017 to February 2018³ 	<ul style="list-style-type: none"> Identify Amtrak's on-time performance standards for state-supported and long-distance trains. Identify VRE's performance targets. 	<ul style="list-style-type: none"> Threshold of 80% for stations served by Amtrak's state-sponsored trains and 70% for stations served only by Amtrak's long-distance trains (Trains are considered on-time if they are within 15 minutes of schedule.) Threshold of 90% (Trains are considered on-time if they are within 5 minutes of schedule.⁴)
5. Compare with thresholds and identify Needs.	<ul style="list-style-type: none"> Station-level performance (output from step 3) Performance thresholds (output from step 4) 	<ul style="list-style-type: none"> Identify Needs for stations whose average on-time performance is below the relevant performance threshold. Assign performance and Needs to station-level geospatial database. 	<ul style="list-style-type: none"> Geospatial database with average on-time performance of every station and a binary variable designating Needs

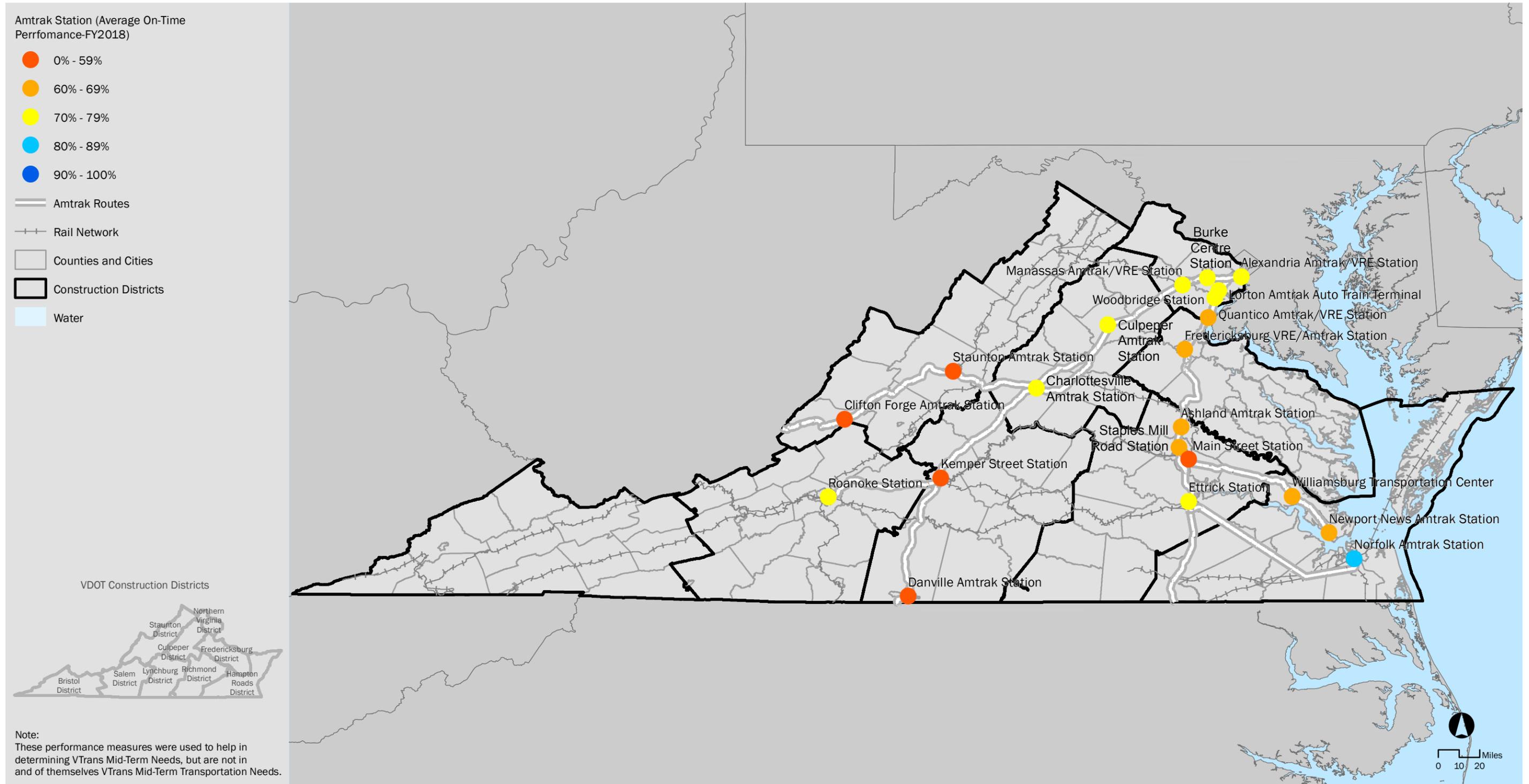
² Accessed September 11, 2019. Available at <http://media.amtrak.com/wp-content/uploads/2019/03/Amtrak-Host-Railroad-Report-Card-and-Route-Grades-2018-with-FAQs.pdf>.

³ Report run March 9, 2018. Provided by VRE.

⁴ Virginia Railway Express (2019). Transit Development Plan: FY 2020 - 2025). Available at <https://www.vre.org/vre/assets/File/VRE%20FY2020-FY2025%20Transit%20Development%20Plan%20FINAL.pdf>.

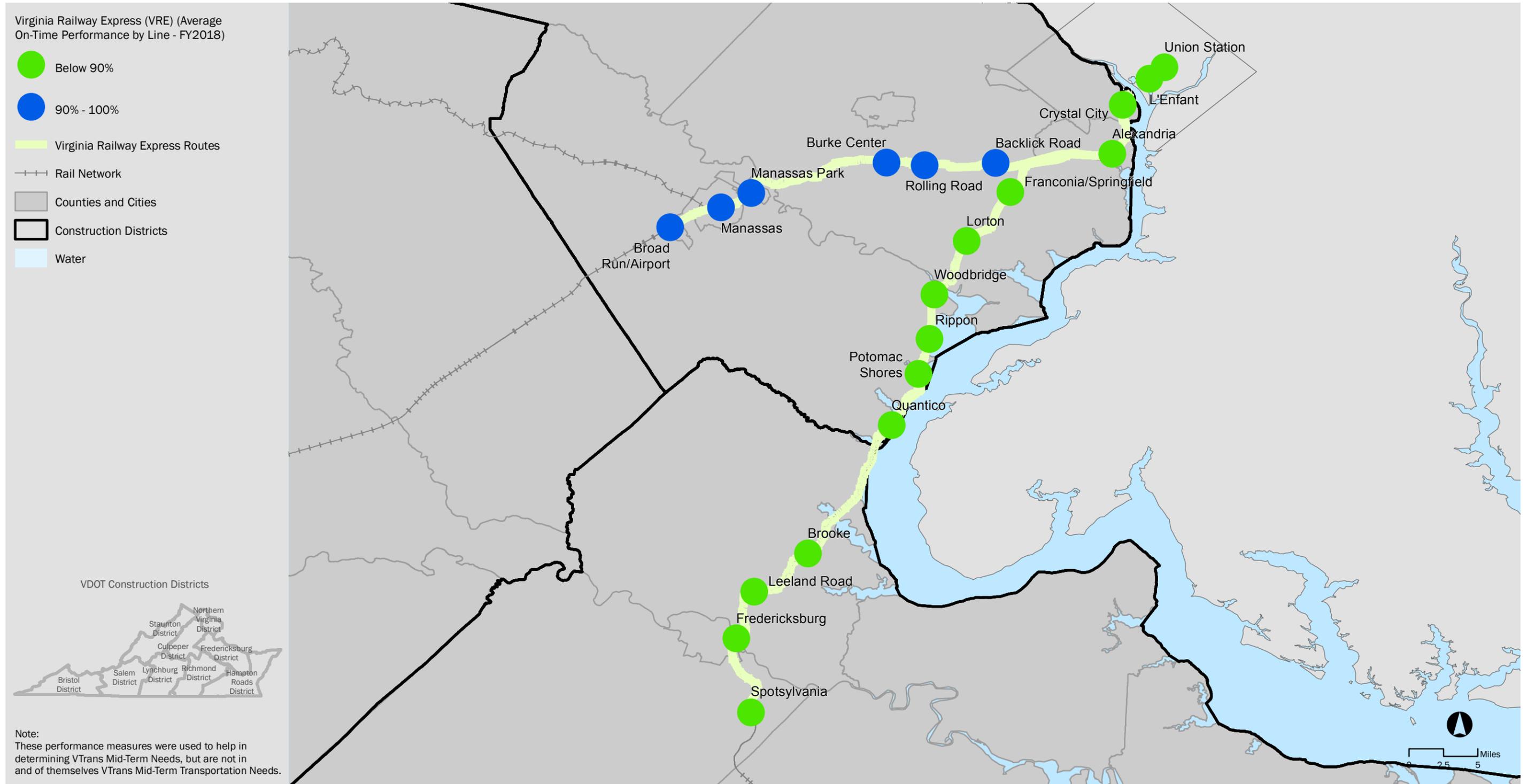
Map 4: Passenger and Intercity Rail On-Time Performance - Amtrak

This performance measure describes the average on-time arrival performance of Virginia's passenger rail systems. This map shows the on-time performance of Amtrak service, by station.



Map 5: Passenger and Intercity Rail On-Time Performance – Virginia Railway Express

This performance measure describes the average on-time arrival performance of Virginia’s passenger rail systems. This map shows the on-time performance of the Virginia Rail Expressway system, by service line.





Goal B: Methodology for Identification of Needs for Transit Access to Activity Centers for Workers

Performance Measure: Transit Access to Activity Centers for Workers

What is an Activity Center: Activity Centers are locations of concentrated employment or other clusters of economic or social activity that are primary attractors of travel trips within Regional Networks. Activity Centers require reliable access to employees, customers, and/or suppliers to function well and increase the economic opportunities that they provide.¹

What it tells us: Activity Centers that require greater transit accessibility for workers

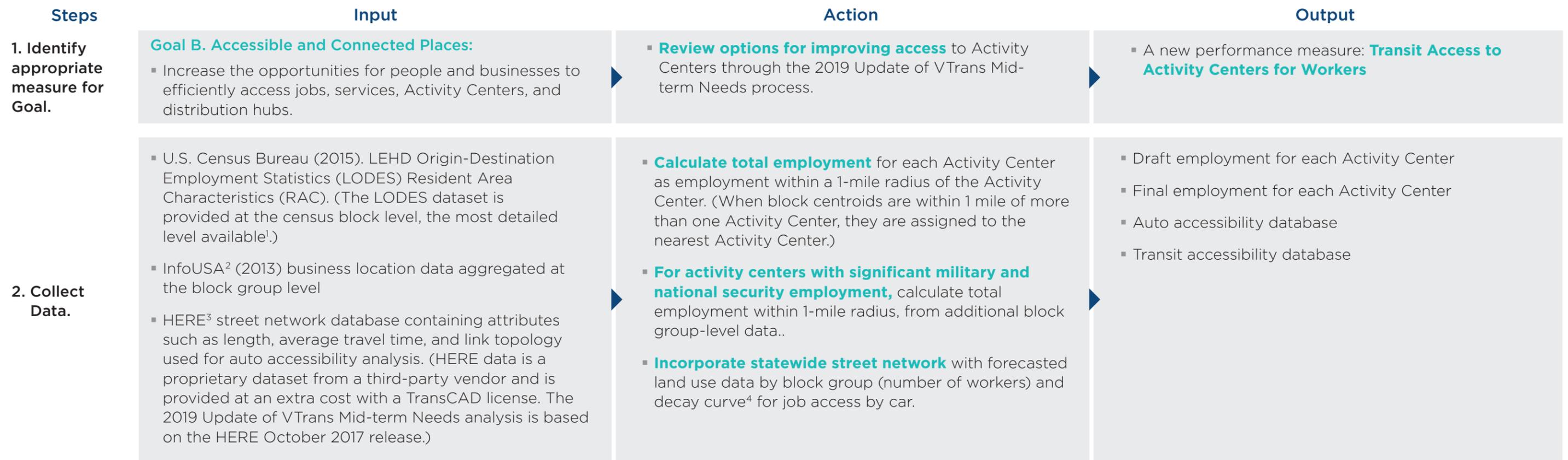
What it measures: The difference between the number of workers that can reach an Activity Center within 45 minutes by car and by transit, normalized by the Activity Centers' employment

Where it applies: All VTrans Activity Centers

Time periods: Calendar year 2017

Unit of Analysis for Performance Measures: Census block group

Unit of Reporting for Mid-Term Needs: Activity Center locations



¹ Available at <https://lehd.ces.census.gov/data/#lodes>

² InfoUSA is a vendor of business location databases, whose website is <https://www.infousa.com/>.

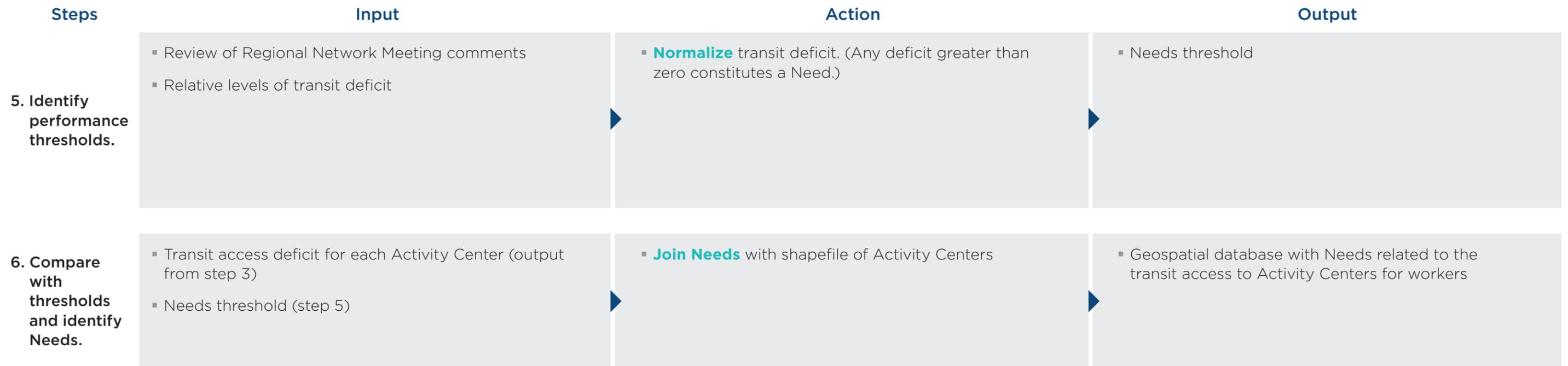
³ HERE is a location technologies vendor, whose website is <https://www.here.com/>.

⁴ In this context, a decay curve is a mathematical relationship that describes the decreasing attractiveness of a location as the distance from it increases. The form of the curve is derived from household travel survey data.

