Blacksburg TRANSIT

Transit Strategic Plan

November 2024

Chapter 1

System Overview

Contents

1.1 | System Overview

This chapter provides a high-level overview of BT and the agency's strategic priorities.

1.1.1 Services Provided and Areas Served

Blacksburg Transit (BT) provides fixed-route/deviated fixed-route, paratransit, and demand response transit service to a 34 square-mile service area within Virginia's New River Valley. BT operates within Montgomery County, Virginia and directly serves the Towns of Blacksburg and Christiansburg. BT operates 17 fixed-routes and two deviated fixed-routes. Table 1 lists Blacksburg Transit's fixed-route/deviated fixed-route service.

The Blacksburg fixed-route service operates at three different service levels throughout the year: full service, intermediate service, and reduced service. BT operates at full service from the end of August until mid-December and from mid-January until the beginning of May, corresponding when Virginia Tech (VT) is in session for the fall and spring semesters, respectively. Intermediate service has the same service spans and hours of operation as full service, but at reduced frequency. There are only nine service days at this level of service, including the week prior to the beginning of the fall semester in August and select holidays. Reduced service is operated during the summer and fall, winter, and spring breaks when VT is not in full session. BT does not operate on New Year's Day, Memorial Day, Independence Day, Thanksgiving, and Christmas.

Deviated Fixed-Route

BT operates two deviated fixed routes, the Explorer Blue and the Explorer Gold, which both operate in the Town of Christiansburg. Deviations can be requested by all riders, and deviations can be requested before or after boarding. Before boarding, deviations should be made at least two hours ahead of the desired pickup time via phone call. After boarding, riders must ask the operator to request approval for a deviation. Deviation requests are considered on a first-come, first-served basis, and will be approved if: the requested stop is an approved location, the deviation will take not more than five minutes, and the deviation will not result in the route being late.

Demand Response Service/Go Anywhere Service

The Go Anywhere demand response service requires advanced reservations and provides service from any place in the Town of Christiansburg to any destination within the town. Reservations can be made Monday-Friday 7:00 a.m. to 5:00 p.m. and the service runs on a consistent schedule, weekly.

ADA Paratransit

Within the limits of the Town of Blacksburg, fixed route service is complemented by Americans with Disabilities Act (ADA) paratransit service, BT Access, for qualified individuals who cannot complete their trip on the fixed route system. Any person traveling to the Town of Blacksburg with a valid ADA Eligibility Card from another locality may also ride BT Access. Individuals can apply to become certified to use BT Access, with travel training provided to teach seniors and people with certain disabilities that it may be possible to travel safely and independently on a fully accessible low floor fixed-route bus.

Table 1: Existing BT Deviated and Fixed Route Service

Route	Route Name	Area Served	Major Origin-Destination	Days of Operation	Span	Frequency
CRB	Carpenter Boulevard	VT– Prices Fork	Burruss Hall–The Retreat–Prices Fork Road–Smith's Landing	Mon–Fri	Full Service: 7:00 a.m.–6:45 p.m.	Full Service: 30 minutes
CRC	Corporate Research Center	VT– South Blacksburg	Burruss Hall–Lane Stadium–Corporate Research Center–VCOM–Knollwood–VT Airport–Blacksburg Industrial Park	Mon–Fri; Sat	Full Service: 6:50 a.m.–9:45 p.m.	Full Service: 30 minutes 60 Minutes (M-F after 6:45 p.m., Sat)
					Reduced Service: 6:50 a.m.–6:45 p.m.	Reduced Service: 30 minutes
BLU	Explorer Blue	Town of Christiansburg	Uptown Mall–Walmart–Spradlin Farm Shopping Center–Downtown Business District–Montgomery County Government Center–Aquatic Center–Laurel Street	Mon–Fri	Year Round: 7:05 a.m.–6:40 p.m.	Year Round: 60 minutes

Route	Route Name	Area Served	Major Origin-Destination	Days of Operation	Span	Frequency
GLD	Explorer Gold	Town of Christiansburg	Uptown Mall–Downtown Business District–Montgomery County Government Center–Exit 118 Park & Ride–Gateway Plaza Shopping Center	Mon–Fri	Year Round: 7:00 a.m.–6:40 p.m.	Year Round: 60 minutes
HDG	Harding Avenue	VT–Downtown Blacksburg	Burruss Hall–Squires Student Center–Roanoke Street–Harding Avenue–Windsor Hills–Roanoke Street Apartments–Apartment Heights	Mon–Fri; Sat; Sun	Full Service: 7:00 a.m.–12:15 a.m. (M-Th) 7:00 a.m.–2:15 a.m. (Fri) 9:45 a.m.–2:15 a.m. (Sat) 9:45 a.m.–10:15 p.m. (Sun)	Full Service: 20 minutes 30 minutes (M-Th 6:45p.m.– 9:45p.m.; Fri 3:45 p.m.–9:45 p.m.) 60 minutes (M-F after 9:45 p.m.; Sat; Sun)
					Reduced Service: 7:00 a.m.–9:30 p.m. (M-F) 9:45 a.m.–9:15 p.m. (Sat) 9:45 a.m.–9:15 p.m. (Sun)	Reduced Service: 30 minutes 60 minutes (Sun after 6:45p.m.)

Route	Route Name	Area Served	Major Origin-Destination	Days of Operation	Span	Frequency
HWD	Hethwood	VT– Prices Fork	Burruss Hall–Hethwood Square Shopping Center–Stroubles Circle–Foxridge and Hethwood Apartments–Oak Manor–The Retreat– Smith's Landing	Mon-Fri; Sat; Sun	Full Service: 9:45 p.m.–12:45 a.m. (M – Th) 9:45 p.m.–2:45 a.m. (Fri) 9:30 a.m.–2:45 a.m. (Sat) 9:30 a.m.–10:45 p.m. (Sun)	Full Service: 30 minutes
					Reduced Service: 9:30 a.m.–9:45 p.m. (Sat) 9:30 a.m.–6:45 p.m. (Sun)	Reduced Service: 30 minutes 60 minutes (Sun after 6:45p.m.)
HWA	Hethwood A	VT– Prices Fork	Burruss Hall–Stroubles Circle–Foxridge and Hethwood Apartments–Oak Manor–Smith's Landing	Mon-Fri	Full Service: 7:00 a.m.–9:45 p.m. (Full)	Full Service: 15 minutes 30 minutes (M-Th after 6:45 p.m.; Fri after 3:30 p.m.)
					Reduced Service: 7:00 a.m.–9:45 p.m.	Reduced Service: 30 minutes
HWB	Hethwood B	VT– Prices Fork	Torgersen Hall–Hethwood Square Shopping Center–Foxridge and Hethwood	Mon-Fri	Full Service: 7:00 a.m.–9:30 p.m.	Full Service: 15 minutes 30 minutes (M-Th after 6:30 p.m.; Fri after 3:30 p.m.)

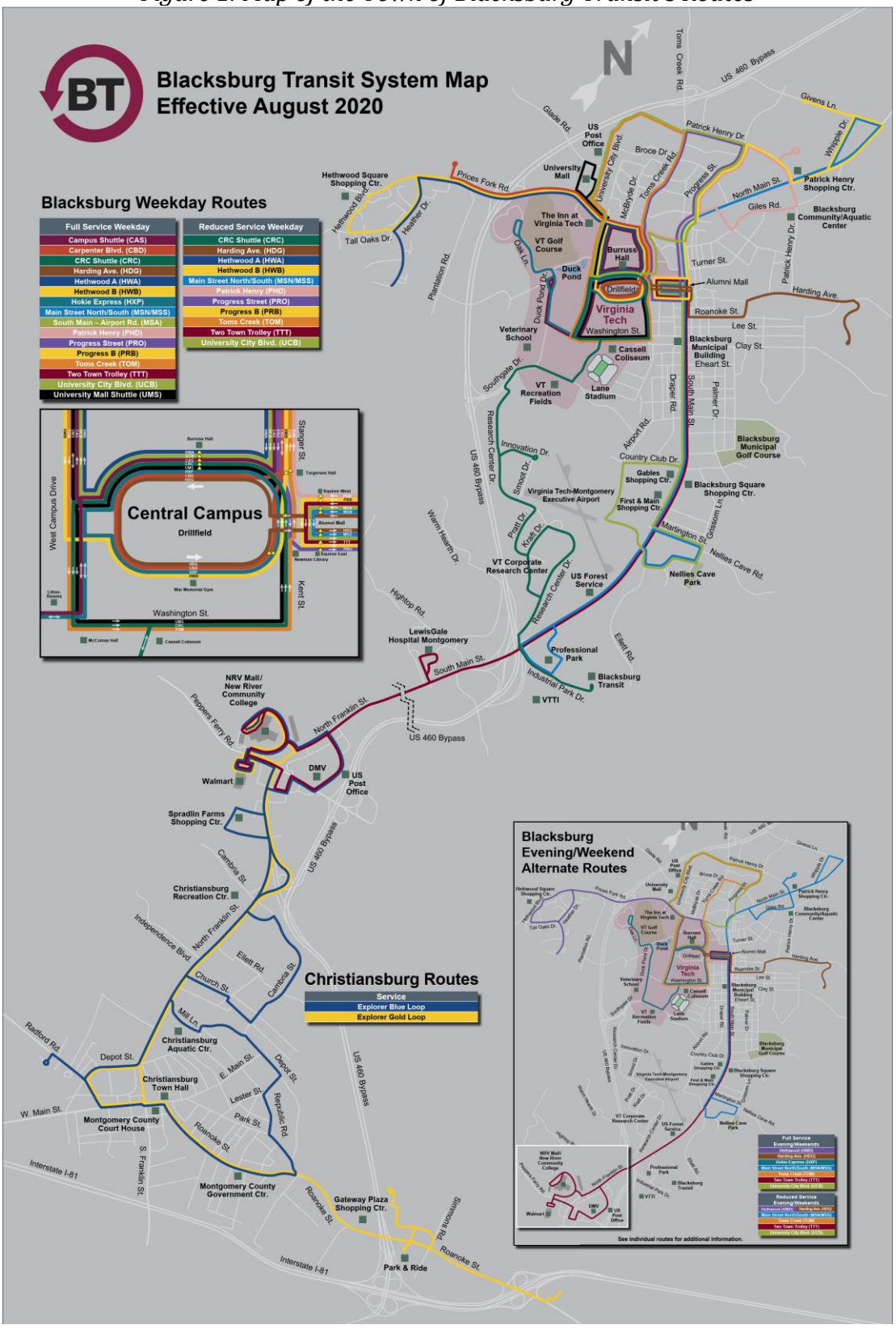
Route	Route Name	Area Served	Major Origin-Destination	Days of Operation	Span	Frequency
			Apartments–Oak Manor-Smith's Landing		Reduced Service: 7:15 a.m.–9:30 p.m.	Reduced Service: 30 minutes
HXP	Hokie Express	VT	Burruss Hall–Litton Reaves Hall–Oak Lane Community–Commuter Parking	Mon-Fri; Sat; Sun	Full Service: 7:10 a.m.–12:45 a.m. (M-Th) 7:10 a.m.–2:45 a.m. (Fri) 9:30 a.m.–2:45 a.m. (Sat) 9:30 a.m.–10:45 p.m. (Sun)	Full Service: 20 minutes 30 minutes (M-Th 6:45p.m.–9:45p.m.; Fri 3:45 p.m.–9:45 p.m.) 60 minutes (M-F after 9:45 p.m.; Sat; Sun)
					Reduced Service: 7:00 a.m.–6:45 p.m. (M-F)	Reduced Service: 30 minutes
MSN/MSS	Main Street	VT–North Blacksburg–Downtown Blacksburg–South Blacksburg	Squires Student Center–Blacksburg Municipal Building–Gables Shopping Center–Patrick Henry Shopping Center–Multiple apartment complexes	Mon-Fri; Sat; Sun	Full Service: 7:00 a.m.–12:45 a.m. (M–Th) 7:00 a.m.–2:45 a.m. (Fri) 9:30 a.m.–2:45 a.m. (Sat) 9:30 a.m.–10:45 p.m. (Sun)	Full Service: 30 minutes

Route	Route Name	Area Served	Major Origin-Destination	Days of Operation	Span	Frequency
					Reduced Service: 7:00 a.m.–9:45 p.m. (M-F) 9:30 a.m.–9:45 p.m. (Sat: Sun)	Reduced Service: 30 minutes 60 minutes (Sat after 6:45 p.m.)
MSG	North Main Givens	VT–North Blacksburg	Squires Student Center–Patrick Henry Shopping Center–Fieldstone–Maple Ridge	Mon-Fri	Full Service 7:10 a.m.–6:25 p.m.	Full Service: 30 minutes
					Reduced Service: 7:30 a.m.–5:55 p.m.	Reduced Service: 60 minutes
PHD	Patrick Henry Drive	VT– North Blacksburg	Squires Student Center–North Main Street–Progress Street–Patrick Henry Drive–Hunters Ridge–Park 37–Terrace View	Mon-Fri	Full Service: 7:00 a.m.–9:30 p.m.	Full Service: 15 minutes 30 minutes (M-Th after 6:30 p.m.; F after 3:30 p.m.)
					Reduced Service: 7:15 a.m.–9:30 p.m.	Reduced Service: 30 minutes
PRO	Progress Street	VT– North Blacksburg	Squires Student Center–North Main Street–Progress Street–Toms Creek Road–University Terrace–Terrace View–The Hub–Alight Blacksburg	Mon-Fri	Full Service: 7:00 a.m.–9:30 p.m.	Full Service: 15 minutes 30 minutes (M-Th after 6:30 p.m.; F after 3:30 p.m.)
					Reduced Service: 7:15 a.m.–9:30 a.m.	Reduced Service: 30 minutes