 **Goal B: Methodology for Identification of Needs for Transit Access to Activity Centers for Workers** *(continued)*

Steps	Input	Action	Output
2. Collect Data.	General Transit Feed Specification (GTFS) text files. (GTFS data provides transit route information including stop location, route shape, and trip schedules and can be used to create a TransCAD route system and network.)	<ul style="list-style-type: none"> ▪ Incorporate statewide route system with forecasted land use data by block group and decay curve for access to jobs by transit. 	
3. Calculate measures.	Outputs from step 2 <ul style="list-style-type: none"> ▪ Statewide transit route system ▪ Activity Center employment totals ▪ Auto and transit accessibility database 	<ul style="list-style-type: none"> ▪ Utilize VDOT's TransCAD accessibility model to determine the number of workers who can reach the primary block group associated with an Activity Center by automobile and by transit within 45 minutes. ▪ Scale the transit access deficit by the share of the Activity Center's employment compared to the employment of the largest Activity Center in the Regional Network in order to map and visualize results. 	Accessibility statistics for each Activity Center: <ul style="list-style-type: none"> ▪ Automotive accessibility: Number of workers that can access an Activity Center with a 45-minute car ride ▪ Transit accessibility: Number of workers that can access an Activity Center with a 45-minute bus, commuter rail, bus rapid transit, rail rapid transit, or light rail transit ride ▪ Transit access deficit: Difference between automotive accessibility and transit accessibility ▪ Normalized transit access deficit ▪ Maps and geospatial database
4. Consider stakeholder input.	<ul style="list-style-type: none"> ▪ Requests to add new Activity Centers ▪ Request to add airports with commercial services and regional hospitals as Activity Centers ▪ Concern that the Activity Center locations shown on the map might not be accurate or precise ▪ Recommendation to portray and describe this measure differently ▪ Recommendation to edit the method to account for the fact that different Activity Centers employ different numbers of workers ▪ Recommendation to review data, as there were some unexpected results ▪ Request to identify transit access Needs for freight-dependent Activity Centers in addition to local-serving and knowledge-based activity centers 	<ul style="list-style-type: none"> ▪ Add several additional Activity Centers. ▪ Add airports with commercial services and regional hospitals. ▪ Reanalyze and correct Activity Center locations. ▪ Change name of measure to "Transit Access to Activity Centers for Workers." ▪ Modify method to normalize transit access deficit by the total employment at Activity Center. ▪ Redo analysis to ensure greater accuracy. ▪ Identify the transit access deficit to freight-dependent Activity Centers. 	<ul style="list-style-type: none"> ▪ Revised analysis with additional Activity Centers ▪ Improved accuracy of activity center locations ▪ Improved analysis accuracy ▪ Revised description of measure

 **Goal B: Methodology for Identification of Needs for Transit Access to Activity Centers for Workers** *(continued)*



ⁱEffective transportation to and from Activity Centers helps the businesses located in them to grow and continue providing jobs, goods, and services to Virginians. Good transportation also helps employees to reach their workplaces. Activity Centers in the 2019 Update of VTrans Mid-term Needs are based on the set of Activity Centers that were identified in VTrans2040, supplemented by new locations identified by regional stakeholders.

Goal B: Methodology for Identification of Needs for Transit Access to Activity Centers for Workers *(continued)*

Activity centers have different economic focuses depending on the industry types that are clustered inside them. Some primarily serve customers in the local community or region with retail shopping, real estate services, healthcare, recreation, or pre-K through 12 education among other “local-serving” activities. Other activity centers primarily export “knowledge-based” services and products to the rest of the state, country, or world through activities like corporate management, information-based industries, and higher education. The remaining “freight-dependent” activity centers create, process, or transport goods and materials that depend on freight transportation.

As part of the 2019 Update of VTrans Mid-term Needs development process, activity centers were assigned to the economic category that contains the plurality of their employment using the alignment between employment classified by North American Industry Classification System (NAICS) codes and the economic categories shown in Table 1.

Employment at the level of U.S. Census blocks was assigned to an activity center if the block’s centroid is within one mile of the point representing an activity center. In cases where the block centroid is within one mile of two or more activity centers, it is assigned to the closest activity center. Different industry clusters have different transportation needs, as illustrated in Figure 1.

Table 1: Alignment Between Industries and Economic Categories

NAICS Code (2-digit)	Industry Name	Economic Category
11	Agriculture, Forestry, Fishing and Hunting	Freight-dependent
21	Mining, Quarrying, and Oil and Gas Extraction	Freight-dependent
22	Utilities	Freight-dependent
23	Construction	Freight-dependent
31	Manufacturing	Freight-dependent
32	Manufacturing	Freight-dependent
33	Manufacturing	Freight-dependent
42	Wholesale Trade	Freight-dependent
48	Transportation and Warehousing	Freight-dependent
49	Transportation and Warehousing	Freight-dependent
51	Information	Knowledge-based
54	Professional, Scientific and Technical Services	Knowledge-based
55	Management of Companies and Enterprises	Knowledge-based
56	Administrative and Support and Waste Management and Remediation Services	Knowledge-based
44	Retail Trade	Local-serving
45	Retail Trade	Local-serving
52	Finance and Insurance	Local-serving
53	Real Estate and Rental and Leasing	Local-serving
61	Educational Services	Local-serving
62	Health Care and Social Assistance	Local-serving
71	Arts, Entertainment, and Recreation	Local-serving
72	Accommodation and Food Services	Local-serving
81	Other Services, except Public Administration	Local-serving
92	Public Administration	Local-serving

Activity Centers of each economic category have different transportation needs. Table 2 shows the degree to which Activity Centers of different economic categories rely on multiple transportation characteristics, based on a review of research and a survey of site selection professionals.

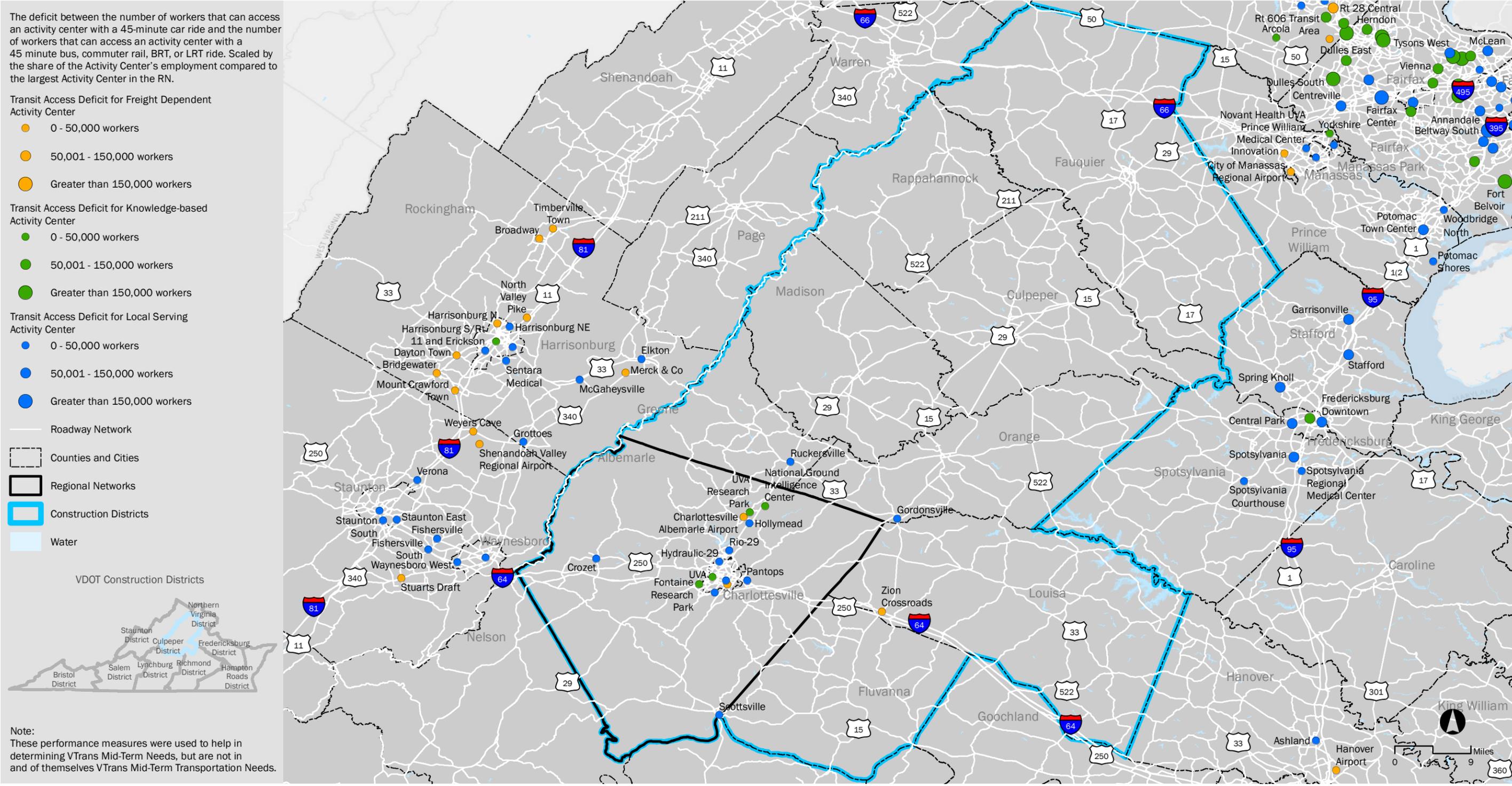
The economic category-specific needs guided the development of needs for access to Activity Centers. While transit access is most strongly correlated with knowledge-based industries, local-serving and freight-dependent industries also rely on transit access for workers to lesser degrees.

Table 2: Transportation Needs Associated with Activity Center Types

	Local-serving Industries	Knowledge-based Industries	Freight-based Industries
Highway Access	High	High	High
Passenger Reliability	Med	High	Med
Bottleneck Relief	Med	High	High
Freight Reliability	Med	Med	High
Freight Accessibility	Med	Low	High
Network Connectivity	High	High	Med
Transportation Demand Management	Low	Med	Med
Modal Choice	High	High	Med
Transit Access	Med	High	Med
Active Transportation Options	Med	Med	Low
Walkable Places	Med	High	Low

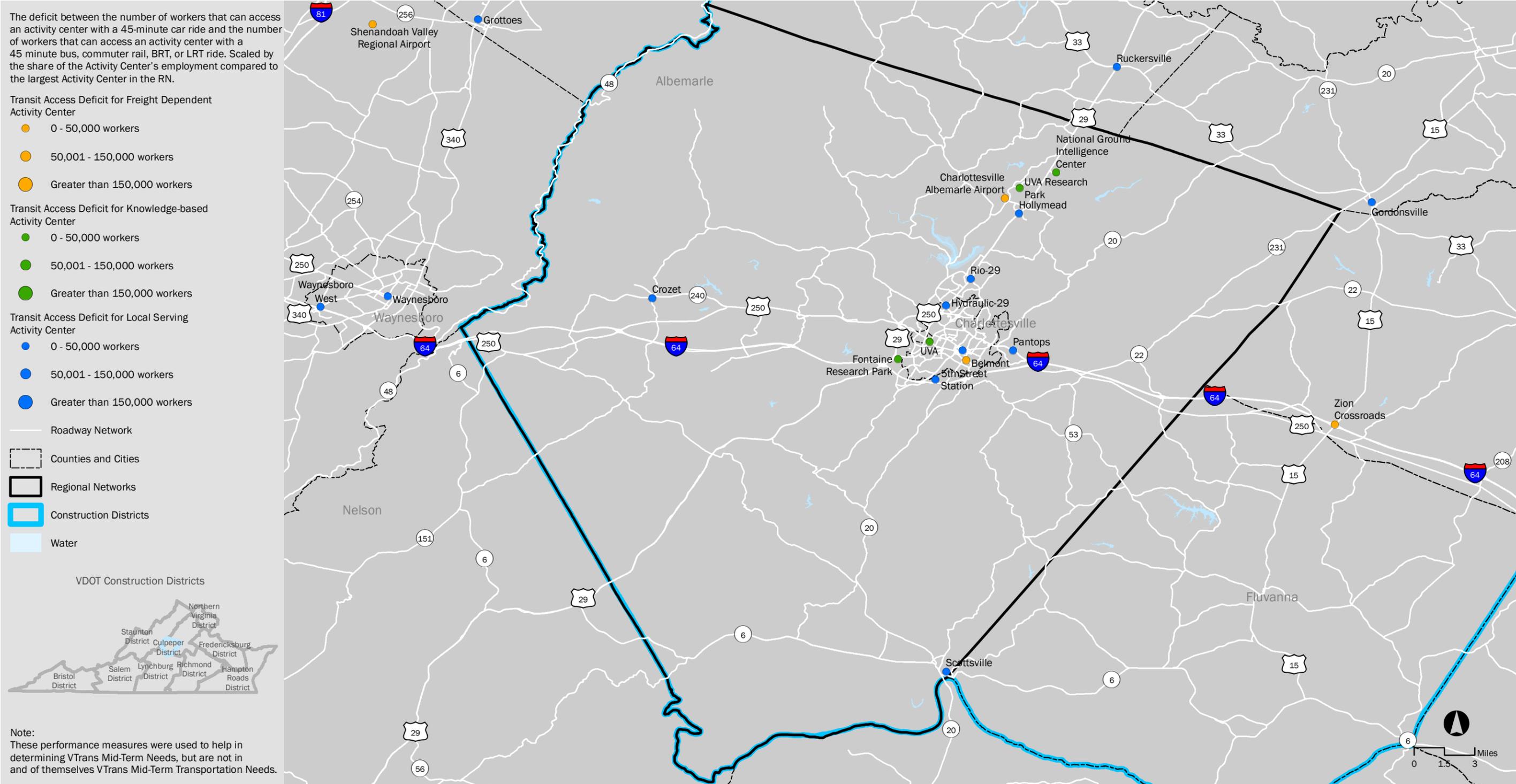
Map 6A: Transit Access to Activity Centers for Workers (Culpeper District)

This performance measure identifies regional Activity Centers where transit access is not competitive with automobile traffic.



Map 6B: Transit Access to Activity Centers for Workers (Charlottesville)

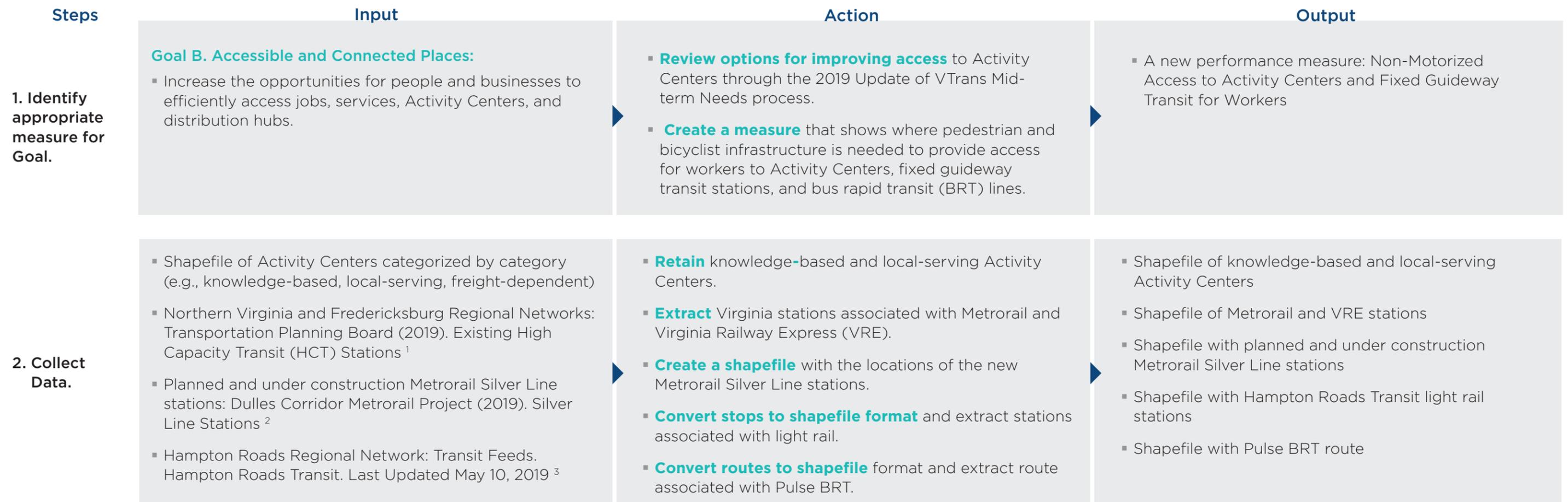
This performance measure identifies regional Activity Centers where transit access is not competitive with automobile traffic.