Route	Route Name	Area Served	Major Origin-Destination	Days of Operation	Span	Frequency
MSA	South Main Airport Road	VT–Downtown Blacksburg–South Blacksburg	Squires Student Center–Blacksburg Municipal Building–Gables Shopping Center–Airport Acres–Multiple apartment complexes near New Kent	Mon-Fri	Full Service: 7:15 a.m.–6:30 p.m.	Full Service: 30 minutes
					Reduced Service: 7:15 a.m.–6:30 p.m.	Reduced Service: 60 minutes
TOM	Toms Creek	VT– North Blacksburg	Torgersen Hall–University Mall–Toms Creek Rd–The Hub–Shawnee–Union Blacksburg	Mon-Fri; Sat; Sun	Full Service: 7:00 a.m.–12:45 p.m. (M–Th) 7:00 a.m.–2:45 a.m. (Fri) 9:30 a.m.–2:45 a.m. (Sat) 9:30 a.m.–10:45 p.m. (Sun)	Full Service: 15 minutes 30 minutes (M-F after 6:45 p.m.; Sat; Sun)
					Reduced Service: 7:00 a.m.–9:45 p.m. (M–F) 9:30 a.m.–9:45 p.m. (Sat; Sun)	Reduced Service: 30 minutes

Route	Route Name	Area Served	Major Origin-Destination	Days of Operation	Span	Frequency
TTT	Two Town Trolley	VT–Downtown Blacksburg - South Blacksburg - Christiansburg	VT–Gables Shopping Center–LewisGale Hospital Montgomery–Uptown Mall–Walmart–The Marketplace	Mon-Fri; Sat; Sun	Full Service: 7:00 a.m.–9:15 p.m. (M–F) 10:00 a.m.–9:15 p.m. (Sat) 10:00 a.m.–6:15 p.m. (Sun)	Full Service: 60 minutes
					Reduced Service: 7:00 a.m.–6:15 p.m. (M-F) 10:00 a.m.–6:15 p.m. (Sat; Sun)	Reduced Service: 60 minutes
UCB	University City Boulevard	VT– North Blacksburg	Burruss Hall–University City Boulevard–Progress Street–Multiple Apartment complexes	Mon-Fri; Sat; Sun	Full Service: 7:00 a.m.–9:45 p.m. (M–F) 9:30 a.m.–9:45 p.m. (Sat) 9:30 a.m.–6:45 p.m. (Sun)	Full Service: 15 minutes 30 minutes (M-F after 6:45 p.m.; Sat & Sun)
					Reduced Service: 7:00 a.m.–9:45 p.m.	Reduced Service: 30 minutes
Intermediate Service: Routes follow the Reduced Service Schedule before 6:30 p.m. and follow the Full Schedule after 6:30 p.m.						

Figure 1: Map of the Town of Blacksburg Transit's Routes



1.1.2 Current/Recent Initiatives

Service Partnerships

Virginia Tech

VT is a major stakeholder for Blacksburg Transit. VT does not have an official governance role with Blacksburg Transit, but BT and VT work closely together on planning efforts, such as the multimodal transit center. VT also has an ongoing and consistent relationship with BT as a partner providing local funding match, which is based on a quarterly funded schedule. The university collects funding for the service per their enrolled students' activity fees. These fees constitute approximately 40 percent of Blacksburg Transit's budget.

Service Initiatives

Transit Center

BT is coordinating with VT to construct a multimodal transit facility on VT's campus. The Transit Center will serve as a central transportation hub for the Town of Blacksburg and the university, and the facility will host multiple public transit and transportation services including Blacksburg Transit, Smart Way, Virginia Breeze, and Radford Transit. The Transit Center will be located adjacent to the Perry Street parking garage and will feature two bus loops containing a total of 17 bus boarding slips, a two-story building which will house a passenger waiting area, the Hokie Bike Hub, an employee break area, office spaces and meeting spaces. Each bus loop is designed to incorporate an on-route electrical charger in the future to extend the range and service capabilities of BT's battery electric buses. The facility will also improve Blacksburg Transit's efficiency and the safety and convenience for the area's pedestrians and transit riders. The Transit Center is expected to begin operations in 2024.

Zero-Emission Bus Transition

BT is undergoing a transition of its fleet to zero emission vehicles. As of the summer of 2023, Blacksburg Transit's fleet is approximately 19% battery electric buses. BT plans to completely transition their fleet to 100% battery electric buses by the fiscal year 2035.

Service Coordination

Radford Transit

Radford Transit provides a direct connection on Monday-Saturday (Route 40) between Radford and the Regal Cinemas/Uptown Mall (Christiansburg). Riders from Radford Transit transfer onto BT's Two Town Trolley to complete trips into Blacksburg. Radford Transit also provides service directly to Squires Student Center on the VT campus on Friday and Saturday evenings between 10:45 p.m. and 12:45 a.m.

Pulaski Area Transit

This service connects the Uptown Mall and New River Community College (Town of Christiansburg) with Fairlawn (Radford), Dublin and the Town of Pulaski. Two daily trips are provided Monday-Friday, arriving in the Town of Christiansburg at 8:50 a.m. and 1:50 p.m.

Smart Way Bus

Smart Way Bus (operated by Valley Metro under the Greater Roanoke Transit Company, GRTC) provides commuter bus service between Roanoke and the New River Valley. Smart Way Bus's

southern terminus is Virginia Tech's Squires Student Center, and the northern terminus is Roanoke's Third Street Station. The bus also connects riders with the Roanoke-Blacksburg Regional Airport and Roanoke's Amtrak Station. While Smart Way Bus does not have a stop in Radford, Smart Way Bus's southern terminus is at Virginia Tech's Squires Student Center which Radford Transit's Route 40 connects with via BT's Two Town Trolley.

Community Transit

Community Transit provides demand response services as well as medical trips for individuals with disabilities and/or special needs in the counties of Floyd, Giles, Montgomery and Pulaski, as well as the City of Radford. Community Transit serves contracts with Medicaid, Virginia Premier, Optimal Translation & Transportation, Radford Department of Social Services, Radford City Public Schools and New River Community Action.

RIDE Solutions

RIDE Solutions is a grant-funded program made possible through the partnership agencies of Virginia Department of Rail and Public Transportation (DRPT), Roanoke Valley-Alleghany Regional Commission, New River Valley Regional Commission, and Central Virginia Planning District Commission. RIDE Solutions provides alternative transportation options–ridesharing (carpooling and vanpooling), biking, public transit, walking, and guaranteed ride home services–to residents living within the greater New River and Roanoke Valleys.

Virginia Breeze

Virginia Breeze provides intercity bus service throughout Virginia. The service is funded by DRPT and operated by Megabus. The Town of Blacksburg is directly served by the Valley Flyer line which runs from Blacksburg to Washington D.C. The Valley Flyer stops outside of Virginia Tech's Squires Student Center and operates one northbound and one southbound trip daily. The Town of Christiansburg is also served by the Valley Flyer line and the Highlands Rhythm line via Exit 118 Park and Ride. The Highlands Rhythm runs between Bristol and Washington D.C. and runs one northbound and one southbound bus daily.

Amtrak

Amtrak is a national passenger rail service offering multiple routes across the country. The Commonwealth of Virginia announced the construction of a station in the Town of Christiansburg with the intention of servicing the station through the extension of the Northeast Regional route. The Northeast Regional currently operates between Roanoke, VA and Boston, MA or Springfield, MA. Currently, from the Roanoke Amtrak station one can transfer to the Smart Way Bus system in order to travel from Roanoke to Blacksburg.

Strategic Vision

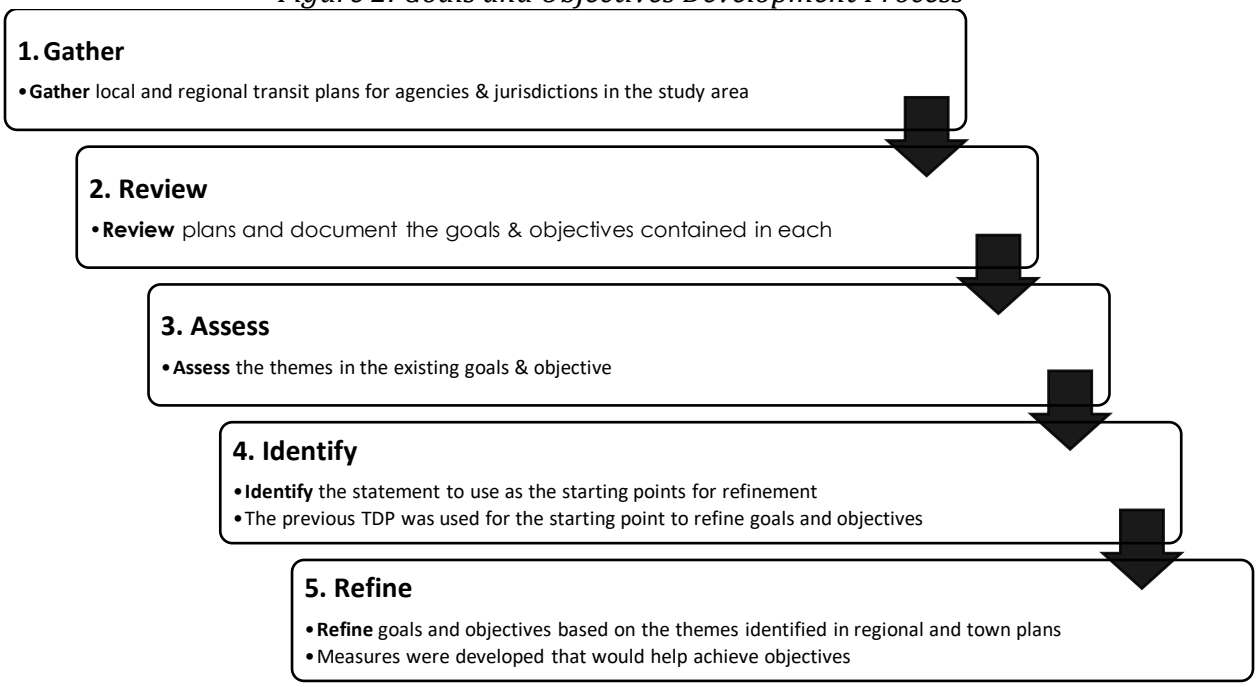
Blacksburg Transit's strategic plan was developed based on input from Town of Blacksburg staff, VT staff, and with consideration for input from stakeholders including community members, human and social services providers, strategic partners, and community representatives. Visioning activities were conducted in spring 2023 and resulted in the goals documented in the section below.

1.1.3 Goals and Objectives

Development Process

The goals for Blacksburg Transit's Transit Strategic Plan (TSP) were derived from those set forth in the most current existing Transit Development Plan (TDP) and evolved upon for this plan's purposes. The previous TDP goals were reviewed alongside goals set forth from previous Town of Blacksburg and regional plans and supplemented with input gathered during public and stakeholder engagement efforts. This information was reviewed, compared, and documented to identify shared priorities across the region that would be relevant to BT. Based on the resulting common themes, a series of proposed goals and objectives were developed together with actionable measures. The previous TDP was used as the starting point for refining goals and objectives. Figure 2 describes this process for the Development of Goals and Objectives.

Figure 2: Goals and Objectives Development Process



Goals

Based on the process described above, four primary goals were developed to guide BT's future service and operations:

1. Provide an effective and safe transit service that meets the needs of the Town of Blacksburg, the Town of Christiansburg, and the surrounding communities
2. Ensure system and route optimization through proactive planning and consistent data collection
3. Provide excellent customer service and improve the rider experience
4. Deepen coordination with Virginia Tech and foster connections within the student population

Objectives

Goal 1: Provide an effective and safe transit service that meets the needs of the Town of Blacksburg, the Town of Christiansburg, and the surrounding communities

Goal one focuses on maintaining or enhancing the quality of service provided by BT through monitoring service, customer service, and effective scheduling.

Table 2: List of Objectives and Measures for Goal 1

Objective	Measure
Maintain efficient scheduling and routing practices to ensure as short a wait time for customers as possible	Review on time performance quarterly to ensure effective system transfers
	Utilize the Transit Center as a hub for university-focused service
	Review service coordination with connecting transit agencies once per year and adjust route schedules concurrently with changes
	Implement headway maintenance for routes providing direct connection to the university
Monitor and review reports related to suspicious activity and incident reports as well as general safety concerns related to facilities (lighting, visibility at bus stops, and facility conditions)	Maintain adherence to BT Safety Performance Targets as identified in the Public Transit Agency Safety Plan (PTASP)
Increase brand awareness among the Town of Christiansburg community	Create a marketing campaign around the Town of Christiansburg Service
Efficiently deploy financial and human resources	Increase scheduling efficiency for similar and concurrent routes

Goal 2: Ensure system and route optimization through proactive planning and consistent data collection

Goal two focuses on creating organizational efficiencies to adapt to and/or mitigate challenges that arise in the future.

Table 3: List of Objectives and Measures for Goal 2

Objective	Measure
Simplify the routing and scheduling of fixed- routes	Integrate the Transit Center into the scheduling and routing of Blacksburg based routes
	Increase efficiency by streamlining existing routes
	Reduce the number of alternate route patterns
Standardize route performance measures	Maintain or improve route metrics compiled for passengers per hour, passengers per mile, operating expense per passenger trip, and operating expense per capita

Goal 3: Provide excellent customer service and improve the rider experience

Goal three focuses on the qualitative experience of BT by improving customer relations and making transit information more user friendly.

Table 4: List of Objectives and Measures for Goal 3

Objective	Measure
Provide excellent customer service through timely service, well-trained drivers, and comfortable accommodations	Track and increase the number of positive customer service interactions and reduce number of complaints
	Track requests for enhanced stop amenities and integrate into an annual service planning activity
Modify the system and informational material to become more user friendly	Provide consistency of scheduling between full and reduced service periods by minimizing or eliminating alternate routing during off-peak hours
	Provide clarity on route deviation and route schedules
Foster community engagement and outreach	Establish partnerships with local organizations to promote and familiarize the community with BT

Goal 4: Deepen coordination with VT and foster connections within the student population. Goal focuses on meeting the transit demands and needs for VT and its students.

Table 5: List of Objectives and Measures for Goal 4

Objective	Measure
Increase awareness and knowledge of BT with VT students	Attend student-related events with pop-up booth and informational materials (i.e., Gobblerfest, new student orientation, transfer orientation, international orientation, etc.)
Improve the speed, quality, reliability, and convenience of transit service for students	Coordinate on VT's future growth plans and new academic, residential, and sports construction
	Monitor and track times and locations of crush-loads

1.1.4 Service Design Standards

Service design standards are benchmarks against which a system and its routes are developed and evaluated to determine if existing services should be modified. Service design standards function as an input to the planning process and address items such as scheduling and route planning, service reliability, system efficiency, safety and security, customer service, multimodal connectivity, and regulatory compliance. When BT considers service changes, these standards presented below will be considered as much as possible within funding constraints.

BT's service design standards are included below in Table 6. All service standards are described for Blacksburg fixed-route service. All service design standards included have been developed with input from BT staff.

Table 6: BT Service Design Standards

Service Element	Service Design Standard
Hours of Operations	During Full Service, the maximum span of service should be: • 7:00 a.m. to 12:45 a.m. from Monday to Thursday • 7:00 a.m. to 2:45 a.m. on Fridays • 9:30 a.m. to 2:45 a.m. on Saturdays • 9:30 a.m. to 12:45 a.m. on Sundays
	During Reduced Service, the maximum span of service should be: • 7:00 a.m. to 9:45 p.m. on weekdays • 9:30 a.m. to 9:45 p.m. on weekends
	Town of Christiansburg routes and other non-campus-oriented routes should be operated during consistent hours year-round and vary according to the need of the service and the community.
Service Levels	The peak period for fixed routes in the Town of Blacksburg is 7:00 a.m. to 6:45 p.m. on weekdays during full service.
	Evening periods are from 6:45 p.m. to 9:45 p.m.
	Night periods are from 9:45 p.m. to end of service.

Service Element	Service Design Standard
	Peak periods for Town of Christiansburg routes are between 7:00 a.m. and 9:00 a.m., and between 3:00 p.m. and 6:00 p.m. on weekdays.
	Off-peak periods are defined as service periods outside of 7:00 am to 6:45 pm, Monday through Friday (during full service), and all times during reduced and intermediate service.
Frequency of Service	Maximum headways for fixed routes are 10 to 15 minutes during peak periods and 30 to 60 minutes during off-peak periods.
	Frequency should not exceed 60 minutes during peak and off-peak hours for Town of Christiansburg routes and non-campus-oriented routes.
Loading Standards	The loading standard is a ratio of total passengers to seated passengers. For fixed routes, the loading standard should be: Crush Load Periods* – 2.0 Peak Periods – 1.0 Non-Peak Periods – 0.5 * *Crush Load Periods are defined as the 30 minutes before and 30 minutes after a university class scheduled start/end time.*
	For individual trips, loading standards should not be exceeded for time periods greater than 10 minutes.
	The maximum number of passengers on-board must not exceed 107 passengers for 60-foot articulated buses, 80 passengers for 40-foot buses, and 70 passengers for 35-foot buses at any time.
Passenger Stops	The spacing of bus stops will vary by location, but as a general rule, there should be bus stops no closer than every 0.2 miles (1,000-1,200 feet).
Bus Stop Amenities	**Town of Blacksburg (excluding stops on VT Campus)** - Shelter – Stop boardings per day during reduced service is greater than 200% of the average stop boardings in the Town of Blacksburg. - Bench – Stop boardings per day during reduced service is greater than 100% of the average for stop boardings in the Town of Blacksburg. - ADA Accessible Landing Pad – All stops.
	Town of Christiansburg (excluding stops at Walmart and Uptown Mall) - Shelter – Stop boardings per day is greater than 125% of the average stop boardings in the Town of Christiansburg.

Service Element	Service Design Standard
	- Bench – Stop boardings per day is greater than 75% of average stop boardings per day in the Town of Christiansburg. - ADA Accessible Landing Pad – All Stops.
	Virginia Tech (VT) Campus Shelter location priorities on campus will be coordinated with VT Sustainable Transportation.
Bus Pull-Offs	**Bus Pull-offs (Blacksburg or Christiansburg)** A bus pull-off should be considered at bus stop locations where two or more of the following conditions are present: - Located on an arterial road through town or located on a road with speed limits of 30 mph, or greater. - Stop is located within one-fourth of a mile of 400 bedrooms or more. - Average dwell time for the bus loading/unloading would be 1 minute or greater. - A safety concern has been identified directly related to buses stopping in the lane of travel. *These are the standards for design, but actual amenities desired/installed may be adjusted based on other factors such as, location, frequency of service, proximity to marginalized communities, challenges with installation of infrastructure, etc.

1.1.5 Performance Standards

Performance standards are metrics developed to create a consistent evaluation for transit service and provide insight into how services should be modified and implemented. Performance Standards differ from Service Design Standards as they quantify how system services are performing and are an output of service provision.

The following statistics are monitored by BT and are required for reporting to DRPT for inputs into annual formula funding applications. Performance monitoring of the service with respect to these standards should be done annually at a minimum. All performance standards are described for fixed-route service.

BT's performance standards are included below in Table 7.

Table 7: BT Service Performance Standards

Performance Element	Performance Standard
System Ridership	Track route and stop level ridership to observe monthly trends
Passenger Productivity	**Town of Blacksburg – Fixed Route**
	Category **Pass./Rev. Hr**

Performance Element	Performance Standard
	Excellent: * >150% Full Service Weekday Average
	Good: 100-150% Full Service Weekday Average
	Satisfactory: 50-100% Full Service Weekday Average
	Marginal: < 50% Full Service Weekday Average
	* Routes approaching 200% of Full Service Weekday Average Pass./Rev. Hr needs evaluation for additional supporting service
	Town of Christiansburg – Explorer
	Category **Pass./Rev. Hr**
	Excellent: > 3.5 Pass./Rev. Hr
	Good: 2.5 – 3.5 Pass./Rev. Hr
	Satisfactory: 2 – 2.5 Pass./Rev. Hr
	Marginal: < 2 Pass./Rev. Hr
	Demand Response (Access/GAR)
	Category **Pass./Rev. Hr**
	Excellent: > 3 Pass./Rev. Hr
	Good: 2 – 3 Pass./Rev. Hr
	Satisfactory: 1 – 2 Pass./Rev. Hr
	Marginal: < 1 Pass./Rev. Hr
Cost Effectiveness	Service falling into the "Marginal" category for passenger productivity should be reviewed to determine if changes can be made to improve productivity. If changes cannot be made, then the service should be analyzed to determine if it is meeting a critical need and therefore justifiable to continue operation without improved productivity.
Schedule Adherence	Category Percent between 0 and 3 minutes late
	Good: > 90%
	Satisfactory: 85% - 90%
	Marginal: 80% - 85%
	Unsatisfactory: < 80%
Load Factor	The loading standard (ratio of total passengers to seated passengers) for Fixed Routes should be: Crush Load Periods * - 2.0 Peak Periods – 1.0 Non-Peak Periods – 0.5 *Crush Load Periods are defined as the 30 minutes before and 30 minutes after a scheduled University class start/end time.
Service Reliability	Mean Distance between Major Failures 10,000 miles (from BT PTASP) Mean Distance between Minor Failures 3,200 miles (from BT PTASP)
	Less than 5 percent missed trips due to operational failures
	Less than 20 customer complaints per 100,000 boardings by mode

Performance Element	Performance Standard
Customer Service	Complaints received are acknowledged within 2 business days and fully investigated within 10 business days.
Safety and Security	Total Number of Safety Events should be 10 or lower annually for fixed-route and 1 or lower annually for Paratransit/Demand Response.

BT has outlined a set of safety performance targets in their Public Transit Agency Safety Plan (PTASP) in accordance with Federal Transit Administration regulations.

The safety performance targets listed in Table 8 serve as benchmarks to evaluate the overall safety performance of the agency. These safety performance targets present a ceiling for which BT aims to not exceed.

Table 8: BT Safety Performance Targets

Safety Performance Targets	Fixed Route	Paratransit/Demand Response
Fatalities (total number of reportable fatalities per year)	0	0
Fatalities (rate per total vehicle revenue miles by mode)	0	0
Injuries (total number of reportable injuries per year)	5	0
Injuries (rate per total vehicle miles)	Less than .5 injuries per 100,000 vehicle revenue miles	Less than .5 injuries per 100,000 vehicle revenue miles
Safety events (total number of safety events per year)	10	1
Safety events (rate per total vehicle miles by mode)	Less than 1 reportable event per 100,000 vehicle revenue miles	Less than 1 reportable event per 100,000 vehicle revenue miles
Distance between Major Failures	10,000 miles	10,000 miles
Distance between Minor Failures	3,200 miles	3,200 miles

Chapter 2

System Performance and Operations Analysis

Contents

The system performance and operations analysis chapter of the Transit Strategic Plan (TSP) evaluates the existing Blacksburg Transit (BT) system through both quantitative and qualitative measures of system performance and operations. Chapter 2 highlights the following topics:

- **Existing System and Service Data**–Summarizes the existing system service, service design standards, and stakeholder and public input.
- **Evaluation of Transit Market Demand and Underserved Areas**–Analysis of transit demand through evaluation of various factors including land use and development factors, population and employment density, socioeconomic variables that influence transit demand and ridership. Travel patterns and demand are analyzed to identify areas with a combination of high activity and needs, and low levels of transit service.
- **Performance Evaluation**–Evaluation of ridership and performance metrics and trends at the system, route, and stop level. An evaluation of peers, route accessibility, route deviations, and safety is also included.
- **Operating and Network Efficiency Evaluation**–Evaluation of the service network using efficiency metrics that assess frequency, span, speed, trip load, service overlap, and reliability of the transit system to provide a measurable baseline for Blacksburg Transit operations that can be used to identify improvements to the system.
- **Analysis of Opportunities to Collaborate with Other Transit Providers**–Identification of opportunities for BT to improve connections with nearby transit providers.

2.1 | System and Service Data

2.1.1 Existing System Service Statistics

Current Fiscal Year Data

BT operates fixed-route, demand response, and ADA complimentary paratransit service within the Towns of Blacksburg and Christiansburg. BT operates a total of 17 fixed-routes and two deviated fixed-routes.

Unless otherwise noted, the data presented in this section is primarily from fiscal year (FY) 2022, which was the latest available data at the time of the analysis.

Table 1: Existing Service Summary

Category	System Total
Service Area Population	73,554
Service Area Population Density	2,163
Service Area Square Miles	34 Square Miles
Operating Cost	$9,966,111
Revenue Hours	100,137
Revenue Miles	1,050,017
Number of Vehicles in Peak Service	32 Buses 9 Demand Response
Directional Route Mileage	76.6

Source: NTD 2022

BT operates at 3 different service levels throughout the year—full service, intermediate service, and reduced service:

- BT operates at full service from the end of August until mid-December and from mid-January until the beginning of May, corresponding when Virginia Tech is in session for the fall and spring semesters, respectively.
- Intermediate service has the same service spans and hours of operation as full service but at a reduced frequency. There are only 9 service days at this level of service, including the week before the beginning of the fall semester in August and select holidays.
- Reduced service is operated during the summer, fall, winter, and spring breaks when Virginia Tech is not in full session. Blacksburg Transit does not operate on New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, and Christmas Day.

Table 2: Summary of Service Types

Category	Full Service Total	Intermediate Service Total	Reduced Service Total
Days of the Week in Operation	7	5	7
Number of Routes in Operation	19	19	15
Average Headway	15–30 minutes	30–60 minutes	30–60 minutes
Service Span (Weekday)	7:00 a.m.–12:45 a.m. (2:45 a.m. Fri)	7:00 a.m.–12:45 a.m. (2:45 a.m. Fri)	7:00 a.m.–9:45 p.m.
Service Span (Weekend)	9:30 am–2:45 am (10:45 p.m. Sun)	N/A	9:30 a.m.–9:45 p.m.
Ridership	3,012,687 (FY 2022)	36,078	182,377

Source: BT Fall Schedule, Blacksburg Transit Data FY 2022

2.1.2 Existing Service Design Standards

Service design standards are benchmarks against which a system and its routes are developed and evaluated to determine if existing services should be modified. BT recently updated their service design standards from those included in the previous Transit Development Plan (TDP). These updated service and performance standards are designed to be more congruent with different classes of route operation. The existing design standards related to route design and scheduling can be found in Section 1.1.4.