Goal B: Methodology for Identification of Needs for Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers

Performance Measure:	None, based on walk and bike zones	Where it applies:	Local-serving and knowledge-based Activity Centers, fixed-guideway transit stations, and bus rapid transit (BRT) lines inside of Metropolitan Planning Area boundaries
What is an Activity Center:	Activity Centers are locations of concentrated employment or other clusters of economic or social activity that are primary attractors of travel trips within Regional Networks. Activity Centers require reliable access to employees, customers, and/or suppliers to function well and increase the economic opportunities that they provide. ¹	Time periods:	Calendar year 2017
What it tells us:	Need for pedestrian and bicyclist access to reach Activity Centers, fixed guideway transit stations, and bus rapid transit (BRT) lines	Unit of Analysis for Performance Measures:	One mile walk access radius and 7-mile bicycle access radius
What it measures:	The maximum distance that pedestrians and bicyclists are likely to travel to reach Activity Centers, fixed guideway transit stations, and bus rapid transit (BRT) lines	Unit of Reporting for Mid-term Needs:	Roadway segment





Goal B: Methodology for Identification of Needs for Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers (continued)

Steps	Input	Action	Output
2. Collect Data.	<ul style="list-style-type: none"> Greater Richmond Transit Company (2019) ⁴ Washington Metropolitan Area Transit Authority (2019) ⁵ Shapefile of metropolitan planning organization (MPO) boundaries in Virginia 	<ul style="list-style-type: none"> Convert routes to shapefile format and extract route associated with Metroway BRT. None 	<ul style="list-style-type: none"> Shapefile with Metroway BRT route Shapefile of MPO boundaries
3. Calculate measures.	<ul style="list-style-type: none"> <i>Manual on Uniform Traffic Control Devices</i> (MUTCD), 2009 Edition. Chapter 4E. Pedestrian Control Features U.S. Census Bureau (2017). Table B08534: Means of Transportation to Work by Travel Time to Work. 5-year 2017 American Community Survey Multiple sources for average urban bike speed ^{7 8 9 10} U.S. Census Bureau (2014). "Modes Less Traveled—Bicycling and Walking to Work in the United States: 2008-2012." <i>American Community Survey Reports</i> ¹¹ 	<ul style="list-style-type: none"> Extract walk speed. Extract Virginia's 90th percentile single-mode walk commute time Extract bike speed by averaging multiple sources. Extract mean bike (19.3 minutes) and walk (11.5 minutes) commute times and impute bike commute time that is equivalent to the walk commute time using the following equation. The 90th percentile walk commute time is 25 minutes. The result is 42 minutes. $\left(\left(\frac{\text{mean bike commute} - \text{mean walk commute}}{\text{mean walk commute}} \right) + 1 \right) \times 90^{\text{th}} \text{ percentile walk commute}$	<ul style="list-style-type: none"> Walk speed of 2.4 mph (3.5 feet per second) Commute time of approximately 25 minutes Bike speed of 9.9 mph Imputed bike commute time of 42 minutes
4. Consider stakeholder input.	<ul style="list-style-type: none"> Request to include non-motorized access to transit 	<ul style="list-style-type: none"> Add non-motorized access to complement transit access to Activity Center needs. (Non-motorized access to fixed-guideway and bus rapid transit [BRT] service was included.) 	<ul style="list-style-type: none"> Implementation of new needs category



Goal B: Methodology for Identification of Needs for Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers *(continued)*

Steps	Input	Action	Output
5. Identify performance thresholds.	<ul style="list-style-type: none"> ▪ Bike speeds and commute times from step 3 ▪ Shapefile of MPO boundaries ▪ Shapefile of knowledge-based and local-serving Activity Centers from step 2 ▪ Walk speeds and commute times from step 3 	<ul style="list-style-type: none"> ▪ Calculate bike needs radius by multiplying the bike speed (9.9 mph) by the bike commute time (42 min) and rounding the result (6.9 miles) to the nearest integer. ▪ Retain only knowledge-based and local-serving Activity Centers inside of metropolitan planning organization (MPO) boundaries. ▪ Calculate walk needs radius by multiplying the walk speed (2.4 mph) by the walk commute time (25 minutes) and rounding the result (1.0) to the nearest integer. 	<ul style="list-style-type: none"> ▪ Bike needs radius of 7 miles ▪ Shapefile of knowledge-based and local-serving Activity Centers inside MPO boundaries ▪ Walk needs radius of 1 miles
6. Compare with thresholds and identify Needs.	<ul style="list-style-type: none"> ▪ Fixed-guideway transit stations and BRT lines from step 2 ▪ Shapefile of Activity Centers inside MPO boundaries and Needs radii from step 5 	<ul style="list-style-type: none"> ▪ Generate walk and bike Needs buffers of 1 and 7 miles respectively around the Activity Centers, fixed-guideway transit stations, and BRT lines. 	<ul style="list-style-type: none"> ▪ Geospatial database with Needs for Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers

¹ Effective transportation to and from Activity Centers helps the businesses located in them to grow and continue providing jobs, goods, and services to Virginians. Good transportation also helps employees to reach their workplaces. Activity Centers in the 2019 Update of VTrans Mid-term Needs are based on the set of Activity Centers that were identified in VTrans2040, supplemented by new locations identified by regional stakeholders.

¹ Available at <https://rtdc-mwcog.opendata.arcgis.com/datasets/existing-high-capacity-transit-hct-stations>

² Accessed August 26, 2019. Available at <http://www.dullesmetro.com/silver-line-stations/>

³ Available at <http://transitfeeds.com/p/hampton-roads-transit/358?p=1>

⁴ Transit Data for Developers. Available at <http://ridegrtc.com/gtfs-files-overview/>

⁵ Developer Resources - GTFS Download. Available at <https://www.wmata.com/about/developers/#main-content>

⁶ Available at <https://mutcd.fhwa.dot.gov/htm/2009/part4/part4e.htm>

⁷ McLeish, M. (2017). "How far is too far to bike to work?" Mobility Lab. Available at <https://mobilitylab.org/2017/02/27/how-far-bike-work/>

⁸ "Average cycling speed for new and experienced cyclists" Road Bike. Available at <https://www.road-bike.co.uk/articles/average-speed.php>

⁹ Tejvan (2017). Average speeds cycling. Available at <https://cyclinguphill.com/average-speeds-cycling/>

¹⁰ "How fast does the average person ride a bike?" Reference. Available at <https://www.reference.com/sports-active-lifestyle/fast-average-person-ride-bike-cf053029272716e0>

¹¹ Available at <https://www2.census.gov/library/publications/2014/acs/acs-25.pdf>



Goal B: Methodology for Identification of Needs for Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers *(continued)*

Activity centers have different economic focuses depending on the industry types that are clustered inside them. Some primarily serve customers in the local community or region with retail shopping, real estate services, healthcare, recreation, or pre-K through 12 education among other “local-serving” activities. Other activity centers primarily export “knowledge-based” services and products to the rest of the state, country, or world through activities like corporate management, information-based industries, and higher education. The remaining “freight-dependent” activity centers create, process, or transport goods and materials that depend on freight transportation.

As part of the 2019 Update of VTrans Mid-term Needs development process, activity centers were assigned to the economic category that contains the plurality of their employment using the alignment between employment classified by North American Industry Classification System (NAICS) codes and the economic categories shown in Table 1.

Employment at the level of U.S. Census blocks was assigned to an activity center if the block’s centroid is within one mile of the point representing an activity center. In cases where the block centroid is within one mile of two or more activity centers, it is assigned to the closest activity center. Different industry clusters have different transportation needs, as illustrated in Figure 1.

Table 1: Alignment Between Industries and Economic Categories

NAICS Code (2-digit)	Industry Name	Economic Category
11	Agriculture, Forestry, Fishing and Hunting	Freight-dependent
21	Mining, Quarrying, and Oil and Gas Extraction	Freight-dependent
22	Utilities	Freight-dependent
23	Construction	Freight-dependent
31	Manufacturing	Freight-dependent
32	Manufacturing	Freight-dependent
33	Manufacturing	Freight-dependent
42	Wholesale Trade	Freight-dependent
48	Transportation and Warehousing	Freight-dependent
49	Transportation and Warehousing	Freight-dependent
51	Information	Knowledge-based
54	Professional, Scientific and Technical Services	Knowledge-based
55	Management of Companies and Enterprises	Knowledge-based
56	Administrative and Support and Waste Management and Remediation Services	Knowledge-based
44	Retail Trade	Local-serving
45	Retail Trade	Local-serving
52	Finance and Insurance	Local-serving
53	Real Estate and Rental and Leasing	Local-serving
61	Educational Services	Local-serving
62	Health Care and Social Assistance	Local-serving
71	Arts, Entertainment, and Recreation	Local-serving
72	Accommodation and Food Services	Local-serving
81	Other Services, except Public Administration	Local-serving
92	Public Administration	Local-serving

Activity Centers of each economic category have different transportation needs. Table 2 shows the degree to which Activity Centers of different economic categories rely on multiple transportation characteristics, based on a review of research and a survey of site selection professionals.

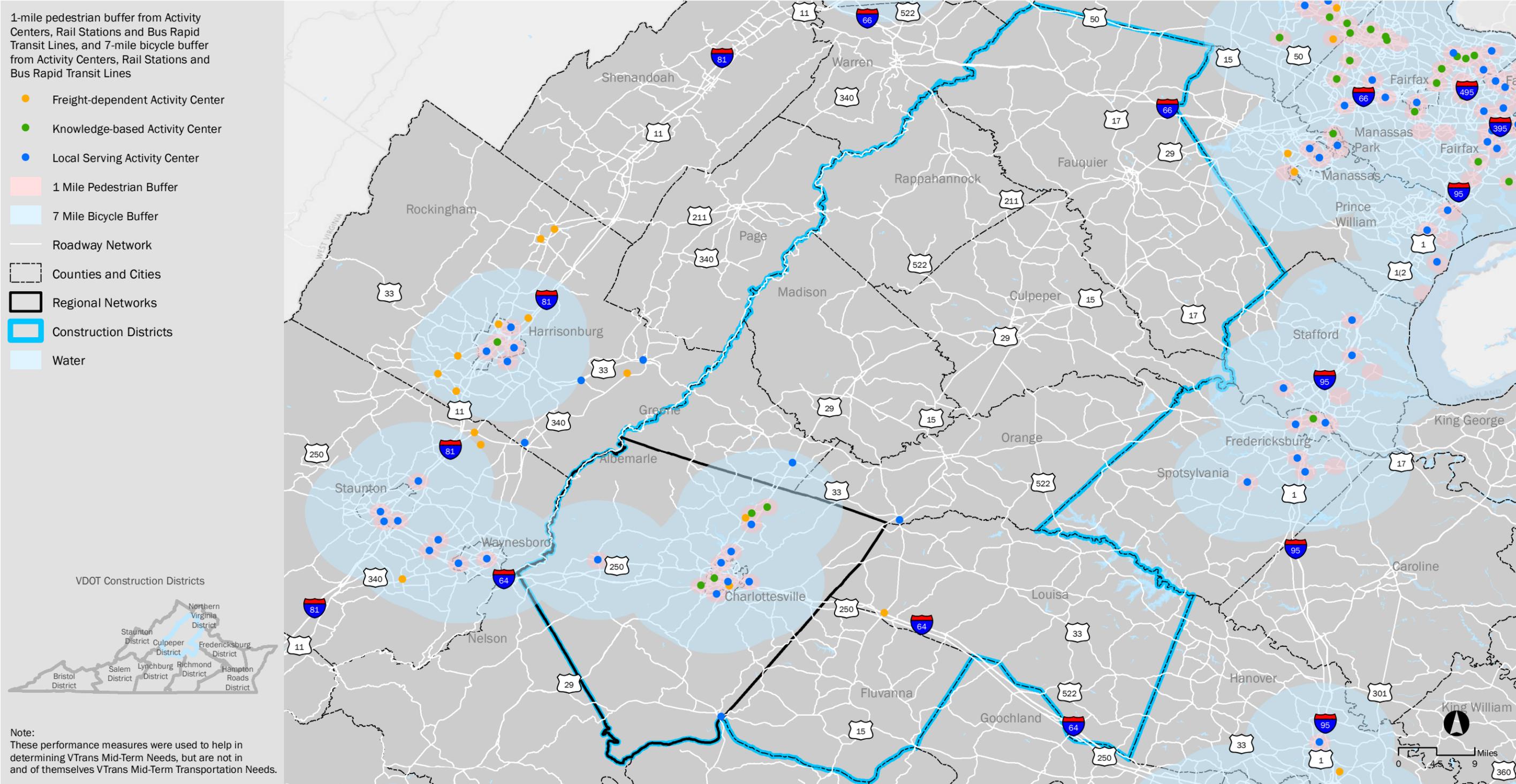
The economic category-specific needs guided the development of needs for access to Activity Centers. While transit access is most strongly correlated with knowledge-based industries, local-serving and freight-dependent industries also rely on transit access for workers to lesser degrees.