2.1.3 Existing Service Performance Standards

Performance standards are metrics developed to create a consistent evaluation for transit service and provide insight into how services should be modified and implemented. Performance standards differ from service design standards as they quantify how system services are performing and are an output of service provision.

BT monitors the performance standards, which are required for Virginia Department of Rail and Public Transportation (DRPT) reporting. Performance monitoring with respect to these standards should be done at minimum annually. The existing performance standards can be found in Section 1.1.5.

2.1.4 Public Survey Results

A public survey was conducted by the study team to understand existing transit ridership and solicit public input on transit priorities to inform the development of recommendations. The survey was available both online and in paper form at key destinations and pop-up events. The surveys were open for responses from April 5-28, 2023, receiving more than 700 responses (499 online, 224 in person, 37 at drop-off locations).

To collect survey responses from traditionally under-represented populations and people who may not know about or use BT services, the study team conducted 7 pop-up events at a variety of locations throughout the service area. Paper copies were available to complete on-site. The study team interacted with nearly 400 people at these events, with more than half completing the survey.

More detailed information on the public survey results can be found in Appendix B section 2.1.4. Below are key takeaways from the public survey:

- Most survey takers were affiliated with the university in some way; they were commuting to Virginia Tech (VT) or lived on campus. Those respondents expressed a desire for more services and needs centered around VT.
- Many survey takers at the pop-up events had never ridden the bus before. These respondents tended to be older, and live outside of the Town of Blacksburg, either in Town of Christiansburg or elsewhere around the region.
- There was expressed interest in BT's app being easily available and clearly advertised so that passengers know about it and for the app to provide real-time bus information.
- There is a desire for BT's service to be expanded to additional local and regional destinations. Both passengers and non-passengers cited this as the key reason that would convince them to begin to ride the bus or to ride the bus more.
- There is also a desire for expanded service on nights and weekends.

- Most bus passengers are walking to and from the bus and would enjoy improved pedestrian amenities surrounding the bus stops, as well as enhanced bus stop amenities.
- Most survey takers were white, female, and between the ages of 18 and 24.

2.1.5 Bus Operator Discussion Findings

In addition, the project team conducted meetings with bus operators to understand their needs. Key takeaways from these meetings are:

- The existing 15-minute frequency and fewer buses lead to high loads during peak periods, making picking up all passengers heading to campus difficult. An increased frequency during peak periods may help spread the passenger load.
- Overcrowding on buses and leaving passengers at stops leads to frustration. Specific campus locations, such as Burruss Hall, consistently seem to have overcrowding issues.
- Operators suggested potential new service areas, expansion, and improved connectivity for BT, including Clay Street, Prices Fork Road, Peppers Ferry Road, and Town of Christiansburg. Microtransit service with demand response trips may provide a more efficient and convenient service for all passengers, especially paratransit users.
- Optimizing bus stop spacing to improve faster and more reliable service during peak times.
- The downtime for charging electric buses is not currently a significant issue; as the fleet transitions to an all-electric one, more downtime will be needed to ensure that the buses are adequately charged. Installation of the rapid charging stations at the Transit Center and vehicles with longer range batteries may offset this issue.
- Passenger information could be simplified and consistent to better understand community route operations. Improving the visibility and placement of head signs on buses can also help passengers understand important messages, such as a full bus. Consider implementing a timer on the head sign that counts the time until the bus leaves in real time.
- Associating colors with routes and having full maps at stops in Christiansburg can help clarify passenger information.

2.1.6 Stakeholder Support

A series of stakeholder meetings were held during the TSP development process in March 2023 to better understand the community's use of and support for transit and identify any unmet needs. These stakeholders include the Town of Blacksburg, the Town of Christiansburg, Montgomery County, and Virginia Tech. Takeaways from these meetings are included in the following sections.

Strengths of existing transit system:

- The system is a foundation of student movement to and from campus. It is reliable, free, efficient, and accessible.
- BT has a great reputation within and outside of the Town of Blacksburg and has strong local relationships with VT, among others.
- The BT system provides additional benefits such as not having to rely on parking on campus, supports emergency response, is used as roadblocks and cooling centers, and has a positive impact on road design.

Ways transit can better meet the needs and goals of the community:

- Provide connections to the Town of Christiansburg, Community College, Uptown Mall, Amtrak, and Montgomery County Office; expand service further down Roanoke Street and Radford Street.
- Provide more frequent service and extend hours of service.
- Provide a remote lot with circulator bus to destinations around VT's campus with additional pick up and drop off locations in the campus core.
- Partner with Radford Transit, or other regional transit providers.
- Consider how to support equity and community well-being and how to serve people without car access.
- Important to consider the accessibility of bus stops and routes.

Measure of a successful transit system:

- Good reliability and convenience
- Transit signal priority, or bus rapid transit strategies
- Bus stops in good condition with ADA access
- System designed around where students live and can easily use it
- Additional buses at the beginning of the semester
- Re-examine routes that have been taken out of service to see if they are needed now. Consider additional fixed routes
- Change perception of transit to something that is useful for everyone
- Reduction of cars on the road, more buses on the road
- Bus fleet is all electric
- Successful relationship with state/federal partners

Trends shaping the future of transit in the region:

- Growth in grad student population, additional growth after 2028
- More online instruction and expansion of remote work
- Rising housing costs are pushing people out of the "traditional" neighborhoods and outside of towns
- Growth along Peppers Ferry, Falling Branch Corporate Park, and other industrial centers
- Autonomous vehicles and other new technology
- Students not bringing cars to campus; increase in micro-mobility use
- Uncertainty of transit funding

Potential tradeoffs:

- Access is more important than frequency
- Quicker trips are a priority

2.2 | Transit Demand and Underserved Areas

Several criteria that affect transit demand must be considered to understand transit in the Towns of Blacksburg and Christiansburg. Transit demand is influenced by land use and development patterns, population and employment density, other socioeconomic factors, and the relationship

between the cost of housing and transportation. Transit demand can drive the need to enhance existing service while also highlighting underserved areas that are either not served or served frequently enough. When the results of the transit demand analysis are compared to the existing BT service, the findings help identify opportunities for service modifications.

2.2.1 Transit Demand and Underserved Area Evaluation

Land Use and Development Patterns

Development in the Towns of Blacksburg and Christiansburg are heavily driven by VT. In Blacksburg, the concentration of the university population has historically driven transit demand. With various routes connecting central campus to residential areas, the area is already well-served, and supply is geographically meeting demand. In Christiansburg, the new developments near U.S Route 460 Bypass provide a framework for communities that may desire transit service in the future. The opportunity to strengthen the connection between the two towns will provide more opportunities for the people of Montgomery County.

Town of Blacksburg

The Town of Blacksburg developed a Comprehensive Plan in 2021 outlining their transportation goals. The Town is shifting to a more multi-modal transportation system that prioritizes less impactful modes, such as transit, cycling, and walking. Additionally, the Town aims to improve their regional connections to the greater New River Valley, including Christiansburg.

The Comprehensive Plan outlines the Town of Blacksburg's future plan for development and land use, shown in Appendix B section 2.2.1. The population has increased 12 percent since 2000 and that growth is reflected in the plans for future development. The Town identified areas in and around the town that would benefit from introduced or improved transit service, including:

- High employment areas, including the VT campus, Corporate Research Center, Blacksburg Industrial Park, Hospital/U.S. Route 460 Business Corridor, and the retail/service corridors which includes downtown, North Main Street, Prices Fork Road, South Main Street, and University City Boulevard.
- Urban/walkable neighborhoods with higher density that are close to the employment and commercial centers, including neighborhoods around downtown, and the original Sixteen Squares.
- Multi-unit residential neighborhoods that are located just beyond the urban/walkable neighborhoods and employment areas, including the triangle bordered by North Main Street, Turner Street NW, and Prices Fork Road (Downtown Northwest), and the area comprised of the North Main Street, Progress Street NW, and Kabrich Streets areas (The Fork). While these neighborhoods are primarily off-campus student housing, the development of multi-family residential uses for non-students are also encouraged.

Town of Christiansburg

The Town of Christiansburg updated their Comprehensive Plan in 2016. Transportation priorities include improving access to transit and increase the convenience of transit service while maintaining safety, reliability, and efficiency (Town of Christiansburg Comprehensive Plan TRN 1.1); and promoting the integration of bus, rail, air, and other modes of travel into the Christiansburg transportation system.

The Town of Christiansburg identified four Urban Development Areas (UDA) in which it plans to focus future growth, shown in Appendix B Section 2.2.1. These locations would be preferable for expanded transit service, as they are close to existing development and have opportunities for increased density in the future. The UDA's include:

- Cambria UDA: located in the general business district along Cambria Street
- Downtown UDA: located in the area within North Franklin, Depot, First and Main streets
- Institute UDA: located along N Franklin Street
- Mall UDA: located at the intersection of N Franklin Street and Peppers Ferry Road

Montgomery County

Montgomery County developed a Comprehensive Plan in 2004, which outlines their future land use, shown in Appendix B Section 2.2.1. Montgomery County aims to avoid sprawl from the Towns of Blacksburg and Christiansburg as well as the City of Radford into the rural areas. As the population grows in Montgomery County, two-thirds of future development will be concentrated within the Towns. The remaining future development in the County will be in focused in the following areas:

- Urban Development Areas: Adjacent to City of Radford, and U.S. Route 460
- Urban Expansion Areas: Adjacent to the Town of Blacksburg, the Town of Christiansburg, and the City of Radford
- Village/Village Expansion Areas: Belview, Elliston/Lafayette, Plum Creek, Prices Fork, Riner, and Shawsville

There is currently no transit service in Montgomery County outside of the town limits of Blacksburg and Christiansburg. Expansion beyond the town limits will require a partnership agreement between BT and the County. An update to the Comprehensive Plan is expected to be adopted in December 2025.

VT

VT utilizes its 2018 Comprehensive Campus Plan to guide growth. With a sustainability goal of reducing campus emissions to 80 percent of 1990 levels by 2050, VT aims to prioritize multi-modal travel, including transit, biking, and walking. VT and the Town of Blacksburg have developed specific actions to facilitate this modal shift, including:

- Blacksburg Transit is building a new Transit Center on Perry Street. The facility will include 17 bus bays on two loops, with bicycle and pedestrian amenities. The transit facility will provide a centralized area for all routes and improve ease of use for passengers. It is expected to open in late 2024.
- VT is relocating central on-campus parking to the periphery of campus to encourage the use of other travel modes.

More information on future plans for transit and parking on Virginia Tech's campus can be found in Appendix B Section 2.2.1.

Population Density and Growth

Identifying areas of population density for both existing and future conditions plays a critical role in deciding where to concentrate transit service and how the network should change over time. Overall, fixed route public transportation is often most efficient when connected to high-density

population and employment centers. Placement of transit service within one-fourth to half a mile of densely populated areas increases the ability of transit to serve a variety of trip purposes and destinations for travelers. According to the Transit Cooperative Research Program (TCRP) Transit Capacity and Quality of Service Manual, 2nd Edition, a population density of three households/acre or four jobs/acre are sufficient to support an hourly fixed-route transit service.

Existing Population Data

Figure 1 shows the existing 2019 census-block level population density for the BT service area. Green shaded areas indicate areas of low population density, yellow and orange shows moderate density, while red shows highly populated areas. Areas that meet or exceed the TCRP recommended threshold for fixed-route transit service in the BT service area include:

- Town of Blacksburg:
  - VT campus
  - Prices Fork Road
  - Main Street
  - Residential areas in Shenandoah/Main-Patrick Henry
- Town Christiansburg
  - N Franklin Street, Farmview Road NE, Oak Tree
  - Residential areas on Republic Road
  - Residential areas on Main Street
  - Residential areas on Roanoke Street

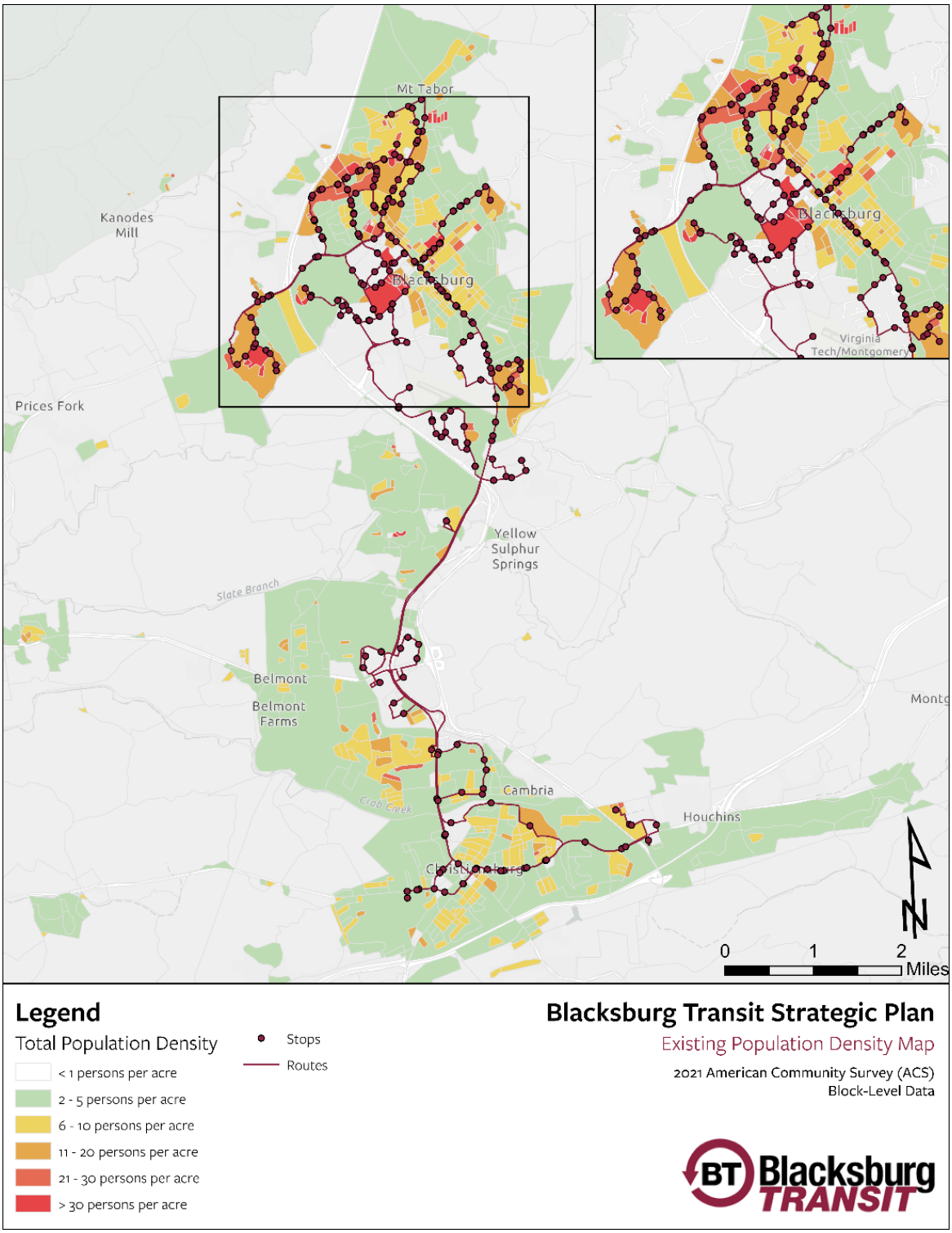
2.2.2 Future Population Forecasts

BT's service area is expected to experience population growth in the next several years as Blacksburg's population is expected to grow alongside increased VT enrollment numbers. The New River Valley Metropolitan Planning Organization (NRV MPO) maintains a travel demand model with the Virginia Department of Transportation (VDOT) that is used to forecast travel conditions and behavior. Figure 2 illustrates the travel demand model's assumptions for growth for the BT service area from 2016 to 2045.

Areas of high population growth include:

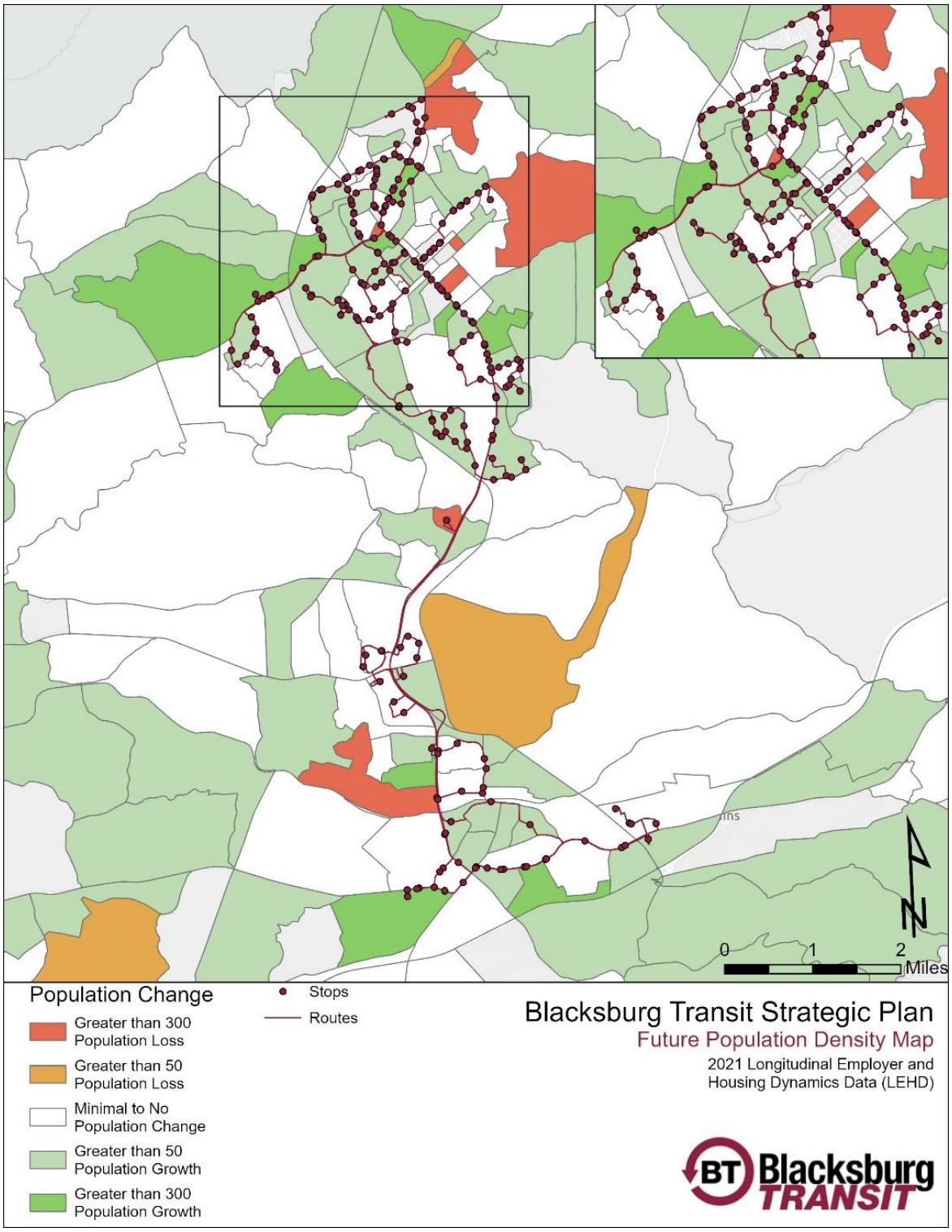
- Town of Blacksburg
  - Prices Fork Road
  - VT campus
- Town of Christiansburg
  - Residential areas around the hospital
  - Radford Street
  - Roanoke Street

Figure 1: Existing Population Density by Acre



Source: ACS, 2021

Figure 2: Forecast Population Change 2016 to 2045



Source: LEHD, 2021

Employment Density and Growth

Employment is traditionally one of the key drivers of transit fixed-route ridership because of regularity of commuting to consistent work locations. While changes in employment and labor market trends are still developing as a result of the COVID-19 pandemic, concentrations of employment, especially classified employment such as retail where in-person work is still encouraged, are still a strong indicator of transit demand.

Existing Employment Data

Figure 3 shows the distribution of employment density in and around the existing Blacksburg Transit service area.

Areas with high employment density include:

- Town of Blacksburg
    - VT campus
    - Airport Acres
    - Virginia Tech Corporate Research Center
    - Main Street
    - University City Boulevard
    - LewisGale Hospital Montgomery
- Town of Christiansburg
    - Uptown Christiansburg Shopping District
    - Northgate Village
    - Roanoke Street
    - Montgomery County Public Schools
    - East Main Street

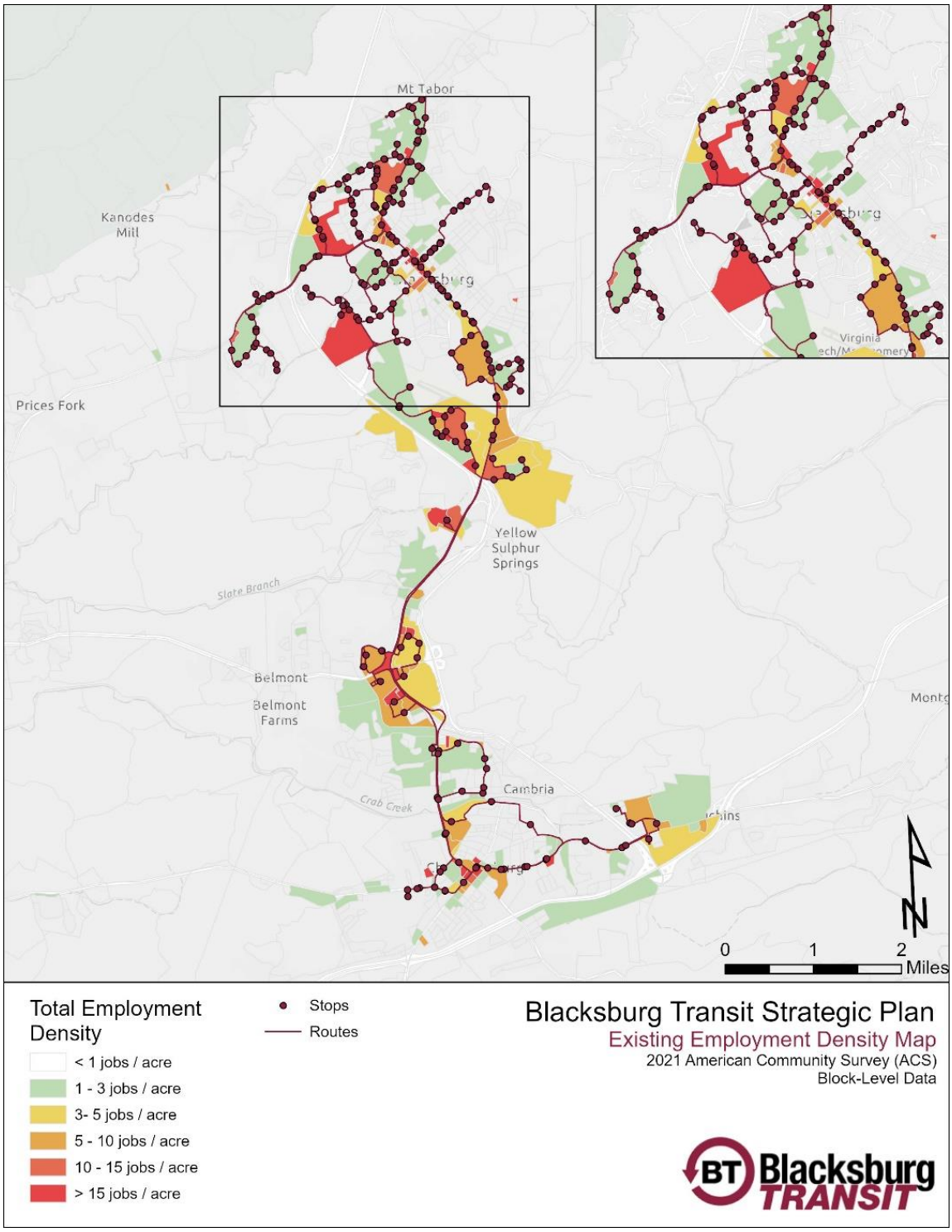
Future Employment Forecasts

Figure 4 illustrates the forecast employment growth in the New River Valley model by Transportation Analysis Zone (TAZ).