Table 2: Transportation Needs Associated with Activity Center Types

	Local-serving Industries	Knowledge-based Industries	Freight-based Industries
Highway Access	High	High	High
Passenger Reliability	Med	High	Med
Bottleneck Relief	Med	High	High
Freight Reliability	Med	Med	High
Freight Accessibility	Med	Low	High
Network Connectivity	High	High	Med
Transportation Demand Management	Low	Med	Med
Modal Choice	High	High	Med
Transit Access	Med	High	Med
Active Transportation Options	Med	Med	Low
Walkable Places	Med	High	Low

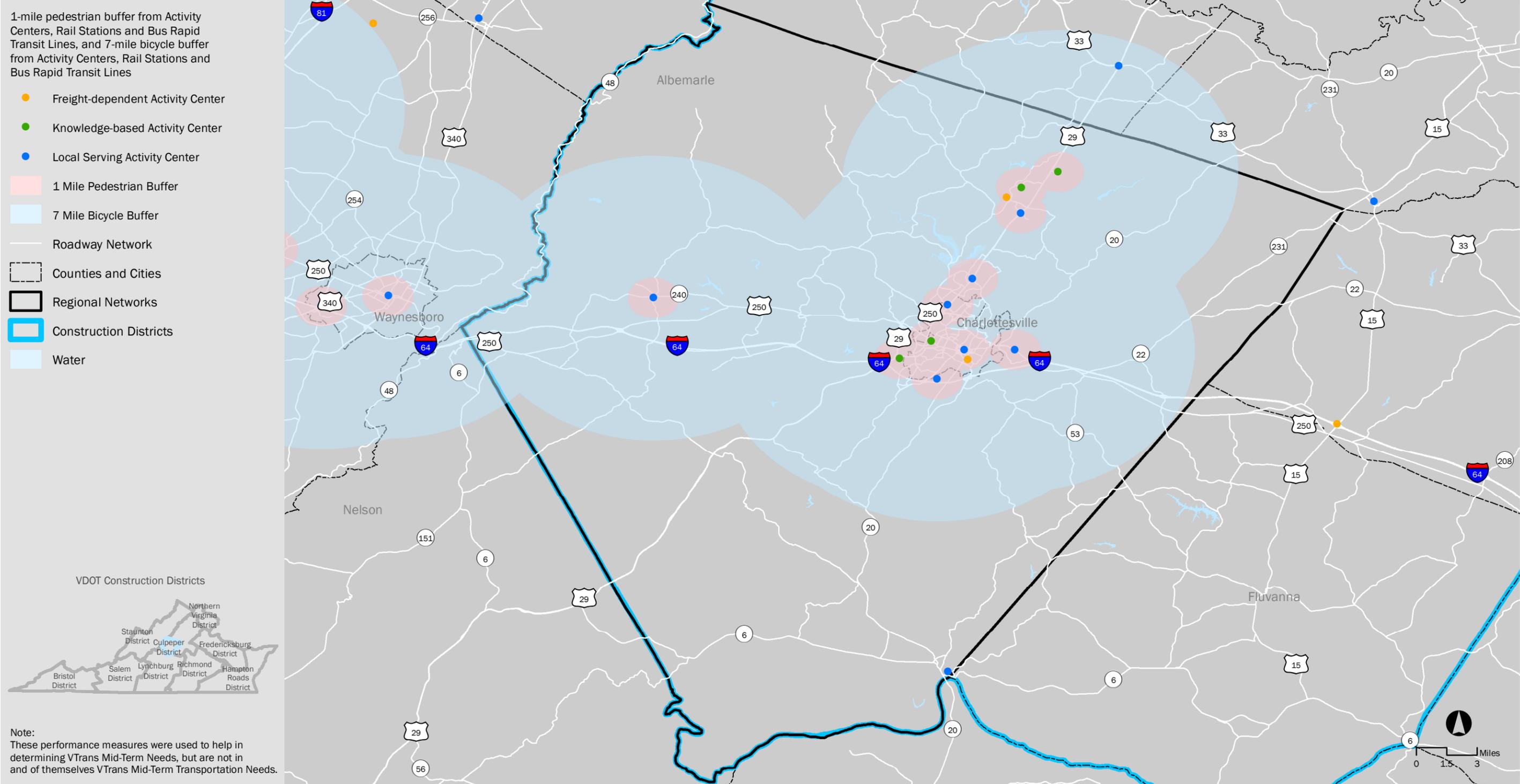
Map 7A: Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers (Culpeper District)

This performance measure identifies knowledge-based and local-serving Activity Centers where bicycle and/or pedestrian access is needed.



Map 7B: Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers (Charlottesville)

This performance measure identifies knowledge-based and local-serving Activity Centers where bicycle and/or pedestrian access is needed.





Goal B: Transit Access Needs for Equity Emphasis Areas

What it tells us: Areas where transit access is of high importance but is unavailable

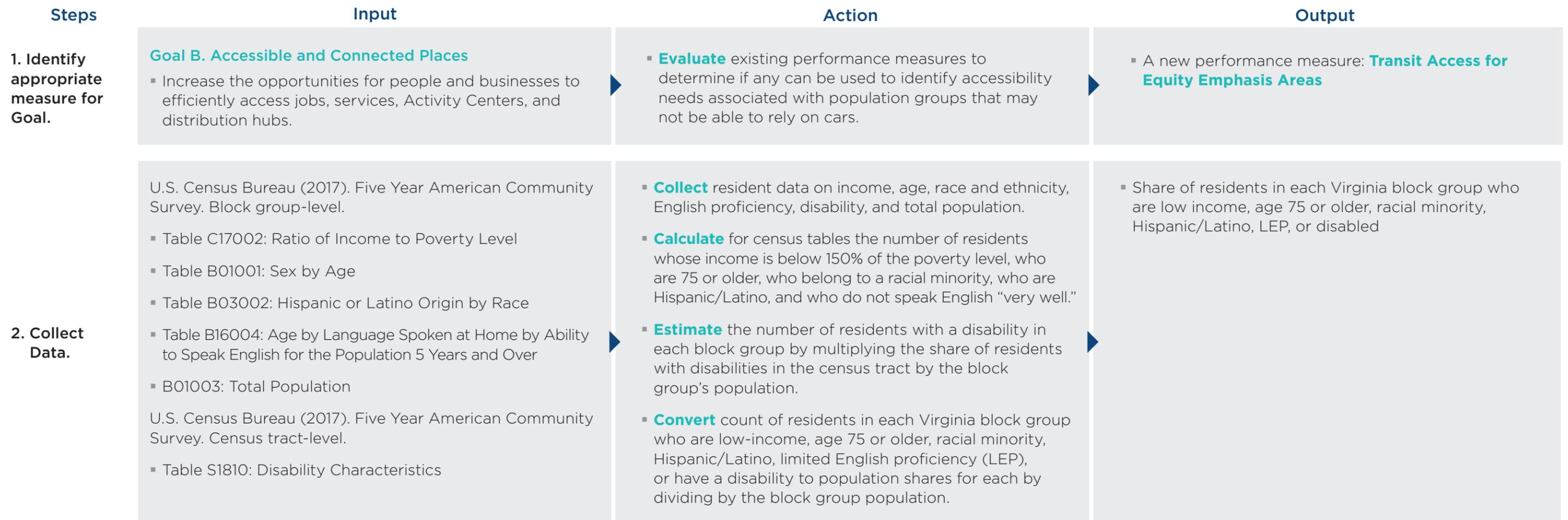
What it measures: Block groups that are Equity Emphasis Areas (EEAs), are currently underserved by transit, and are densely populated enough to likely sustain new fixed-route transit service

Where it applies: All block groups in Virginia

Time periods: Demographic data from 2017 and transit data from 2019 or earlier

Unit of Analysis for Performance Measures: Census block group

Unit of Reporting for Mid-term Needs: Census block group and roadway segment





Goal B: Transit Access Needs for Equity Emphasis Areas *(continued)*

Steps	Input	Action	Output
2. Collect Data.	U.S. Census Bureau (2017). <ul style="list-style-type: none"> ▪ Cartographic Boundary Files – Shapefile. Virginia block groups (500k). Available at https://www.census.gov/geographies/mapping-files/time-series/geo/cartographic-boundary-file.2017.html 	<ul style="list-style-type: none"> ▪ Join block group population and shares of residents in each category to the block group shapefile. 	<ul style="list-style-type: none"> ▪ Block group shapefile with shares of residents in each category and total population
	Shapefile of regional network (RN) boundaries	<ul style="list-style-type: none"> ▪ None 	<ul style="list-style-type: none"> ▪ Shapefile of RNs
	Shapefile of all transit stops in Virginia provided by Virginia Department of Rail and Public Transportation (DRPT). In May 2019, this was updated with newer transit stop data from the following sources. <ul style="list-style-type: none"> ▪ Fairfax Connector. Accessed May 30, 2019. Available at https://www.fairfaxcounty.gov/connector/bustracker/data. ▪ Washington Metropolitan Area Transit Authority (WMATA). Accessed May 30, 2019. Available at https://www.wmata.com/about/developers/WMATA-Developer-License-Agreement.cfm ▪ Hampton Roads Transit (HRT). Updated May 10, 2019. Available at http://transitfeeds.com/p/hampton-roads-transit/358?p=1 ▪ DASH. Updated April 29, 2019. Available at https://transitfeeds.com/p/alexandria-transit-company/423 ▪ Greater Richmond Transit Company (GRTC). Updated May 30, 2019. Available at http://ridegrtc.com/gtfs-files-login. 	<ul style="list-style-type: none"> ▪ Convert GTFS data into stops in shapefile format. Replace stops for these agencies in the transit stop dataset provided by DRPT with these updated stop locations. 	<ul style="list-style-type: none"> ▪ Shapefile with all transit stops in Virginia



Goal B: Transit Access Needs for Equity Emphasis Areas *(continued)*

Steps	Input	Action	Output
3. Calculate measures.	<ul style="list-style-type: none"> ▪ Shapefile of RN boundaries (output of step 2) ▪ Block group shapefile with resident data (output of step 2) 	<p>Equity Emphasis Area:</p> <ul style="list-style-type: none"> ▪ Identify the centroid of each block group and intersect the centroid with the RN shapefile. For each RN and each category (i.e., low-income, age 75 or older, racial minority, Hispanic/Latino, LEP, or disabled), calculate the mean concentration across the block groups. (This is the regional average concentration.) ▪ Identify for each block group the RN that contains its centroid or the nearest RN if the block group is outside an RN. ▪ Divide the block group's concentration for each resident category by the regional concentration, to calculate the ratio of concentration (ROC). ▪ Sum all six ROCs into an index, converting all ROCs above 3 to 3, low-income ROCs below 1 to 0, and ROCs for the other categories below 1.5 to 0. 	<ul style="list-style-type: none"> ▪ Table with ratios of concentration and index for each block group
	<ul style="list-style-type: none"> ▪ Block group shapefile with population (output of step 2) ▪ Transit stop shapefile (output of step 2) ▪ RN shapefile (output of step 2) 	<p>Transit Viability:</p> <ul style="list-style-type: none"> ▪ Calculate block groups' population density by dividing population by the block group area. ▪ Identify each block group's centroid and add a 1/4-mile buffer to the transit stop shapefile. ▪ Intersect the centroids with the transit stops buffer ▪ Intersect the result with the RN shapefile. 	<ul style="list-style-type: none"> ▪ Intersected block groups in each RN



Goal B: Transit Access Needs for Equity Emphasis Areas *(continued)*

Steps	Input	Action	Output
4. Consider stakeholder input.	The term “disadvantaged” does not accurately convey the measure results.	<ul style="list-style-type: none"> ▪ Change measure name from “Disadvantaged Population Beyond 1/4 Mile Access to Transit” to “Transit Access for Equity Emphasis Areas.” 	<ul style="list-style-type: none"> ▪ Revised definition of measure
	Use of block group centroid to identify transit underserved block groups does not accurately capture transit access for irregular shaped block groups.	<ul style="list-style-type: none"> ▪ Change method for identifying transit-underserved block groups so that at least half of the block group has to be outside the 1/4-mile radius of a transit stop. 	
	Recommendation to: <ul style="list-style-type: none"> ▪ Include racial and ethnic minority, and LEP populations ▪ Review the Metropolitan Washington Council of Governments (MWCOG) method for identifying EEAs 	<ul style="list-style-type: none"> ▪ Change method to include racial and ethnic minority and LEP populations. <ul style="list-style-type: none"> ○ It is now more aligned with MWCOG’s method. 	
	Recommendation to include relative population concentration, not just the presence of one criterion. <ul style="list-style-type: none"> ▪ Recommendation to require that at least one of the two following groups be present in concentrations at least as high as the regional average: <ul style="list-style-type: none"> ▪ Number of low-income populations or ▪ Population with disabilities. 	<ul style="list-style-type: none"> ▪ Change method to an index that takes into account the concentration of populations for each EEA component compared to the RN as a whole. <ul style="list-style-type: none"> ○ This ratio of the block group population share to the RN population share is the ratio of concentration (ROC). 	
5. Identify thresholds.	Table with ROCs and index for each block group (output of step 3)	Equity Emphasis Area: <ul style="list-style-type: none"> ▪ Flag a block group as an EEA if the index is 2 or greater, and either the ROC for low-income or disability is at least 1. 	<ul style="list-style-type: none"> ▪ List of block groups that are EEAs
	Intersected block groups in each RN (output of step 3)	Transit Viability: <ul style="list-style-type: none"> ▪ Compare to each block group population density. <ul style="list-style-type: none"> ○ The threshold for viability for fixed-route transit in each RN is the 10th-percentile population density of the intersected block groups. ▪ Flag block groups as transit viable if population density is at least as high as the relevant RN threshold. 	<ul style="list-style-type: none"> ▪ List of block groups that are viable for fixed-route transit



Goal B: Transit Access Needs for Equity Emphasis Areas (continued)

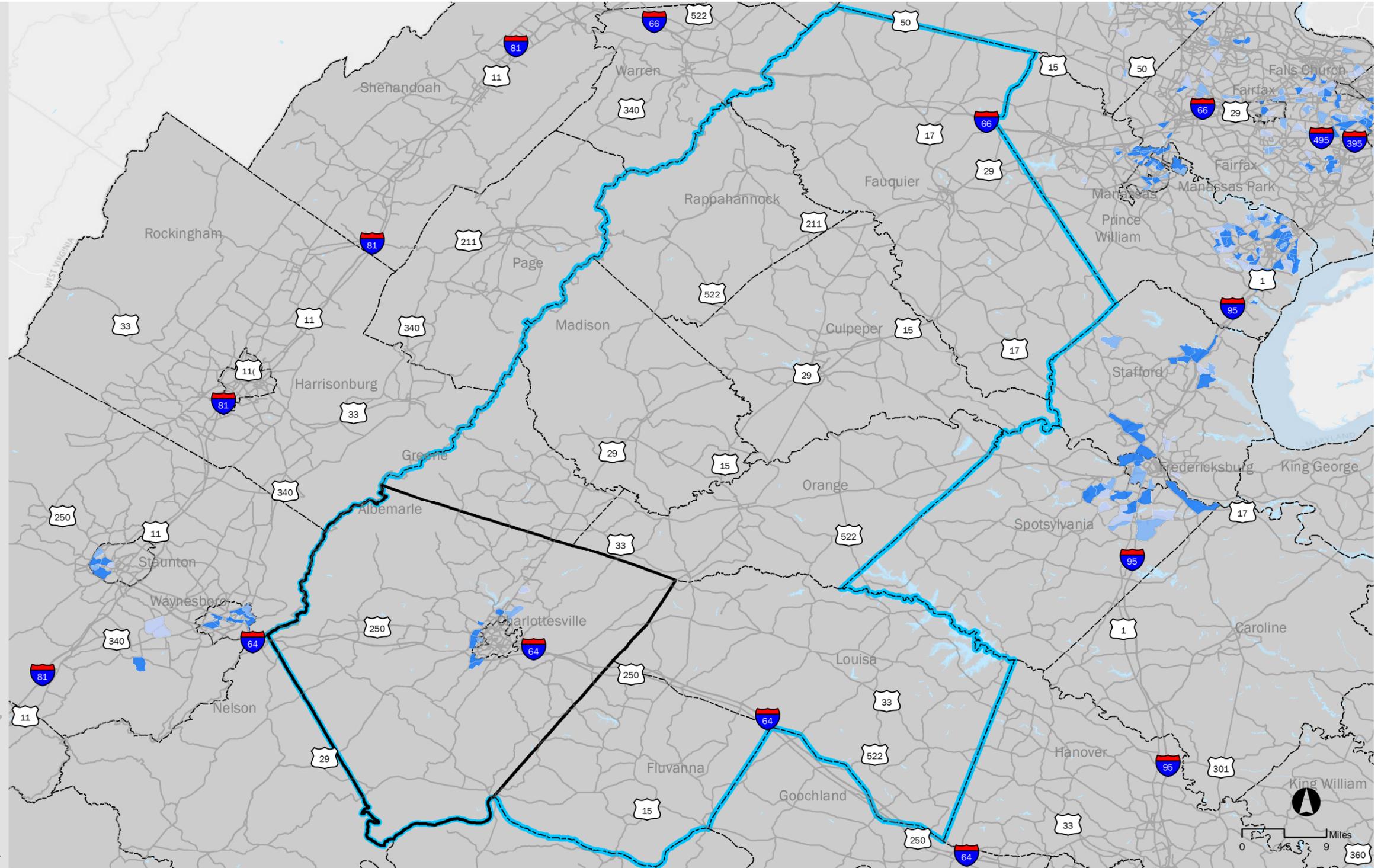
Steps	Input	Action	Output
5. Identify thresholds.	<ul style="list-style-type: none"> ▪ Block group shapefile (output of step 2) ▪ Transit stop shapefile (output of step 2) ▪ Shapefile of RNs (output of step 2) 	<p>Underserved by Transit:</p> <ul style="list-style-type: none"> ▪ Calculate block groups' area. ▪ Add a 1/4-mile buffer to the transit stop shapefile. ▪ Intersect with the block group shapefile. ▪ Recalculate block groups' area post intersection. <ul style="list-style-type: none"> ○ If the post-intersection area is at least half of the pre-intersection area, flag the block group as being heavily served by transit. ○ The remaining block groups are considered underserved by transit. 	<ul style="list-style-type: none"> ▪ List of block groups that are underserved by transit
6. Identify Needs.	<p>List of block groups that are EEAs, that are viable for fixed-route transit, and that are underserved by transit</p>	<ul style="list-style-type: none"> ▪ Designate Needs in block groups that are EEAs, are transit-viable, and are underserved by transit. ▪ Intersect block group-level Needs to corresponding roadway segments. 	<ul style="list-style-type: none"> ▪ Geospatial database with block groups with transit needs related to Equity Emphasis Areas, and a geospatial database with the corresponding roadway segments having an Equity Emphasis Area Need