Areas that are projected to increase their overall employment include:

- Town of Blacksburg
    - VT Campus
    - Airport Acres
    - Toms Creek Road
    - LewisGale Hospital Montgomery
- Town of Christiansburg
    - Uptown Christiansburg Shopping District
    - Roanoke Street

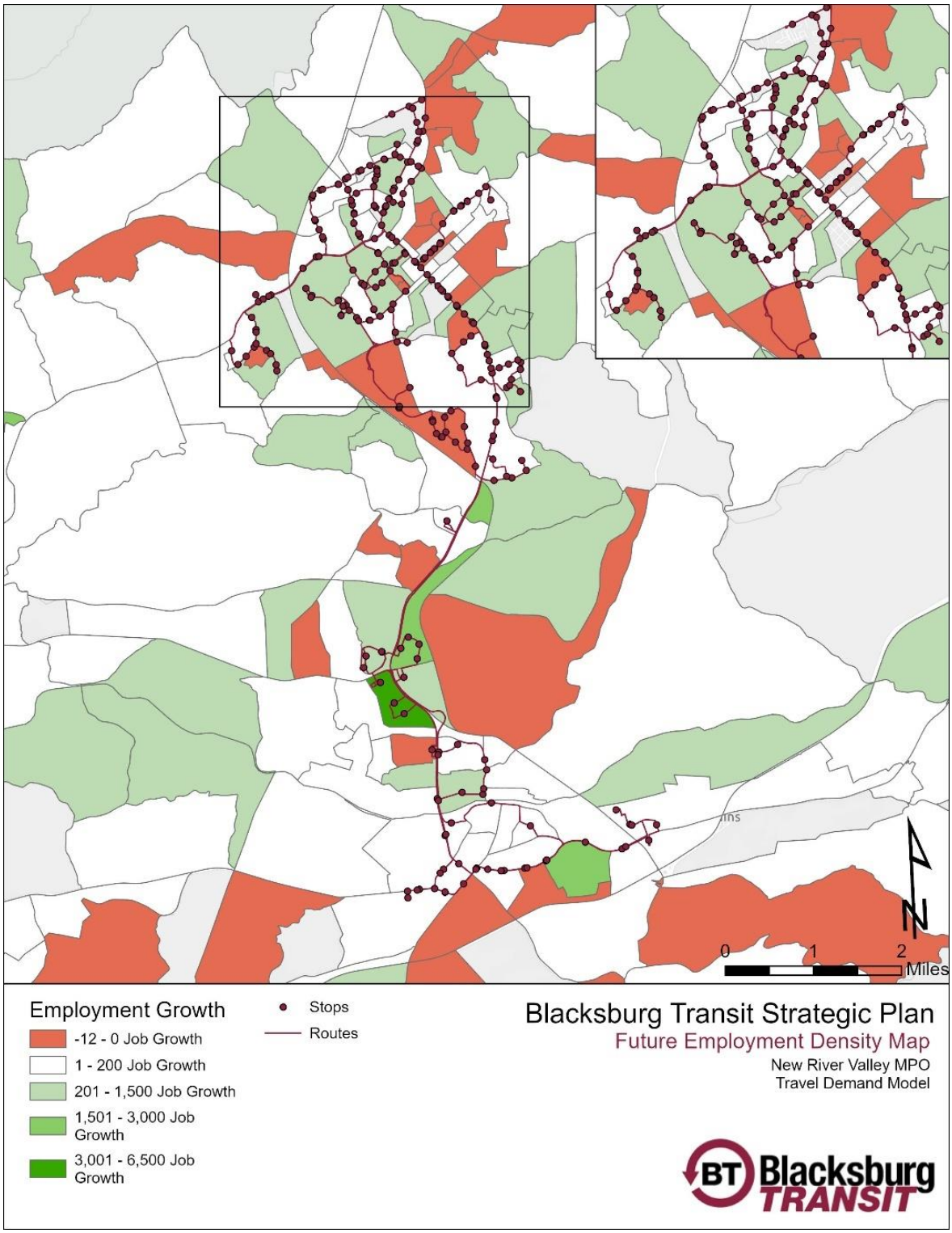
Figure 3: Existing Employment Density



Source: ACS, 2021

1. VT Employment Center is displaying at a nonstandard location on this figure. Job density shown for VT may not account for all jobs on campus.

Figure 4: Future Employment Density



Source: NRV MPO Travel Demand Model

Demographics and Socioeconomic Factors

The propensity of residents of the Town of Blacksburg, the Town of Christiansburg, and Montgomery County to ride transit are influenced by a variety of demographic and socioeconomic factors: adult (65+) populations, populations 18-years and younger, populations enrolled in college, people with disabilities, Limited English Proficiency (LEP) population, low-income households, minority populations, and households without access to a vehicle. Overlaying this data with the existing BT network helps to examine how well the existing service serves these populations. More information on demographic information within the service area can be in Appendix B Section 2.2.1. This demographic information was used to determine transit propensity.

Transit propensity is a composite index that utilizes key demographic and socioeconomic factors described above to determine areas that may have a need for fixed route transit service. Transit propensity models identify opportunities for service based on a collection of certain need-based factors. By combining areas where these need-based populations live into a single index, BT can determine whether its service is adequately covering areas where passengers rely more heavily on bus service for their transportation needs.

Transit propensity for BT is calculated by combining data for certain demographic categories from the 2021 ACS data at the block group-level. Within the model, block groups are ranked and weighted based on the categories in Table 3. This calculation results in a score for each block group based on the population density, employment density, no vehicle households, people with disabilities as well as youth and senior populations they have, as compared to neighboring block groups.

Table 3: Transit Propensity Weights

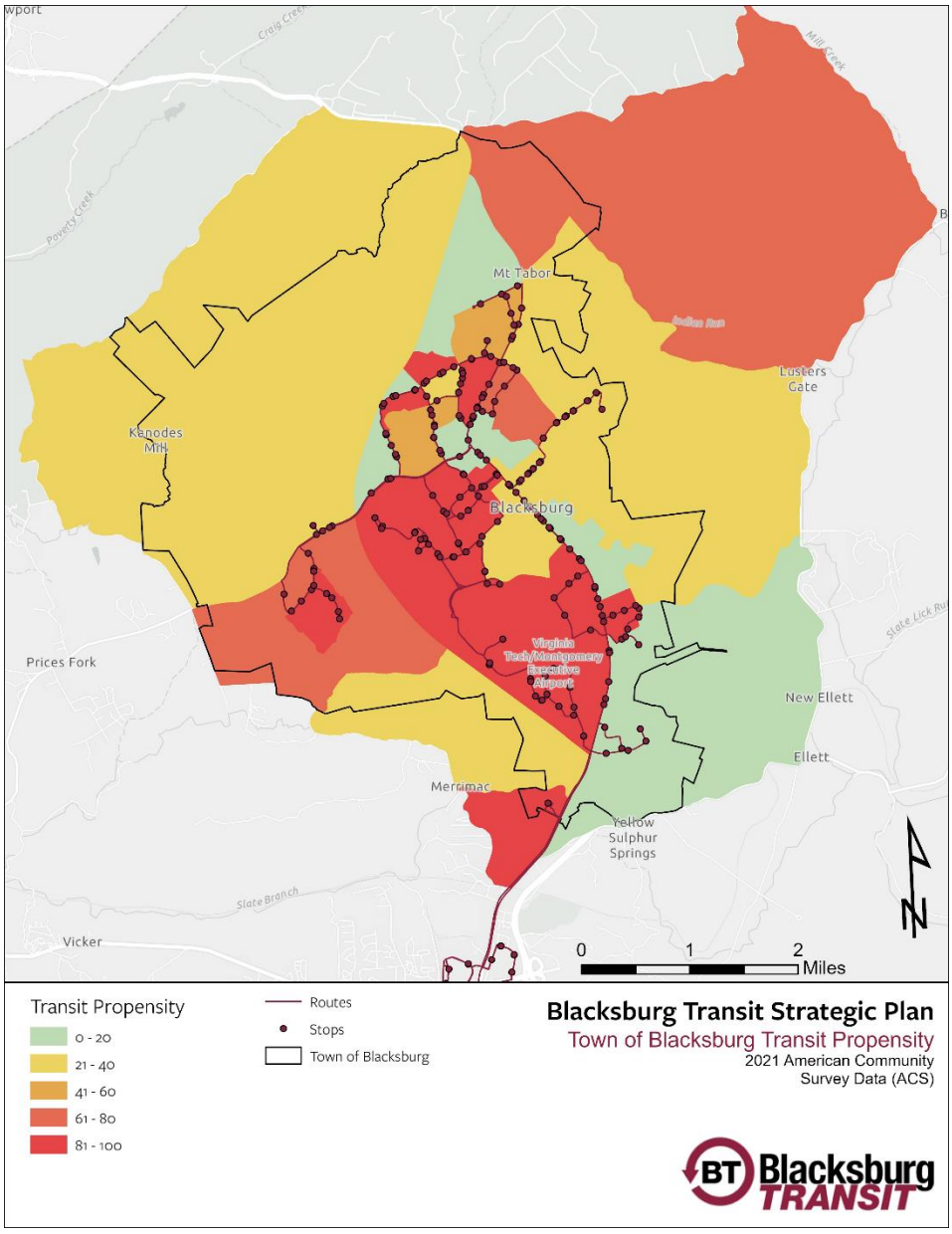
Category	Weight
Population Density	30%
Employment Density	20%
% No Vehicle Households	20%
% of People with Disabilities	10%
% of Low-income Households	10%
Age	10%

Figure 5 shows the transit propensity for the census block groups within and immediately surrounding the Town of Blacksburg. The transit propensity for the Towns of Blacksburg and Christiansburg were calculated separately using the same weight to avoid higher concentrations of populations in the Town of Blacksburg skewing the smaller demographics of the Town of Christiansburg. Areas of notable high transit propensity in the Town of Blacksburg include:

- Downtown Blacksburg west of Main Street with high amounts of population, employment density and youth population
- Area between North Main Street and Mt. Tabor with high propensity scores for low-income households and population density
- Hethwood-Prices Fork with high propensity scores driven by low-income, senior and youth populations

- Areas north of Patrick Henry Drive and West of Toms Creek Road comprised of low-income and high population density
- Farmview-Ramble along Research Center Drive comprised of low-income and zero-vehicle households

Figure 5: Town of Blacksburg Transit Propensity

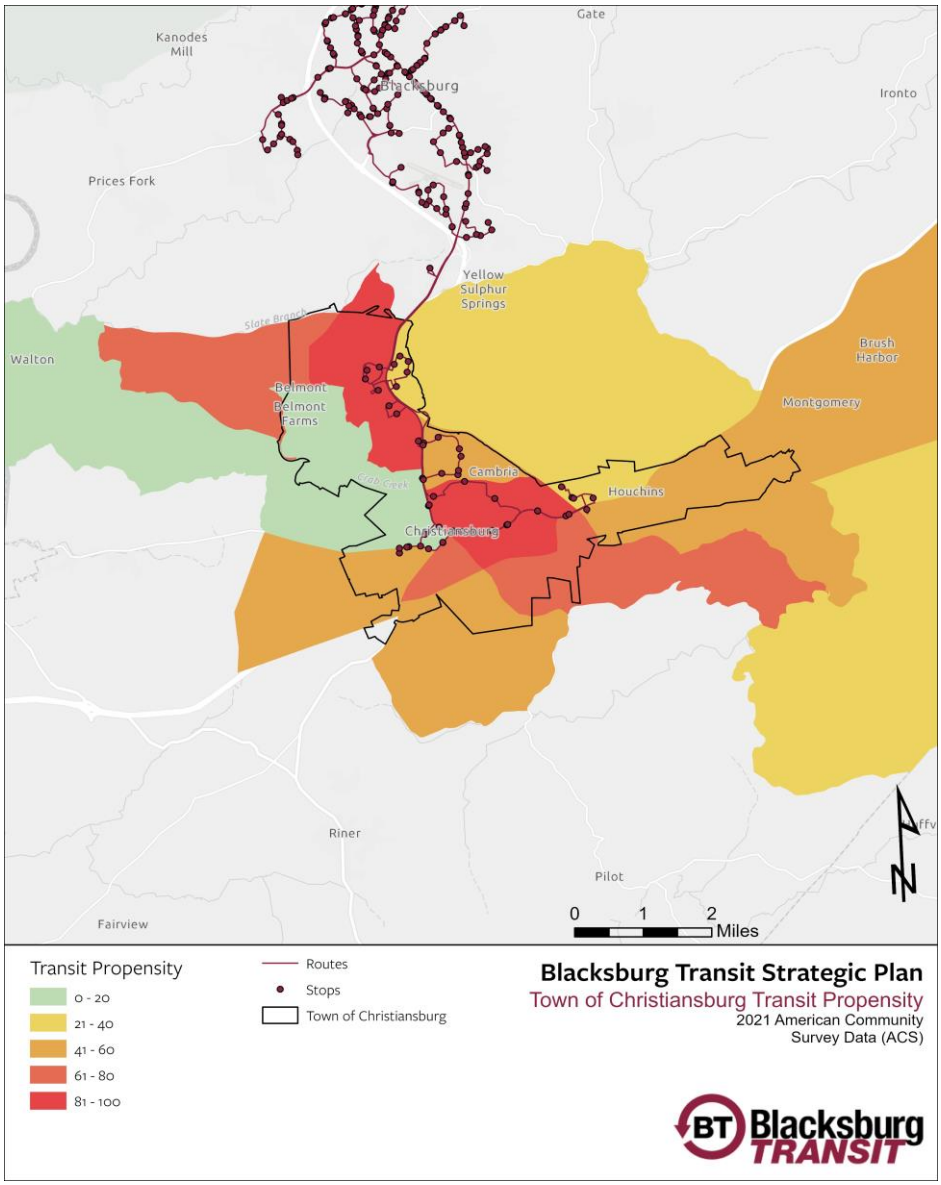


Source: ACS, 2021

Figure 6 illustrates the transit propensity for the Town of Christiansburg which include areas of high propensity in the following areas:

- Residential neighborhoods north of Roanoke and Franklin Streets driven mostly by high population density and zero vehicle households relative to other areas in the Town of Christiansburg
- Commercial areas along North Franklin Street and Peppers Ferry Road with high propensity driven by the concentration of employment density
- Belmont Farms area with transit propensity driven by population density and senior and youth populations
- Residential areas south of Roanoke Street immediately east and west of the 460 Bypass with moderate amounts of employment density and youth and senior populations

Figure 6: Town of Christiansburg Transit Propensity



Source: ACS 2021

2.2.2 Travel Market Data

Methodology

This analysis used Replica to analyze travel information and patterns. Replica is a third-party dataset that uses GPS, cellphone, and other anonymized location-based sources to model travel patterns. This data is available at the census block level. In Replica, typical trip data is sourced for Thursdays and Saturdays in the Fall of 2022 and validated using real-world conditions. Replica provides insight into travel patterns for the Towns of Blacksburg and Christiansburg and across the greater region. The data can be disaggregated into categories including trip by purpose, trip length,

trip duration, trip mode taken, and trip start and end times which helps supplement public survey and outreach results.

Replica provides anonymized, demographic data on trip takers including age, race, ethnicity, income, home location, and employment. As a tool, Replica is useful for understanding the characteristics of the population within the transit service network. When combined with origin and destination data, the demographic data can be visualized in a variety of ways. This level of granularity allows the concerns of specific customers by location to be fulfilled. The travel data considered as part of this analysis is divided into two major categories of trips taken:

- Trips originating within Montgomery County
- Trips originating outside of and terminating within Montgomery County

The trips starting within the Towns of Blacksburg and Christiansburg can be further broken into trips that stay within the town boundaries and surrounding counties and those that end externally.

More information on travel market data can be found in Appendix B Section 2.2.2.

2.2.3 Travel Patterns

Travel patterns can describe when, why, or how people move between destinations. Understanding travel patterns can help identify specific locations, times of day, or trip purposes that occur throughout the region. Travel patterns can also illuminate peak periods of travel. Additional information on travel patterns can be found in Appendix B Section 2.2.3.

Trip Start Time

The trip start time identifies when people are trying to get to a new destination and the trip origin can describe where people are coming from. This information can be used to identify the peak travel times with the highest potential of ridership. The following observations can be made:

- The weekday morning peak is between **6:00 a.m. and 9:00 a.m.** The weekday evening peak is between **2:00 p.m. and 5:00 p.m.**
- On the weekend, most trips occur between 1:00 p.m. and 5:00 p.m.

Average Trip Duration

Average trip duration data shows typical travel times by mode. The following observations on trip durations in the service area are outlined below:

- Transit trips typically last the longest
- The typical public transportation trip is around **21 minutes** between 6:00 a.m. and 8:00 p.m.
- The peak evening period for all trips is between 3:00 p.m. and 8:00 p.m. for a typical weekday and a typical weekend.
- After 8:00 p.m. there are more public transportation trips than other modes
- At 1:00 a.m. on a typical weekday, auto-passenger and on-demand trip durations peak likely due to the surge in longer rideshare trips like for Uber and Lyft.

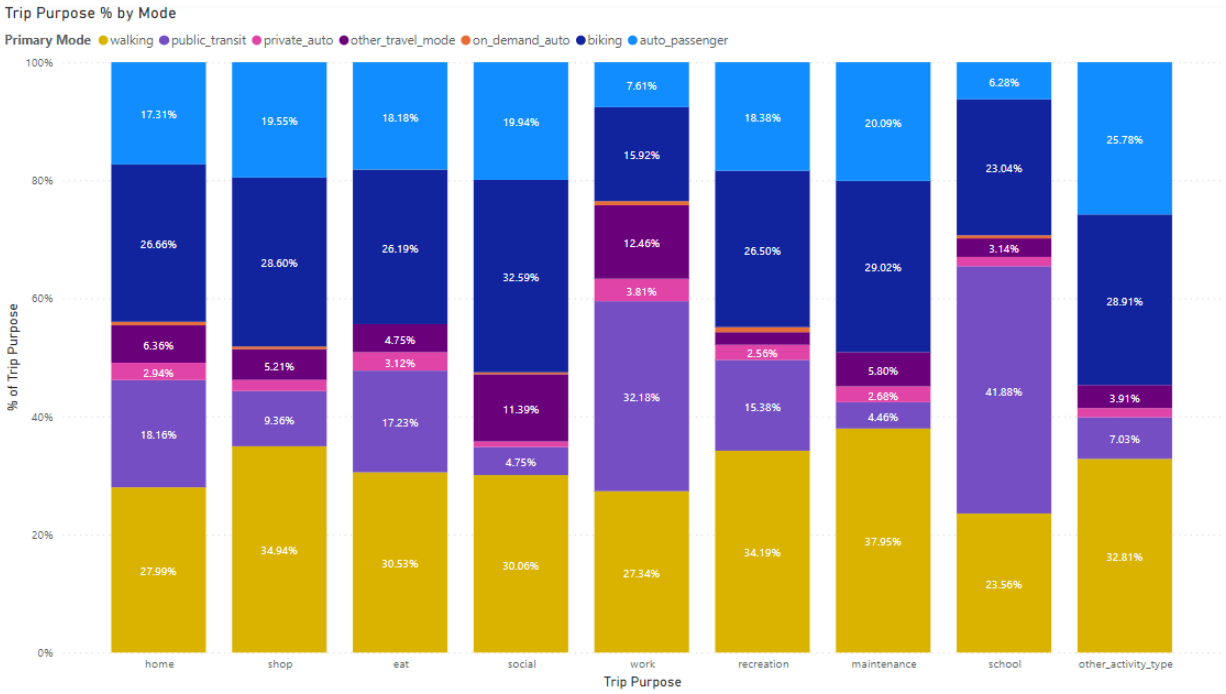
2.2.4 Travel Purpose

The following section builds on the foundation of the Travel Demographic and Travel Demand section. Not only is each unique trip observed in the trip data tied to socioeconomic data, but it is also tied to trip purpose information. Trip purpose can include trips to and from home, work, shopping, school, social, recreation, and lodging. The individual trip purpose data may also be attributed to the origin and destination land use. In this analysis, travel purpose can be broken down by demographic attribute and travel time preference to understand how public transportation may differ between typical weekday and weekend trips. This process allows BT to fill gaps in data for the travel needs of transit passengers and County residents.

Understanding what time of day travel is occurring is vital to identifying the role public transportation can have in the region. BT service could be adjusted to better service transit passengers or shift service to address unmet demand. The Replica data can provide further insight into the start and end time of trips taken and the trip distance and duration.

In Figure 7, the trip purpose by travel mode for zero vehicle and low-income households is shown. For zero vehicle and low-income households, public transportation trips increase across all trip purposes including home (18 percent), shopping (9 percent), eating (17 percent), social (4 percent), work (32 percent), recreation (15 percent), school (41 percent), and other activity types (7 percent).

Figure 7: Trip Purpose by Travel Mode Split (Zero Vehicle and Low-Income Household)



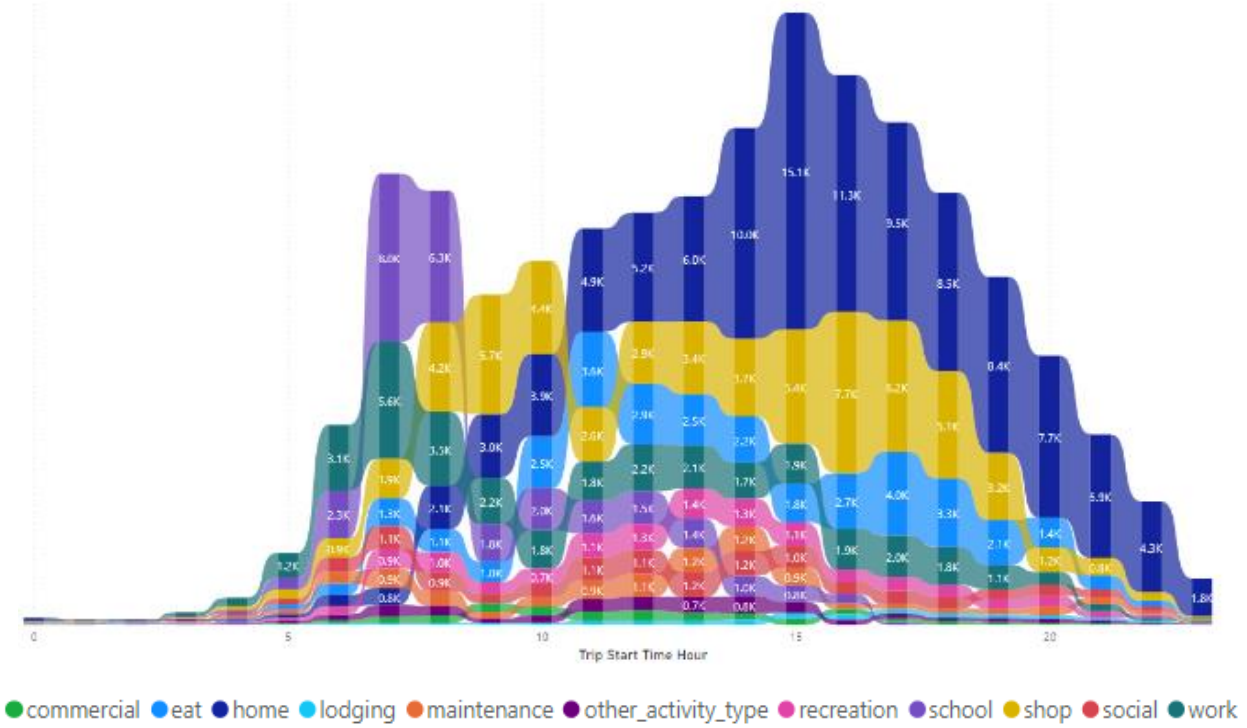
Source: Replica 2022

Figure 8 show trip purpose by time of day for trips starting and ending in Montgomery County on a typical weekday. The different colored bands represent the number of people traveling for each

purpose category at each hour of the day. The key observations from trip purpose by time of day on a typical weekday include:

- There are more than **319,000 trips** taken during the typical weekday
- The majority of travel purposes are comprised of trips to home (35 percent), followed by shopping (18 percent), work (11 percent), eating (10 percent) and school (8 percent)
- Typical weekday travel patterns follow a morning and afternoon peak with the highest travel demand occurring at 7:00 a.m. and 3:00 p.m.
- Weekday school trips, which include trips to all educational institutions, are concentrated between 6:00 a.m. and 8:00 a.m. then gradually decrease throughout the day
- Weekday shopping trips increase after the peak commute period around 8:00 a.m. to 10:00 a.m.
- Weekday home trips become the primary trip type around 11:00 a.m. as the majority of travel shifts to traveling from various errands and other activities to home. This can be used to balance BT's midday and off-peak service by putting more emphasis on trips to home from shopping, eating, and schools.

Figure 8: Trip Purpose by Start Hour (Weekdays)



Source: Replica 2022

Trip purpose by destination block group for weekday and weekend trips starting and ending in Montgomery County was analyzed. Detailed graphics can be found in Appendix B Section 2.2.4 This data can be used to determine the level of activity at major trip destinations and serve as a preview

of the origin-destination travel patterns. This trip purpose information will also be used to align routes to serve travel needs in Chapter 3 of the TSP. Key observations include:

- There is a large volume of daily trips destined for the Town of Blacksburg mostly comprised of trips to work, home, shopping, social, and recreation.
- Trip purpose and destination on weekends in the Town of Christiansburg is focused around the Uptown Mall in Christiansburg for shopping and in the commercial area along North Franklin St.
- Weekend shopping activity increases outside of the Town of Blacksburg at the Uptown Mall in Christiansburg and commercial areas along North Franklin St. This could represent an opportunity for BT to increase service to these activity centers for retail, eating, and employment.
- Areas such as the Gables Shopping Center and University City Boulevard, offer a variety of trip destinations and purposes for passengers and could be a candidate for more service accessibility.

2.2.5 General Travel Market Data Observations

Understanding the travel patterns of Montgomery County provides valuable insight into the mobility needs of the County. As a form of transportation, public transit in the Towns of Blacksburg and Christiansburg reflects both choice and captive ridership. While the primary mode of transportation in the County is private-auto, the impact that BT has on the region is apparent in the data as it provides the primary means of transportation to many travelers. The key observations from this analysis include:

- The average trip distance by primary modes across all trip purposes except commercial is less than seven miles
- The average age of public transportation passengers in Montgomery County is 21 years-old
- The peak trip start times on a typical weekday and weekend occur between 6:00 a.m. and 9:00 a.m. and 2:00 p.m. and 5:00 p.m.
- During weekdays, the majority of trips originate from education, single-family, and retail land use types. This represents an opportunity for transit to serve areas with educational land uses specifically around the weekday peak at 3:00 p.m. to a variety of trip destinations throughout the late afternoon and evening.

2.2.6 Origin-Destination Analysis

Origin-destination data provides an overview of travel patterns to and from specific locations that may be used to determine where transit can serve a particular market. Building off of previous sections, the origin-destination flows are divided into separate analyses that correspond with specific trip characteristics including low-income, zero-vehicle households, older adults, and trip purpose. The corresponding visuals can be found in Appendix B Section 2.2.6. The origin-destination flow data will be used to align BT's service with major trip destinations and along highly traveled corridors. If there is a gap between existing service and travel flow, it will be noted at the end of this section.

All Trips

When considering daily trips that start and end in BT's service area, approximately:

- 7,500 trips start and end in Downtown Christiansburg
- 5,200 trips start and end near the Gables Shopping Center in Blacksburg
- 3,100 trips travel to apartment complexes between University City Boulevard and VT's campus
- 2,600 trips start and end near the University Mall Shopping Center in Blacksburg
- 4,800 trips start and end near the intersection of Prices Fork Road and Main Street in Blacksburg

Work Trips

Work trips ending in Blacksburg Transit's service area show that the largest number of work trips take place between Virginia Tech and areas north of campus. There are more than 3,300 daily round trips involving campus.