Map 8A: Transit Access for Equity Emphasis Areas (Culpeper District)

This performance measure identifies Equity Emphasis Areas (areas that score high on an index that considers income, age, disability status, racial minority status, Hispanic or Latino origin and limited English proficiency) where transit, bicycle and/or pedestrian access is needed.

Equity Emphasis Areas with no or low fixed-route transit service that are transit-viable based on population density and existing regional transit service patterns. The index for designating Equity Emphasis Areas considers resident characteristics along income, age, disability, race, ethnicity, and English proficiency. A higher index number implies a greater concentration of the identified population groups.
 Source: 2017 ACS 5-year estimates, based on Census Block Groups.

- 2.0 - 4.0
- 4.1 - 6.0
- Greater than 6.0
- Roadway Network
- Counties and Cities
- Regional Networks
- Construction Districts
- Water



Note:
 These performance measures were used to help in determining VTrans Mid-Term Needs, but are not in and of themselves VTrans Mid-Term Transportation Needs.

Goal B: Methodology for Identification of Needs to Access Industrial Economic Development Areas (IEDA)

Performance Measure: Location and Readiness Status of Industrial and Economic Development Areas

What it tells us: Location of development sites qualifying for designation as an Industrial Economic Development Area (IEDA) Need to connect or improve access to and from the nearest Corridor of Statewide Significance

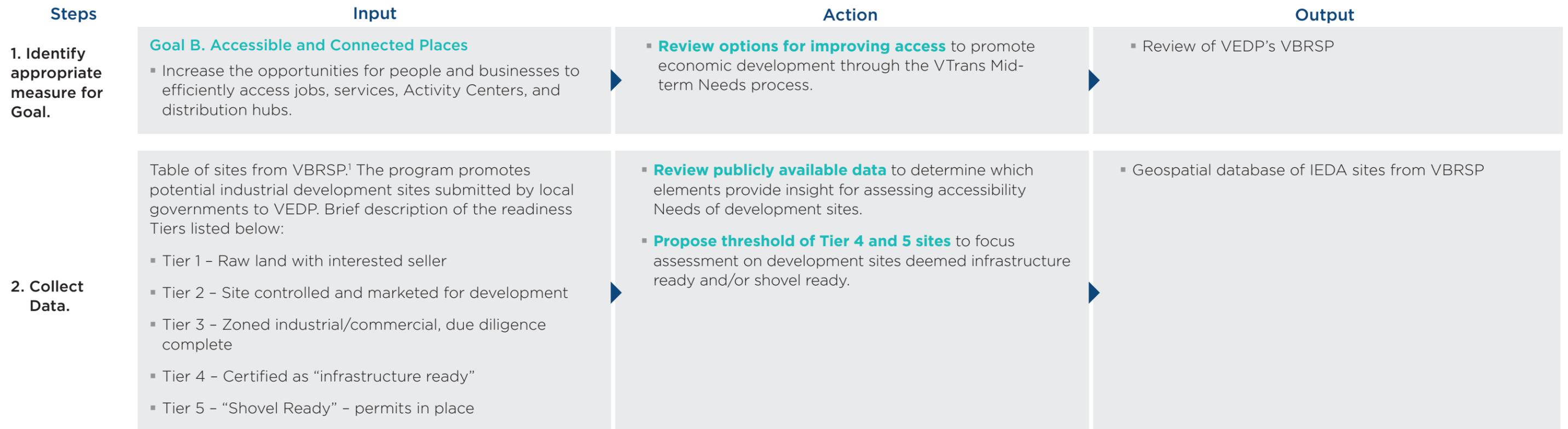
What it measures: Location and readiness status of potential economic development sites in VEDP’s Business Ready Site Program (VBRSP)

Where it applies: Statewide, subset of VBSRP with readiness status Tier 3 or above

Time periods: The assessment of IEDA Needs is based on Virginia Economic Development Partnership (VEDP) data as of May 2019. The IEDA Needs are subject to change as VEDP continually assesses site readiness and tiering. If a site is later designated as Tier 3 or above it will be considered as VTrans Need.

Unit of Analysis for Performance Measures: Development site

Unit of Reporting for Mid-term Needs: Development site



¹ <https://www.vedp.org/vbrsp>

 **Goal B: Methodology for Identification of Needs to Access Industrial Economic Development Areas (IEDA) (continued)**

Steps	Input	Action	Output
3. Consider stakeholder input.	<ul style="list-style-type: none"> ▪ Recommendation to include Needs associated with sites Tier 3 and higher (add a lower tier to make more sites eligible) ▪ Recommendation to exclude office-only sites that were included based on data provided by VEDP 	<ul style="list-style-type: none"> ▪ Proposed threshold lowered to include Tier 3 sites. ▪ Worked with the VEDP to exclude office-only sites. 	<ul style="list-style-type: none"> ▪ Revised geospatial database IEDA sites from VBRSP
4. Identify threshold and Need.	<p>Output from steps 2 and 3</p>	<ul style="list-style-type: none"> ▪ Finalize definition of IEDA access Needs using VBRSP Tiers 3-5: <ul style="list-style-type: none"> o Tier 3 - Zoned industrial/commercial, due diligence complete o Tier 4 - Certified as “infrastructure ready” o Tier 5 - “Shovel Ready” (permits in place) 	<ul style="list-style-type: none"> ▪ Geospatial database with sites assigned an IEDA Need to connect or improve access to and from the nearest CoSS for sites that have achieved readiness status of Tier 3 or higher in VEDP’s VBRSP



Goal B: Methodology for Identification of Needs within Designated Urban Development Areas

Performance Measure: None, based on an online survey of sponsoring jurisdictions

Time periods: Up to date, as of November 2019

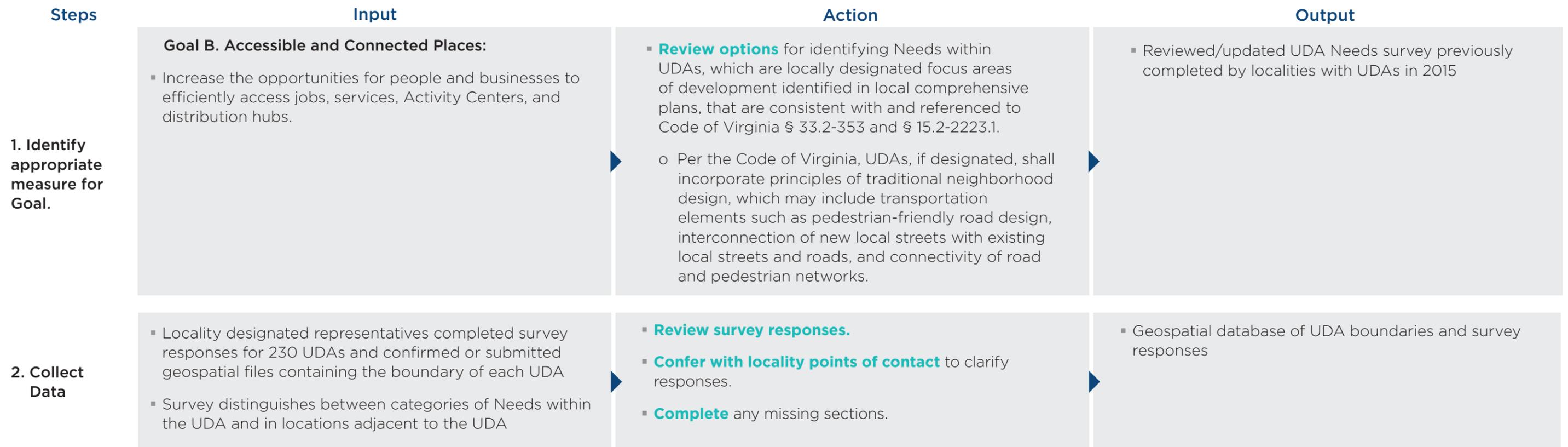
What it tells us: Types and levels of Urban Development Area (UDA) Needs and those of adjacent areas, and location of UDAs and adjacent areas

Unit of Analysis for Performance Measures: UDA boundary

What it measures: Need for transportation improvements identified by local jurisdiction

Unit of Reporting for Mid-term Needs: Roadway segments within UDA boundary for Needs “within UDA” and roadway segments within 1/4 mile of UDA boundary for Needs “adjacent to the UDA”

Where it applies: Statewide for locally designated UDAs that are consistent with and referenced to Code of Virginia § 33.2-353 and § 15.2-2223.1



 **Goal B: Methodology for Identification of Needs within Designated Urban Development Areas** *(continued)*

Steps	Input	Action	Output
3. Calculate measure.	<ul style="list-style-type: none"> ▪ Geospatial database of localities' UDA survey responses 	<ul style="list-style-type: none"> ▪ Code survey responses of “high,” “moderate,” “low,” and “not applicable” as submitted by locality designated respondent, for survey question: “Please assess the types of transportation improvements that are most needed to promote the development of the UDA.” 	<ul style="list-style-type: none"> ▪ Geospatial database contains each Need category and local prioritization from survey
4. Consider stakeholder input.	<ul style="list-style-type: none"> ▪ Requests to extend survey completion date ▪ Requests to edit UDA boundaries, and other shapefile edits to allow for polygon-based selection of roadway segments 	<ul style="list-style-type: none"> ▪ Extend survey completion deadline to 11/8/2019. ▪ Review, and if necessary, revise boundaries of shapes in geospatial files to ensure internal roads are included. 	<ul style="list-style-type: none"> ▪ Revised geospatial database of UDA boundaries and survey responses; additional responses received up to extended deadline
5. Compare with Thresholds and Identify Needs.	<p>Output from steps 2-4</p>	<ul style="list-style-type: none"> ▪ Review options to convert survey responses to Needs. ▪ Convert “high,” “moderate,” and “low” survey responses to UDA Needs for each category. ▪ Distinguish between Needs within UDA and adjacent to UDA. ▪ Exclude limited access facility roads from UDA Needs designation. 	<ul style="list-style-type: none"> ▪ Geospatial database with roadway segments assigned UDA Needs by category



Goal C: Methodology for Identification of Safety Improvement Needs

Performance Measure: Potential for Safety Improvement

Time periods: Calendar years 2014-2018

What it tells us: Roadway segments and intersections where crash frequency and severity are higher than expected compared to similar locations

Unit of Analysis for Performance Measures: Roadway segment and intersection

What it measures: Potential for safety improvement (PSI), PSI history, crash severity history and crash rank measure crash risk and need for improvement

Unit of Reporting for Mid-Term Needs: Roadway segment and intersection

Where it applies: All state-maintained roadways, including intersections

Steps	Input	Action	Output
1. Identify appropriate measure for Goal.	<p>Goal C. Safety for all Users:</p> <ul style="list-style-type: none"> Provide a safer and more secure transportation system for passengers and goods on all travel modes. 	<ul style="list-style-type: none"> Consult with VDOT Highway Safety Improvement Program (HSIP) staff. Review HSIP procedures and procedures for considering safety in SMART SCALE. Confirm that potential safety measure would address VTrans Goal C and objectives. Confirm initial approach would consider crash frequency and severity. 	<ul style="list-style-type: none"> Measure based on PSI and crash data over 5-year period (see Input, Step 2 below)
2. Collect Data.	<ul style="list-style-type: none"> All crashes in Virginia between 2014-2018 by location and severity, including intersection and interchange-related crashes and segment-level crashes between intersections or interchanges on limited access facilities.¹ PSI analysis provided by VDOT Traffic Engineering Division. This analysis identifies and ranks locations where crash frequency is higher than expected for the traffic volume using Highway Safety Manual methods. The tables have a set of highway segments and intersections/interchanges with total crash PSI and injury crash PSI values. Also included is information such as VDOT PSI rankings by Construction District, and the number of years the segment or intersection has been on the PSI list. 	<ul style="list-style-type: none"> Merge 2014-2018 crash database with PSI table. (With this information, the number of accidents by severity can be calculated and related to the PSI values by location.) Create two sets of tables: One for accidents within 250 feet of an intersection and one for all other crashes that occur along segments between interchanges/intersections. 	<ul style="list-style-type: none"> Merged data sets (intersections, segments) for use in analyzing alternative tiers and thresholds and for reviewing the resulting number and locations identified

¹ Crash data available from <https://services.arcgis.com/p5v98VHDX9Atv3I7/arcgis/rest/services/VirginiaCrashes/FeatureServer>



Goal C: Methodology for Identification of Safety Improvement Needs *(continued)*

Steps	Input	Action	Output
2. Collect Data.	<ul style="list-style-type: none"> Merged roadway inventory (Linear Reference System or LRS³), traffic count and crash database records are used to determine the PSI for each site and site subtypes. Data tables are created categorizing 16 segment site subtypes accounting for functional class, number of lanes and for 12 intersection site sub-types accounting for traffic control and number of approaches. Each site may be related back to the crash data for further filtering, safety assessment and diagnosis. The LRS route and intersection identifiers provide a linking table for segments that provides a means to match records in the PSI analysis to the crash database for more detailed analysis. 	<ul style="list-style-type: none"> Merge 2014-2018 crash database with PSI table. (With this information, the number of accidents by severity can be calculated and related to the PSI values by location.) Create two sets of tables: One for accidents within 250 feet of an intersection and one for all other crashes that occur along segments between interchanges/intersections. 	<ul style="list-style-type: none"> Merged data sets (intersections, segments) for use in analyzing alternative tiers and thresholds and for reviewing the resulting number and locations identified
3. Calculate Measures.	<p>Output from steps 1 and 2</p>	<ul style="list-style-type: none"> Apply alternative tests based on: <ul style="list-style-type: none"> Total crash aggregate five-year PSI Fatal and injury crash aggregate five-year PSI Number of years PSI analysis flags location for crashes Number of years PSI analysis flags location for fatal and injury crashes Number of fatal and injury crashes occurred at the location during the past five years Number of crashes of any severity occurred Consider alternative methods of accounting for the accident ranking of each location. Use district-specific PSI rankings (intersections) and mileage (segments) to identify and extract critical locations, ensuring these locations are designated as Needs (based on combination of the PSI and Fatal/Injury Crash Frequency). 	<ul style="list-style-type: none"> Number of crashes and records exceeding criteria by district Intersection and segment PSI Needs based on ranking and other factors, based on step 2

³ LRS, in this context, is a means of identifying features along a highway route (e.g., VA 288) by their milepost, or distance from the starting point of the route. For more information, see <https://www.arcgis.com/apps/Cascade/index.html?appid=dfd5ea4d540f485f9ab2a8fe7697c256>

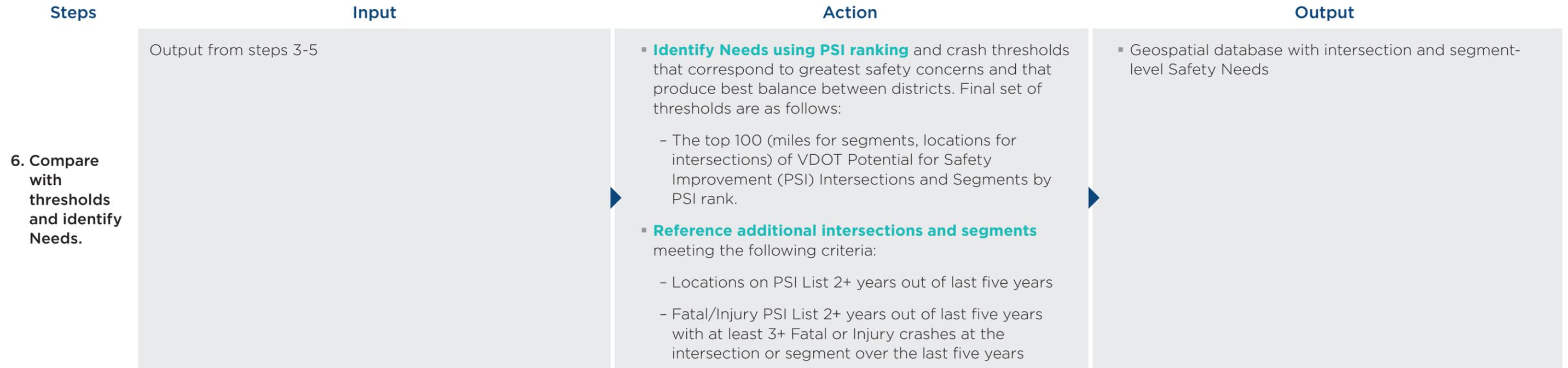


Goal C: Methodology for Identification of Safety Improvement Needs *(continued)*

Steps	Input	Action	Output
4. Consider stakeholder input.	<ul style="list-style-type: none"> ▪ VTrans Safety Needs should include consideration for non-motorized needs that may not get highlighted based on PSI-only (crash-based) method. ▪ Do not limit the PSI list to the top 100 locations in each district. ▪ Consider serious and severe injury crashes similar to fatal crashes due to impact on quality of life. ▪ Identify clusters of fatal and injury crashes 	<ul style="list-style-type: none"> ▪ Add location of Virginia’s 2018 Pedestrian Action Plan (PSAP) priority corridors as a separate category of Needs to complement the PSI-based Safety Needs (described separately in <i>Pedestrian Safety</i>) ▪ Review combinations of PSI ranking factors and threshold factors addressing frequency and severity of crashes. ▪ Use safety models and methods for determining safety Needs to capture all fatal and injury crashes clustered within 250 feet of intersections and along segments. 	<ul style="list-style-type: none"> ▪ Reconstructed database to accommodate additional analysis of potential thresholds based on PSI and other factors. <ul style="list-style-type: none"> - Consideration of options for Pedestrian Safety Needs (described separately in <i>Pedestrian Safety</i>)
5. Identify performance thresholds.	<ul style="list-style-type: none"> ▪ Tests of alternative thresholds and combinations of factors based on stakeholder input 	<ul style="list-style-type: none"> ▪ Test various combinations. <ul style="list-style-type: none"> - The team used 17 combinations of thresholds based on the measures considered in Step 3, to determine the effect on the quantity and distribution of Needs across Construction Districts. - This review was completed both for segments and intersections. 	<ul style="list-style-type: none"> • Roadway segment and intersection locations flagged as having safety needs at various thresholds in geospatial database



Goal C: Methodology for Identification of Safety Improvement Needs *(continued)*





Goal C: Methodology for Identification of Pedestrian Safety Improvement Needs

Performance Measure: None, utilization of roadway segments included in VDOT's Pedestrian Safety Action Plan (PSAP)

What it tells us: Location of corridors with higher than normal risk of a pedestrian-involved accident

What it measures: Higher-risk areas for pedestrians. VDOT's Pedestrian Safety Action Plan (PSAP) conducted a predictive systemic analysis that considered accident histories on major thoroughfares throughout the state on a comparative basis to identify locations with elevated risk.

Where it applies: VDOT-maintained roads statewide

Time periods: Based on calendar year 2012-2016 crash data

Unit of Analysis for Performance Measures: Roadway segment

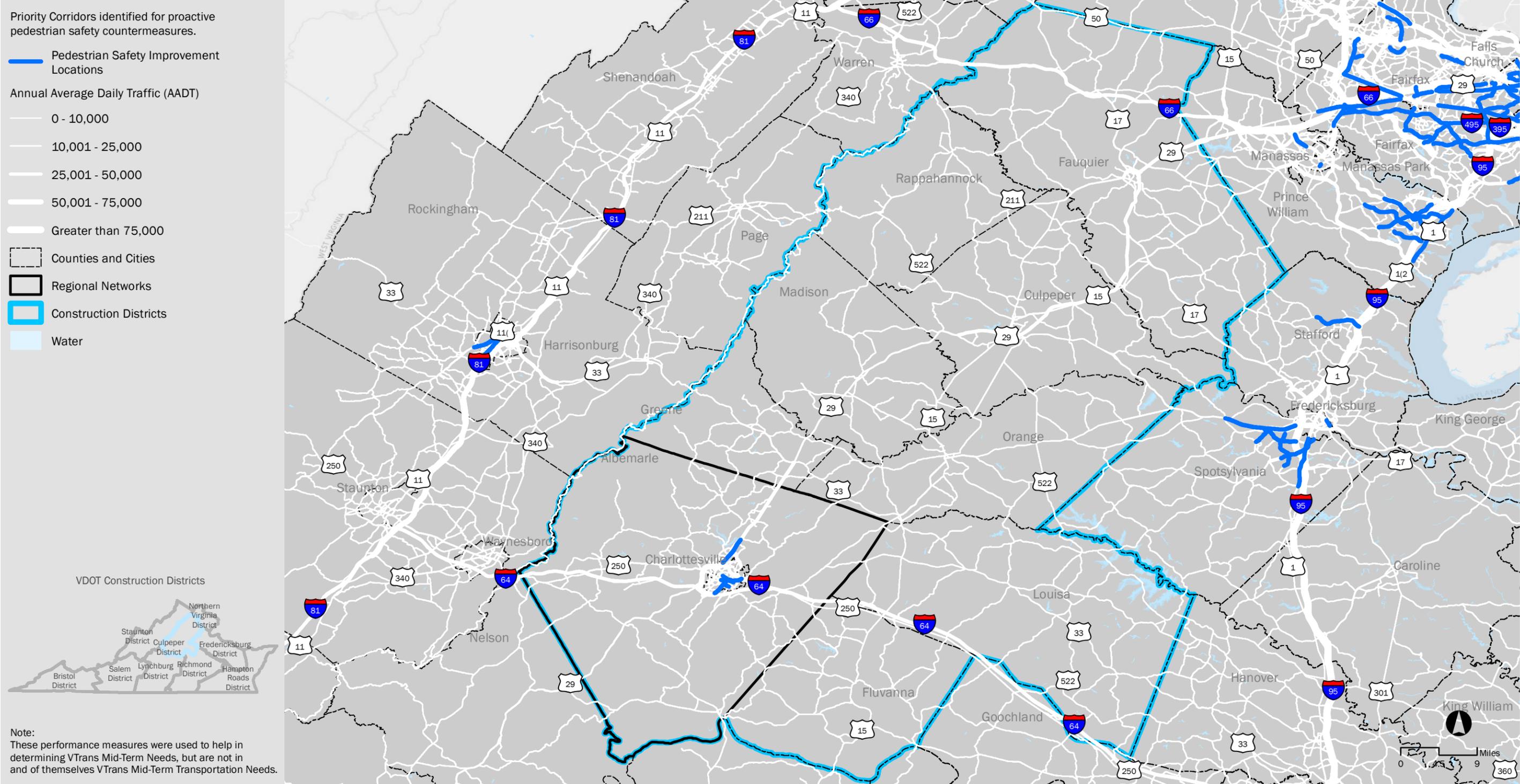
Unit of Reporting for Mid-Term Needs: Roadway segment

Steps	Input	Action	Output
1. Identify appropriate measure for Goal.	<p>Goal C. Safety for all Users:</p> <ul style="list-style-type: none"> Provide a safer and more secure transportation system for passengers and goods on all travel modes. 	<ul style="list-style-type: none"> Consult with VDOT Highway Safety Improvement Program staff. Review VDOT's PSAP and procedures for considering safety in SMART SCALE. Confirm that using PSAP designations would address VTrans goal area and objectives. 	<ul style="list-style-type: none"> PSAP report and priority corridors map
2. Consider stakeholder input.	<p>Include consideration for non-motorized needs that may not get highlighted based on Potential for Safety Improvement (PSI) method.</p>	<ul style="list-style-type: none"> Add location of PSAP corridors as a separate category of Needs to complement the PSI-based Safety Needs. 	<ul style="list-style-type: none"> PSAP report and priority corridors map
3. Collect Data.	<ul style="list-style-type: none"> Geospatial database developed for May 2018 PSAP¹, which identified corridors with a history of pedestrian safety crashes and assessed pedestrian crash risk <ul style="list-style-type: none"> AADT, posted speed limit, number of lanes, presence of a median, crash history, the population of the surrounding area and other factors in assessing pedestrian safety risk 	<ul style="list-style-type: none"> Integrate PSAP database with other needs layers. 	<ul style="list-style-type: none"> Geospatial database and locations of corridors with elevated risk of pedestrian-involved crashes and Need for Pedestrian Safety Improvement
4. Compare with thresholds and identify Needs.	<p>Output from steps 2 and 3</p>	<ul style="list-style-type: none"> Identify all corridors included in PSAP as Pedestrian Safety Improvement Need. 	<ul style="list-style-type: none"> Geospatial database and locations of corridors with elevated risk of pedestrian-involved crashes and Need for Pedestrian Safety Improvement

¹ Accessed at <http://vdot.maps.arcgis.com/apps/View/index.html?appid=ae073e60495948deafc34d08812dfb20>

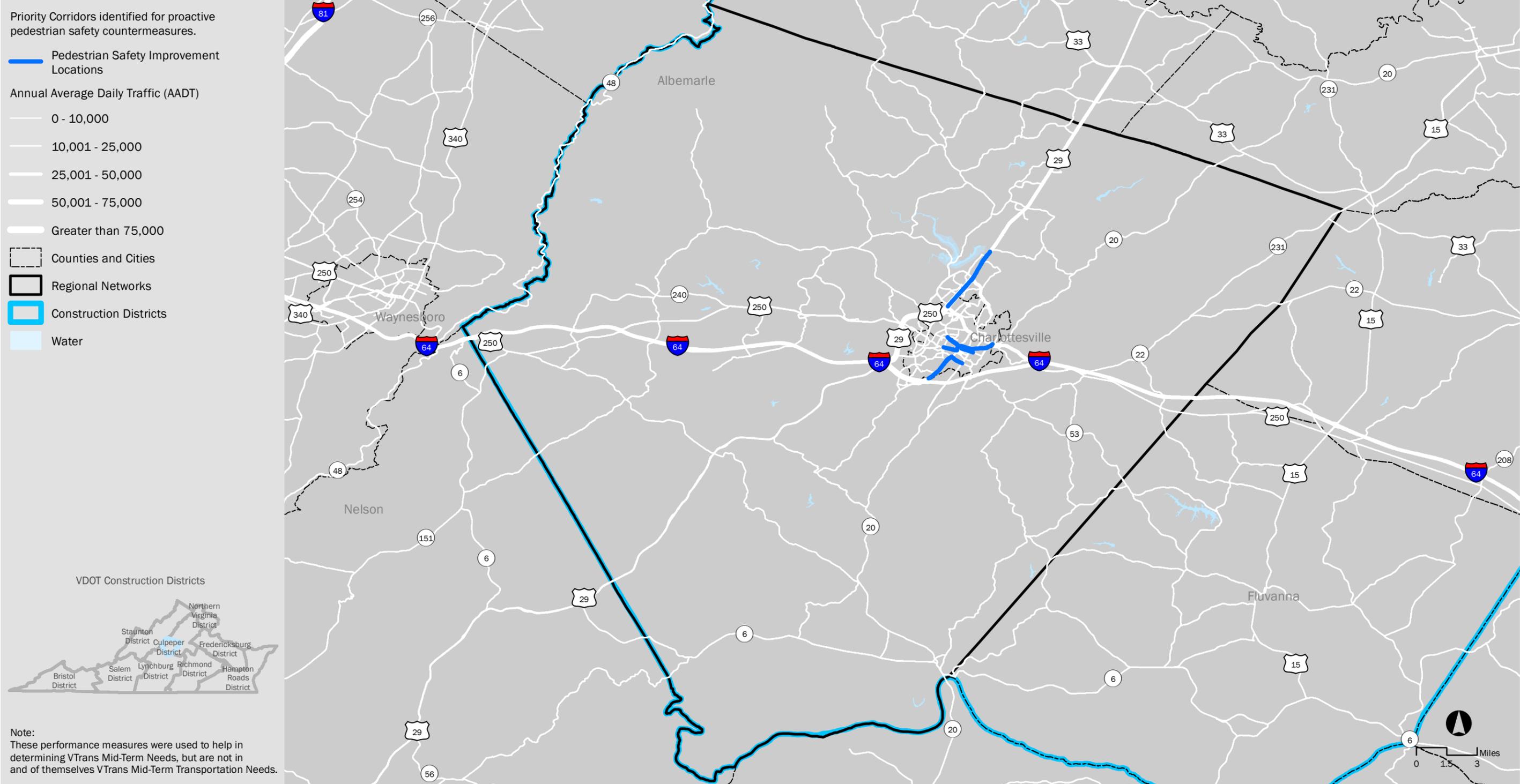
Map 9A: Pedestrian Safety Improvement Locations (Culpeper District)

This performance measure identifies roadway segments and intersections with pedestrian safety needs.



Map 9B: Pedestrian Safety Improvement Locations (Charlottesville)

This performance measure identifies roadway segments and intersections with pedestrian safety needs.





Goal D: Methodology for Identification of Capacity Preservation Needs

Performance Measure: None, utilization of VDOT's Arterial Preservation Network

What it tells us: Location of roads with a Need to preserve and enhance capacity

What it measures: It is an assignment of a Capacity Preservation Need based on inclusion in VDOT's Arterial Preservation Network

Where it applies: VDOT's Arterial Preservation Network is a subset of the state-maintained portion of the National Highway System and some additional highways that facilitate connectivity. The Capacity Preservation measure applies to Regional Networks and to CoSS outside of Regional Networks.

Time periods: The assessment of Capacity Preservation Needs is based on VDOT's Arterial Preservation Network designation as of September 2019.

Unit of Analysis for Performance Measures: Roadway segment

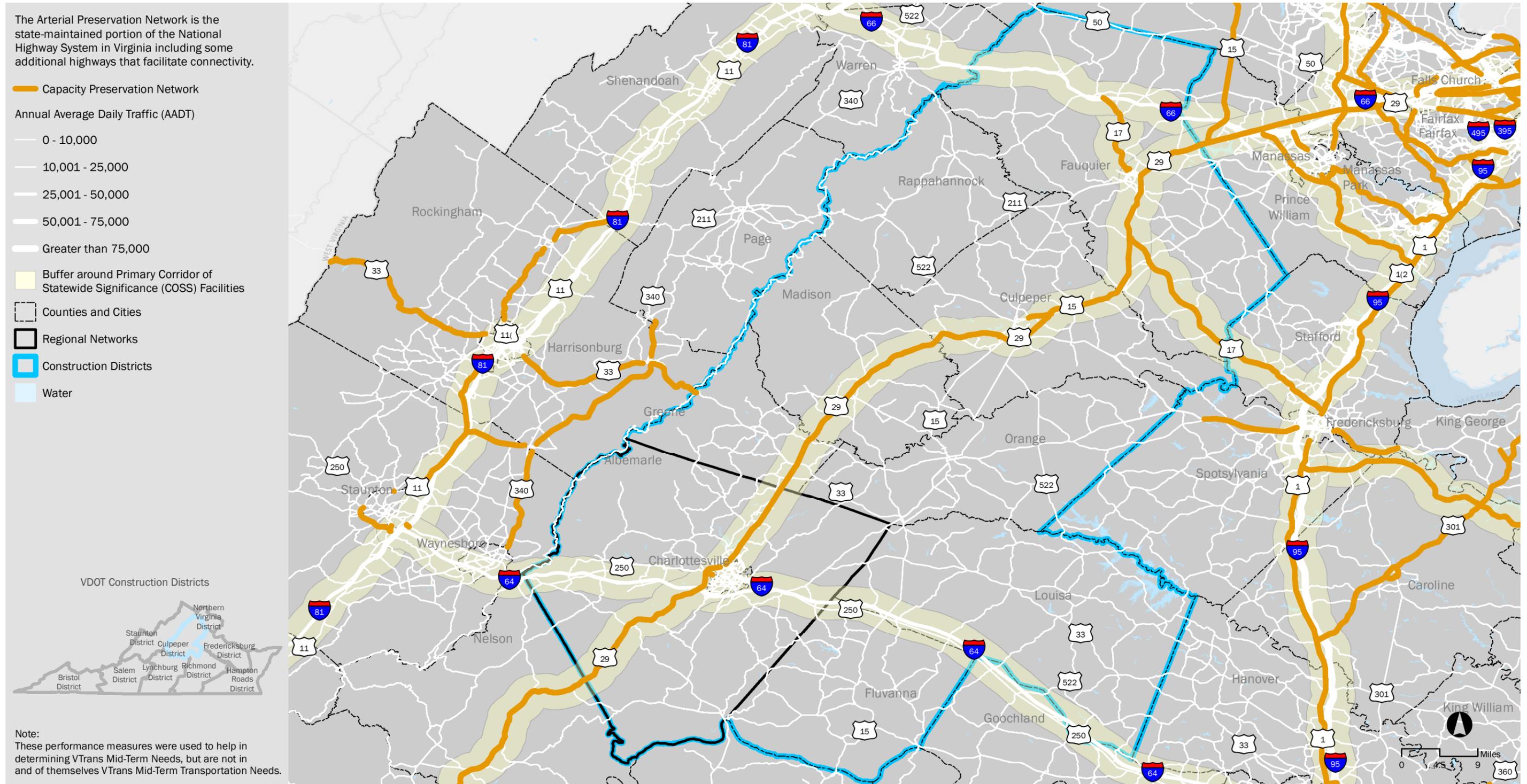
Unit of Reporting for Mid-Term Needs: Roadway segment

Steps	Input	Action	Output
1. Identify appropriate measure for Goal.	<p>Goal D. Proactive System Management:</p> <ul style="list-style-type: none"> Maintain the transportation system in good condition and leverage technology to optimize existing and new infrastructure. 	<ul style="list-style-type: none"> Review options for incorporating corridor management needs into the VTrans process. 	<ul style="list-style-type: none"> Review of VDOT's Arterial Preservation Program¹, whose purpose is to maintain mobility on high-demand corridors by employing strategies such as managing access, implementing limited capacity expansions and using traffic management technologies to improve safety and smooth vehicular flow along corridors.
2. Consider stakeholder input.	Proactive system management related Needs	<ul style="list-style-type: none"> Address System Management Goal by incorporating capacity preservation, using VDOT's Arterial Preservation Network designations. 	<ul style="list-style-type: none"> Review of VDOT's Arterial Preservation Program¹, whose purpose is to maintain mobility on high-demand corridors by employing strategies such as managing access, implementing limited capacity expansions and using traffic management technologies to improve safety and smooth vehicular flow along corridors.
3. Collect Data.	Geospatial database of VDOT's Arterial Preservation Network	<ul style="list-style-type: none"> Identify VDOT's Arterial Preservation Program roadways. Identify which VTrans travel markets are appropriate for designation as Capacity Preservation Needs. 	<ul style="list-style-type: none"> Location within Regional Network or on CoSS outside of Regional Networks as candidates for designation as a Capacity Preservation Need
4. Compare with thresholds and identify Needs.	Output from steps 2 and 3	<ul style="list-style-type: none"> Validate roadway designations and label roadways within Regional Network or on CoSS outside of Regional Networks for Needs. 	<ul style="list-style-type: none"> Geospatial database with roadways assigned a Capacity Preservation Need

¹ http://www.virginiadot.org/programs/vdot_arterial_preservation_program.asp

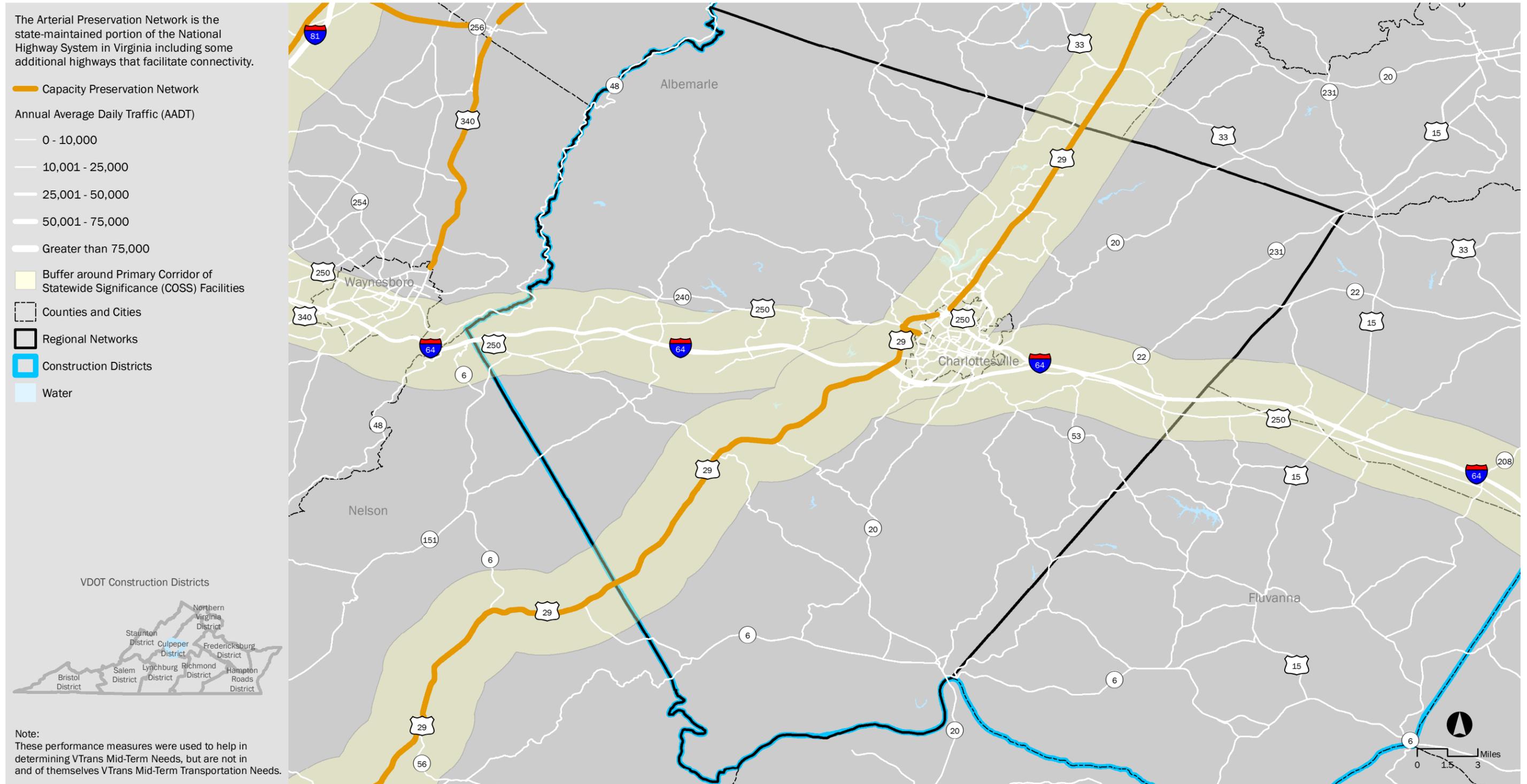
Map 10A: Capacity Preservation for COSS and Regional Networks (Culpeper District)

This map identifies locations where low-cost investments made now can minimize need for costly improvements later.



Map 10B: Capacity Preservation for COSS and Regional Networks (Charlottesville)

This map identifies locations where low-cost investments made now can minimize need for costly improvements later.





Goal E: Methodology for Identification of Transportation Demand Management Needs

Performance Measure:	None, based on location and facility type	Time periods:	Based on roadway location and facility types as of October 2019
What it tells us:	Locations where Transportation Demand Management (TDM) strategies can be beneficial	Unit of Analysis for Performance Measures:	Roadway segment
What it measures:	Transportation corridors with potential to reduce vehicles miles traveled (VMT)	Unit of Reporting for Mid-Term Needs:	Roadway segment
Where it applies:	CoSS and Metropolitan Planning Areas within Regional Networks		



¹ Shared Mobility as defined per *Taxonomy and Definitions for Terms Related to Shared Mobility and Enabling Technologies*, SAE International Publication J3163 issued September 2019

 Goal E: Methodology for Identification of Transportation Demand Management Needs *(continued)*

Steps	Input	Action	Output
4. Compare with thresholds and identify Needs.	Output from steps 2 and 3	<ul style="list-style-type: none"> ▪ Recognize that roadway type and location influence the appropriateness of particular TDM strategies. ▪ Validate roadway designations. ▪ Label the following roads as qualifying for designation as a TDM Need: <ul style="list-style-type: none"> - Limited Access facilities on CoSS: These roads have a Need whose solution may be new or expanded park and ride facilities, rail and public transportation services and passenger facilities, bicycle and pedestrian facilities where permitted, and expansion and coordination of commuter assistance programs services. - Non-Limited Access facilities on CoSS: These roads have a Need whose solution may be new or expanded park and ride facilities, rail and public transportation services and facilities, bicycle and pedestrian facilities, and expansion and coordination of commuter assistance programs services. - Limited Access facilities within Regional Networks: These roads have a Need whose solution may be new or expanded park and ride facilities, rail and public transportation services and facilities, bicycle and pedestrian facilities, and expansion and coordination of commuter assistance programs services. - Non-limited Access and non-local roads within Metropolitan Planning Organization Areas: These roads have a Need whose solution may be new or expanded public transportation services and facilities, bicycle and pedestrian facilities, expansion and coordination of commuter assistance programs, and Shared Mobility solutions. 	<ul style="list-style-type: none"> • Geospatial database with roadways assigned a TDM Need, according to the four designations of TDM Needs

APPENDIX A – CHANGES TO MID-TERM NEEDS MEASURES METHODOLOGY POST REGIONAL WORKSHOPS

ID	Measure	Method or Threshold Prior to Workshops	Comment Received	Source (Which Regional Workshop Comment Received)	Change to Measure following Workshops
1	Percent of Person-Miles Traveled in Excessively Congested Conditions (PECC)	Option for PECC Thresholds—60%, 75%, and 90% of Posted Speed Limited	Support for speed threshold of 75% of posted speed limited	Central Shenandoah	Draft VTrans Needs are based on speed threshold of 75% of posted speed limited.
2		Time period—weekday 6 am to 8 pm	Ensure that weekend travel is captured	Bristol, Fredericksburg, Hampton Roads, Richmond	Threshold is based on weighted average of weekday and weekend.
3		Time period—weekday 6 am to 8 pm	Ensure that the measure captures seasonality	Roanoke Valley, Hampton Roads, Bristol	The method takes into account reasonable variations. Develop future method to reflect large variations between seasonal and non-seasonal traffic and their impact on the need identification method.
4		Applied to Interstates and Select Limited Access Facilities (LAF)	Request to clarify criteria for selecting facilities as limited-access	Lynchburg, Northern Virginia, Charlottesville-Culpeper	Updated LAF list to include more segments (used a logic that allowed shorter segments of less than 10 miles if they connected to another LAF).
5	Travel Time Index (TTI)	TTI threshold of 1.5	TTI threshold of 1.5 is too high	New River Valley	TTI 1.5 or above for 1+ hours OR TTI 1.3 or above for 3+ hours.
6		Values were based on weekday average	Weekday average does not reflect peak period conditions	Richmond, Roanoke	(1) Modified period of analysis to 6 am to 8 pm. (2) Modified measure to reflect number of hours of congestion. The revised method reflects peak and non-peak conditions.
7		TTI numbers were based on weekday average	Weather-related incidents and spot issues are major contributors to unreliability	Bristol	Please see change made to ID #12 below.
8		Values were based on weekday average	Request to consider weekend travel	Roanoke	Threshold is based on weighted average of weekday and weekend.
9	Unreliable Delay (UD)	Cumulative number of hours that experience unreliable delay during weekday 6 am and 8 pm	The method does not capture peak hour or peak period delay	Northern Virginia, Winchester-Frederick	New measure, Level of Travel Time Reliability (LOTTR), reflects unreliable conditions for one or more hours. It allows the measure to capture peak-hour only traffic.
10		Time period—weekday 6 am to 8 pm	Ensure that weekend travel is captured	Fredericksburg	Threshold is based on weighted average of weekday and weekend.
11		Annual average was calculated for each hour	Consider the impacts of seasonal traffic patterns on reliability	Danville	We confirmed that the method takes into account reasonable variations. We will need more time to develop a method to reflect large variations between seasonal and non-seasonal traffic and their impact on the need identification method.
12			The method does not capture non-recurring congestion or reliability issues	Crater-Southside, Roanoke, and others	We confirmed that the method takes into account non-recurring congestion. We will need more time to develop a method to capture large variations between recurring and non-recurring congestion and their impact on the need identification method.
13	Buffer Time Index (BTI)	The method conveys time buffer required to be on time 95% of time	The method is not fully reflective of unreliable conditions in different areas	Fredericksburg	New measure, LOTTR, reflects unreliable conditions for one or more hours.
14	Passenger and Intercity Rail On-Time Performance	The measure reflects on-time performance against agency-adopted thresholds.	Consider ridership to ensure that needs are based on impacts	Charlottesville-Culpeper	We are currently limited by data availability, but would like to work with Amtrak and VRE to conduct this analysis in the future.

APPENDIX A – (CONTINUED)

ID	Measure	Method or Threshold Prior to Workshops	Comment Received	Source (Which Regional Workshop Comment Received)	Change to Measure following Workshops
15	Transit Access to Activity Center for Workers	List of existing Activity Centers	Requests to add Activity Centers	Lynchburg, Hampton Roads, others	Added several additional Activity Centers.
16		List of existing Activity Centers	Request to add airports with commercial services and regional hospitals	Winchester-Frederick, Lynchburg	Added airports with commercial services and regional hospitals.
17		Location of existing Activity Centers	Concern that the locations shown on the map might not be accurate or precise	Hampton Roads	Reanalyzed and corrected Activity Center locations.
18		Activity Center specific transit access deficit was shown in three different colors	Recommendation to portray and describe this measure differently	Roanoke	The name of this measure was changed to “Transit Access to Activity Centers for Workers.”
19		Access deficit was based on the total number	Recommendation to review the method – different activity centers need different number of workers	Lynchburg, Winchester-Frederick	The method was modified to normalize transit access deficit by the total employment at Activity Center.
20			Recommendation to review data as there were some unexpected results	Richmond	The analysis was redone to ensure greater accuracy.
21		Access to the nearest bus stop is limited to walk-only	Concern that the method does not reflect trip-chaining where a user might rely on micro transit or access to park and ride facilities	Hampton Roads	Additional work is required to develop tools and methods to reflect trip chains involving park and ride facilities, micro transit and other emerging mobility options.
22	Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers	Walk and bike buffer around Activity Centers	Request to include non-motorized access to transit	Northern Virginia	Non-motorized access to fixed-guideway transit stations and bus rapid transit (BRT) lines was included.
23	Transit Access for Equity Emphasis Areas	Disadvantaged block groups were identified where any one of the three conditions were met: (1) age; (2) income; and, (3) disability status	The term “disadvantaged” does not accurately convey the measure results	Northern Virginia	The measure name was changed to – “Transit Access for Equity Emphasis Areas.”
24		Bus stop within 1/4 mile from the Block Group Centroid	The method, block group centroid, does not accurately capture transit access for irregular shaped block groups	Northern Virginia	The method for identification of such population was changed - half of the block group has to be outside the 1/4-mile access to bus stop.
25		Disadvantaged populations based on the following three criteria: (1) age; (2) income; and, (3) disability status	Recommendation to: (1) include minority and Limited English Proficient (LEP) populations; and, (2) review Metropolitan Washington Council of Government’s (MWCOG’s) method	Northern Virginia	The method was changed to include Minority/Hispanic and LEP populations. It is now more aligned with MWCOG’s method.
26		Bus stop within 1/4 mile from the Block Group Centroid	Criteria for areas served does not take into account the quality of transit service offered	Fredericksburg	We are currently limited by data availability and consistency, but would like to work with DRPT and transit service providers to develop a method for future work.
27		Disadvantaged block groups were identified where any one of the three conditions were met: (1) age; (2) income; and, (3) disability status	Recommendation to include concentration, not just presence of one criteria	Charlottesville-Culpeper	The method was changed to an index that takes into account the concentration of populations.

APPENDIX A – (CONTINUED)

ID	Measure	Method or Threshold Prior to Workshops	Comment Received	Source (Which Regional Workshop Comment Received)	Change to Measure following Workshops
28	Access to Industrial and Economic Development Areas	Consider VTrans Needs for IEDAs with Readiness level Tier 4 or higher	Recommendation to consider Tier 3 and higher	Winchester-Frederick, Hampton Roads, Crater-Southside, and others	Recommendation to include Needs associated with sites Tier 3 and higher.
29			Recommendation to also include Enterprise Zones, Opportunity Zones	Winchester-Frederick, Northern Virginia, Charlottesville-Culpeper	It is a good suggestion that we will consider for future updates.
30		Office-only sites were included based on data provided by Virginia Economic Development Partnership (VEDP)	VEDP sites are useful for industrial development but it could promote sprawl by incentivizing office development in rural areas without services	Winchester-Frederick	Confirmed that VEDP's Business Ready Sites Program should not include office-only sites. VEDP will make the corrections.
31		Method was to provide access to sites with Readiness Level Tier 4 or higher	Suggestion to incorporate proximity to Surface Transportation Assistance Act and National Highway System (NHS) highways systems	Winchester-Frederick	The method has been refined to provide access from the nearest Corridor of Statewide Significance that include NHS routes.
32	No measure	No method	VTrans should include proactive system management related needs	Fredericksburg	Included Needs associated with Capacity Preservation.
34			VTrans should include reliability (on-time performance) for local transit services	Bristol, Central Shenandoah	We did not have a good statewide data source developed for this, but will consider for future updates.
34			VTrans should include needs associated with park-and-ride and other Travel Demand Management	Central Shenandoah, Charlottesville-Culpeper	Included Needs associated with Transportation Demand Management.
35			Consider scooters and emerging mobility options	Charlottesville-Culpeper	Included Needs associated with emerging mobility options.
36	Potential for Safety Improvement	The measure is based on Potential for Safety Improvement (PSI) only	VTrans Safety Needs should include consideration for non-motorized needs that may not get highlighted based on PSI-only method	Bristol, Fredericksburg	Included Needs associated with pedestrian safety (from Pedestrian Safety Action Plan).
37			DUI or crashes that are related to behavioral aspects should be included in the analysis for PSI	Northern Virginia, Charlottesville-Culpeper	It is a good suggestion and we will work towards implementing it. We were unable to complete this for this round of VTrans Mid-term Needs update.
38			Separate safety needs for bicycle crashes should be considered	Winchester-Frederick	It is a good suggestion and, while we are able to include pedestrian safety related considerations, we will need more time to develop needs related to bicycle safety.
39			Do not limit the PSI list to the top 100 locations in each district	Danville	Safety needs will not be limited to the top 100 locations within a construction district.
40			Accidents causing injuries and fatalities should carry more weight	Bristol	In addition to the risk based method or PSI, VTrans Needs will also be based on fatalities and injuries.
41			Consider severe injury similar to fatality due to impact on quality of life	Roanoke	Fatalities and severe (ambulatory) injuries will be grouped together.
42			Identify clusters of fatal and injury crashes	Richmond	Method for Intersection Safety Needs captures crashes clustered within 250 feet of intersections.
43	Urban Development Areas	Locally determined needs shared via an online survey	Request to extend survey completion data	Charlottesville-Culpeper	Deadline to complete the survey was extended to ensure that more localities can provide needs.

APPENDIX B – STEERING COMMITTEE

First name	Last name	Division
Ben	Mannell	VDOT – Transportation and Mobility Planning (Long-Range Planning)
Barbara	Nelson	Port of Virginia
Chad	Tucker	OIPI – SMART SCALE
Chris	Smith	DRPT – Policy, Communications, and Legislative Affairs
Grant	Sparks	DRPT – Transit and TDM
Hari	Sripathi	VDOT – Office of Strategic Innovation
Jennifer	Ahlin	VDOT – Asset Management
Jo Anne	Maxwell	VDOT – Governance and Legislative Affairs
John	Bolecek	VDOT – Transportation and Mobility Planning (Bike/Ped)
John	Scrivani	VDOT – Safety, Security and Emergency Management
Kim	Pryor	VDOT – Infrastructure Investment
Laura	Farmer	VDOT – Financial Planning
Margie	Ray	OIPI – Performance Management
Michael	Todd	DRPT – Rail
Paul	Szatkowski	VDOT – Operations
Russell	Dudley	VDOT – Local Assistance
Mark	Cole	VDOT – Traffic Engineering (Safety)
Marsha	Fiol	VDOT – Transportation and Mobility Planning
Mena	Lockwood	VDOT – Traffic Engineering (Engineering and Data Analysis)

APPENDIX C – CHANGES MADE BASED ON FEEDBACK RECEIVED ON DRAFT MID-TERM NEEDS

ID	Measure	Method or Threshold in Draft Document (October 2019)	Comment Received or Issue Identified	Change to Measure
1	Transit Access for Equity Emphasis Areas	Equity Emphasis Areas were identified based on an index that considered the concentration of population groups defined by: (1) age; (2) low income; (3) disability status; (4) racial minority status; (5) Hispanic/Latino origin; and (6) limited English proficiency.	Recommendation to require that at least one of the two following groups be present in concentrations at least as high as the regional average: (1) low-income residents; or (2) residents with disabilities.	Accepted recommendation and modified the measure to require that at least one of the two following groups be present in concentrations at least as high as the regional average: (1) low-income residents; or (2) residents with disabilities.
2	Transit Access to Activity Centers for Workers	Transit access needs were identified for local-serving and knowledge-based Activity Centers. Needs were not identified for freight-dependent Activity Centers.	Recommendation to include transit access needs for freight-dependent Activity Centers as they often employ a large workforce in some areas.	Accepted recommendation and identified transit access needs for freight-dependent Activity Centers.
3	Non-Motorized Access to Activity Centers and Fixed Guideway Transit for Workers	Non-motorized Needs were identified for local-serving and knowledge-based Activity Centers within Regional Networks (RN)	Some of the non-motorized needs in less populated areas may not serve the intended purpose.	Modified, TDM needs are identified for CoSS and metropolitan planning areas within RNs.
4	Transportation Demand Management (TDM)	Transportation Demand Management needs were identified for Corridors of Statewide Significance (CoSS) and Regional Networks (RN).	Some of the TDM needs in less populated areas may not serve the intended purpose.	Modified, TDM needs are identified for CoSS and metropolitan planning areas within RNs.
5	None	N/A	Miscellaneous errors and inconsistencies	Modified, report and datasets reflect corrections and modifications
6	None	N/A	Need to label route numbers on print-ready maps	Modified print-ready maps to include more route numbers

APPENDIX D – DEFINITION OF VTRANS TRAVEL MARKETS

Corridor of Statewide Significance/Primary Facility and Major Components

Name	Primary Facility	Major Components - Roadway	Major Components - Multimodal
Coastal Corridor	US 17		Port of Virginia, Norfolk Southern Heartland Corridor, Norfolk Southern Coal Corridor, CSX National Gateway Corridor, CSX Coal Corridor, Amtrak, Norfolk International Airport, Newport News/Williamsburg International Airport, Rappahannock River
Crescent Corridor	I-81	I-381, I-581, US-11	Norfolk Southern Crescent Corridor, Short Line Railroads, Roanoke Regional Airport, Virginia Inland Port, Shenandoah Valley Regional Airport
East-West Corridor	I-64	I-264, I-464, I-564, I-664, US-60, US-11, US-250	CSX Coal Corridor, Norfolk Southern Coal Corridor, Amtrak, Charlottesville-Albemarle Airport, Richmond International Airport, Norfolk International Airport, Newport News/Williamsburg International Airport, Port of Virginia, Port of Richmond, James River, York River
Eastern Shore Corridor	US-13		Norfolk Southern, CSX, Amtrak, Bay Coast Railroad and Barge, Port of Virginia, Norfolk International Airport, Newport News/Williamsburg International Airport
Heartland Corridor	US-460	Coalfields Expressway	Norfolk Southern Heartland Corridor, Amtrak, Roanoke Regional Airport, Lynchburg Regional Airport, Norfolk International Airport, Newport News/Williamsburg International Airport, Richmond International Airport, Port of Virginia, James River
North Carolina to West Virginia Corridor	US-220		Norfolk Southern, Roanoke Regional Airport
North-South Corridor	RT-234	Prince William County Parkway, RT659, Bi-County Parkway, Northstar Boulevard	Washington Dulles International
Northern Virginia Corridor	I-66	US-50, RT-55	Norfolk Southern Crescent Corridor, Amtrak, Virginia Railway Express, WMATA Orange Line, Washington Dulles International, Ronald Reagan Washington National Airport, Virginia Inland Port
Seminole Corridor	US-29	US-50, RT-28	Norfolk Southern Crescent Corridor, Amtrak, Virginia Railway Express, WMATA Orange Line, Lynchburg Regional Airport, Charlottesville Albemarle Airport, Washington Dulles International
Southside Corridor	US-58		CSX National Gateway, Norfolk International Airport, Newport News/Williamsburg International Airport, Port of Virginia
Washington to North Carolina Corridor	I-95	I-85, I-195, I-295, I-395, I-495, US-1, US-301, RT-288	CSX National Gateway, Amtrak, Virginia Railway Express, WMATA Blue Line, WMATA Yellow Line, Ronald Reagan Washington National Airport, Richmond International Airport, Port of Richmond, James River
Western Mountain Corridor	I-77	US-11, US-52	

APPENDIX D – DEFINITION OF VTRANS TRAVEL MARKETS

Regional Networks/Cities and Counties

Regional Network	Counties and Cities Included
New River Valley Region	Montgomery County, Pulaski County, City of Radford
Richmond Region	Charles City County, Chesterfield County, Goochland County, Hanover County, Henrico County, New Kent County, Powhatan County, City Richmond
Staunton/Augusta/Waynesboro Region	Augusta County, City of Staunton, City of Waynesboro
Tri-Cities Region	Chesterfield County, Dinwiddie County, Prince George County, City of Colonial Heights, City of Hopewell, City of Petersburg
Northern Virginia Region	Arlington County, Fairfax County, Loudoun County, Prince William County, City of Alexandria, City of Falls Church, City of Fairfax, City of Manassas, City of Manassas Park
Harrisonburg Region	Rockingham County, City of Harrisonburg
Charlottesville Region	Albemarle County, City of Charlottesville
Roanoke Region	Botetourt County, Roanoke County, City of Roanoke, City of Salem
Bristol Region	Washington County, City of Bristol
Winchester Region	Frederick County, City of Winchester
Fredericksburg Region	Spotsylvania County, Stafford County, City of Fredericksburg
Danville Region	Pittsylvania County, City of Danville
Central VA MPO Region (Lynchburg)	Amherst County, Bedford County, Campbell County, City of Lynchburg
Kingsport Region	Scott County
Hampton Roads Region	Gloucester County, Isle of Wight County, James City County, Suffolk County, Southampton County, York County, City of Chesapeake, City of Franklin, City of Hampton, City of Newport News, City of Norfolk, City of Portsmouth, City of Poquoson, City of Virginia Beach, City of Williamsburg

PREPARED BY THE OFFICE OF INTERMODAL
PLANNING AND INVESTMENT FOR THE
COMMONWEALTH TRANSPORTATION BOARD