Home Trips

Regional trips to home show the following:

- The most frequent origin-destination pairs for home travel generally extend from VT to nearby neighborhoods in the northern part of the Town of Blacksburg.
- From VT's campus, there are more than 22,000 daily departing home trips.
- From northern Town of Christiansburg, there are more than 18,400 daily departing home trips.
- From areas west of VT's campus, there are approximately 7,100 departing home trips.

Home trips ending in BT's service area show the following:

- In surrounding areas of the Town of Blacksburg, there are a large number of departing home trips, specifically to the areas north of VT's campus.
- In downtown Christiansburg, there are more than 7,400 departing home trips.

School trips

In the Town of Blacksburg, VT is a major destination for school trips. Other schools in the area include the public schools in the Towns of Blacksburg and Christiansburg. School trips show the following:

- VT has a total of 14,800 round trips with 6,400 incoming trips from surrounding areas.
    - Approximately 4,000 of the incoming trips are originating from areas north of campus
    - Of the 6,400 incoming trips, 2,100 of those trips are coming from the Town of Christiansburg

Low-Income Households

The trips taken by lower-income households in the Towns of Blacksburg and Christiansburg are predominately taken using public transportation. The following summary highlights the key takeaways when considering trips made by people from households making less than $15,000:

- From VT's campus, there are a large number of trips moving between central campus and areas north of campus. This area is concentrated with apartment complexes.
- Along Prices Fork Road, the area around Hethwood has 3,300 incoming and departing trips.

- In the Town of Christiansburg, approximately 500 trips occur between the areas directly north and south of Peppers Ferry Road. This area is predominately commercial and retail locations where lower-income employment opportunities are present. Surrounding the commercial and retail areas are apartment complexes.

Public Transportation Trips

The number of internal or round trips using public transportation occurring on VT's campus is around 2,000 trips a day, with approximately 5,000 incoming and outgoing trips a day. The primary movement is between areas north of VT's campus and central campus. Based on this dataset, the trips between the Towns of Blacksburg and Christiansburg are a relatively small portion of the existing trips taken using public transportation. The trips in northern Christiansburg reflect a small number of trips with nearly 150 incoming and outgoing trips. This analysis reflects the existing ridership is strongly made up of VT students. The opportunity to capture more trips in the Town of Christiansburg is possible if BT can provide more frequent service to areas of interest.

2.2.7 Transit Demand and Underserved Area Opportunities for Improvement

Land Use and Development

Most areas that have planned future development in the Towns of Blacksburg and Christiansburg are currently covered by BT. Some areas with potential opportunities for improvements to future BT service include the following:

- LewisGale Hospital Montgomery/U.S. Route 460 Business Corridor
- VT's planned student housing additions, including Glade Road Mixed Use Village, Creativity and Innovation District housing, New Slusher, Oak Lane District, and Upper Quad
- VT's future developments that may be significant trip generators for transit include Alumni Mall at the Integrated Design Building, Creativity and Innovation District Commons, Global Systems Science Commons, and the 21st Century Living-Learning District Commons
- Town of Christiansburg's existing commercial hubs, including Peppers Ferry Road/North Franklin Street, Eastern Roanoke Street, and the Radford Street Corridor
- Town of Christiansburg's four UDAs, including the Cambria UDA (located in the general business district along Cambria Street), the Downtown UDA (located in the area within North Franklin, Depot, First and Main streets), the Institute UDA (located along North Franklin Street), and the Mall UDA (located at the intersection of North Franklin Street and Peppers Ferry Road)

Demographic and Future Growth Data

Many of the areas with high concentrations of VT students are covered by existing BT service. Some areas with potential opportunities for increased future BT service include the following:

- Prices Fork Road (Town of Blacksburg) is partially served by CRB, HWA, HWB, and HWD, however further west along Prices Fork Road there are high concentrations of population 18-years or younger, LEP populations, and older adult populations not currently served by BT.
- The Belmont Farms residential area in Town of Christiansburg and the residential areas near Uptown Christiansburg Shopping Center, has high concentrations of population 18-years or younger, people with disabilities and older adult populations, but is not currently

served by BT fixed routes. The Two Town Trolley (TTT) and both Explorer routes serve a small segment of Peppers Ferry Road NE, but do not currently extend west to serve residential areas.

- The residential areas in Merrimac by the LewisGale Hospital Montgomery, has high concentrations of disadvantaged populations not currently served by BT. The TTT does serve the hospital but service does not extend to the residential areas.

Travel Pattern Data

While the majority of trips in Town of Blacksburg are to/from VT's campus, there are several high-volume trip locations where transit service can be improved in the larger BT service area and regionally, including:

- Downtown Christiansburg (7,500 trips)
- Gables Shopping Center (5,200 trips)
- Apartment complexes between University City Boulevard and VT's campus (3,100 trips)
- University Mall Shopping Center (2,600 trips)

Other travel pattern behavior data on transit passengers and traveler preferences can help inform future transit design including:

- School and work trips in the wider service area occur mostly in the morning from 7:00 a.m. to 9:00 a.m. while shopping and errands become the dominant trip category in the early afternoon after 1:00 p.m. If resources are available, more transit service could target retail and commercial destinations during the afternoon to help serve more diverse traveler purposes.
- Public transportation trips average around 22-minutes for various trip purposes compared to private-auto at 18-minutes and biking at 28-minutes. Transit trips may compete or attract passengers with those modes where travel time is higher or near equivalent by targeting transit travel times to major social, shopping, school, and employment destination less than 20-minutes.

2.3 | Performance Evaluation

2.3.1 Performance Evaluation

Understanding the performance of BT's services is imperative in order to understand the system as a whole and spotlight both the routes that are underperforming and areas where the system as a whole can improve. Performance evaluation considers the operations that BT conducts and how many miles, hours, and dollars it has to expend in order to offer the best possible service. This analysis looks at performance metrics for service area characteristics, operational statistics, ridership, revenue, and cost.

In accordance with DRPT's Performance Based Operating Assistance Allocation Guidance, this analysis includes the following performance metrics:

- Ridership
- Passengers per Vehicle Revenue Mile
- Passengers per Vehicle Revenue Hour
- Operating Cost

- Operating Cost per Vehicle Revenue Mile
- Operating Cost per Vehicle Revenue Hour
- Operating Cost per Passenger

Fixed Route Operating Measures

Table 4 and Table 5 show the operating expenses and performance measures for BT at a system-wide level.

- Operating expenses and ridership increased each year, barring a two-year period from FY 2020 to FY 2021 where operating expenses remained stable.
- During the COVID-19 pandemic, BT suspended fares temporarily. Fares were eliminated permanently in December 2022.
- The number of unlinked passenger trips increased steadily until 2019. Ridership decreased substantially due to the COVID-19 pandemic. In FY 2022, ridership grew to 70 percent of pre-pandemic levels.
- Operating expenses per trip increased in 2021 and 2022 due to the decrease in ridership from the COVID-19 pandemic.
- Passenger trips per revenue mile and revenue hour peaked at 4.1 and 41, respectively in 2019, but decreased to 3.1 and 32.6, respectively from the COVID-19 pandemic.

Table 4: Operating Measures Five-Year Trend

Operational Measure	2017	2018	2019	2020	2021	2022
Operating Expenses	$7,884,961	$8,535,642	$9,136,254	$9,336,473	$9,301,702	$9,966,111
Fare Revenues	$1,939,551	$2,102,297	$2,413,700	$1,690,721	$ -	$ -
Annual Unlinked Trips	3,734,989	4,057,334	4,659,053	3,557,261	810,758	3,267,836
Annual Vehicle Revenue Miles	945,587	1,039,319	1,147,826	1,058,018	1,082,589	1,050,017
Annual Vehicle Revenue Hours	95,483	105,570	113,580	102,121	104,799	100,137

Source: National Transit Database (NTD)

Table 5: Performance Measures Five-Year Trend

Performance Measure	2017	2018	2019	2020	2021*	2022*
Operating Expenses per Passenger Trip	$2.11	$2.10	$1.96	$2.62	$11.47	$3.05

Performance Measure	2017	2018	2019	2020	2021*	2022*
Operating Expenses per Vehicle Revenue Mile	$8.34	$8.21	$7.96	$8.82	$8.59	$9.49
Operating Expenses per Vehicle Revenue Hour	$82.58	$80.85	$80.44	$91.43	$88.76	$99.52
Passenger Trips per Vehicle Revenue Mile	3.9	3.9	4.1	3.4	0.7	3.1
Passenger Trips per Vehicle Revenue Hour	39.1	38.4	41.0	34.8	7.7	32.6
Farebox Recovery Ratio	24.6%	24.6%	26.4%	18.1%	0%	0%

Source: National Transit Database (NTD)

* Operated with zero fare in 2021 and 2022

Peer Service Comparison

A peer comparison was conducted to understand the efficiency and effectiveness of BT service with respect to similar agencies across the country and in the Commonwealth of Virginia. The peer comparison provides a quantitative comparison between similar agencies to highlight opportunities to improve transit service and identify challenges in the region.

A selection process using National Transit Database data, as well as a review of local transit development plans was conducted to identify BT peers. Peers that were ultimately selected possessed several, but not always all, of the following selection criteria:

Similar city characteristics:

- Urban area population is between 60,000–150,000
- System serves a college or multiple colleges with total undergraduate enrollment between 5,000–30,000 students
- Regional destinations to neighboring towns and cities with 10–20 miles

Similar services provided:

- Vehicle revenue miles between 300,000–1,000,000 (2021)
- Vehicle revenue hours between 15,000–100,000 (2021)
- Standard bus vehicles operated in maximum service is 4–40 (2021)
- Provides fixed-route service or fixed-route deviated service

Similar agency makeup

- Total facilities between zero and three
- Only Virginia agencies

Table 6 and Table 7 compares BT system totals to various peers around the Commonwealth of Virginia operating similar service based on the attributes listed above. Key comparisons to other systems include:

- Overall, Blacksburg Transit operates service with similar market characteristics to many of its peers in Virginia, focused on service to a moderate-sized with a major university within a rural county. However, Blacksburg Transit's service efficiency compared to its service area far outranks any of its peers within Virginia at 150.2 trips per acre, whereas other transit systems, even those with similar populations and university ridership only reach a maximum of 68.6.
- Blacksburg Transit ranks among the highest in Vehicle Revenue Miles per Acre (48.3) and Vehicle Revenue Hours per Acre (4.6) illustrating the high level of service it focuses within the Town of Blacksburg, Virginia Tech, and surrounding communities. Peer systems in Virginia often focus on coverage over a wider service area which may contribute to less concentration of service spread over a wider area. This is also represented by the amount of operating expenses BT uses to concentrate service over a smaller area ($458.00) which ranks highest among Virginia peer systems.
- Table 7 shows Blacksburg Transit ranks as one of the most efficient systems among its peers in operating expenses per passenger trip at $3.0 per trip whereas the peer average is $10.8. This can be attributed to BT's high unlinked passenger trips per annum than other systems.
- Blacksburg Transit ranks in-line with its peers on operating expenses per vehicle revenue mile and vehicle revenue hour, representing that the operating costs (driver pay, fuel, administration) does not exceed the level of service BT provides.
- Blacksburg Transit ranks significantly higher than its peers in passengers per revenue mile (3.1) and passengers per revenue hour (32.6) than its peers showing it serves the high demand of transit riders in Blacksburg well and may have an additional need to expand capacity to ensure there is sufficient service.

Table 6: Service Area Based Peer Comparison

Performance Measure	BT	Peer Average	Radford Transit	Charlottesville Area Transit	Greater Lynchburg Transit Company	City of Harrisonburg
Service Area (Acres)	21,760	27,360	6,400	24,320	58,880	19,840
Passenger Trips/Acre	150.2	36.0	20.3	47.6	7.6	68.6
Vehicle Revenue Miles/Acre	48.3	34.0	50.5	29.3	18.2	38.0
Vehicle Revenue Hours/Acre	4.6	3.3	5.2	3.1	1.3	3.8
Operating Expenses/Acre	$458.00	$274.5	$261.3	$404.4	$133.6	$298.9

Source: National Transit Database (NTD FY 2022)

Table 7: Operating Expense and Passenger Based Peer Comparison

Performance Measure	BT	Peer Average	Radford Transit	Charlottesville Area Transit	Greater Lynchburg Transit Company	City of Harrisonburg
Operating Expenses per Passenger Trip	$3.0	$10.8	$12.9	$8.5	$17.6	$4.4
Operating Expenses per Vehicle Revenue Mile	$9.5	$8.6	$5.2	$13.8	$7.4	$7.9
Operating Expenses per Vehicle Revenue Hour	$99.5	$92.0	$50.6	$132.1	$105.8	$79.6
Passenger Trips per Vehicle Revenue Mile	3.1	1.1	0.4	1.6	0.4	1.8
Passenger Trips per Vehicle Revenue Hour	32.6	10.9	3.9	15.5	6.0	18.2

Source: National Transit Database (NTD)

Safety

Six years of safety performance data (2017-2022) is available for BT from the National Transit Database (NTD). NTD defines the formal conditions of a reportable incident as a fatality, injuries requiring medical attention away from the scene for one or more people, or property damage greater than or equal to $25,000.

As outlined in Chapter 1, BT has outlined a set of safety performance targets in their Public Transit Agency Safety Plan (PTASP) in accordance with Federal Transit Administration regulations. In the agency's most recent Safety Plan, the following measurable safety performance targets were established as a benchmark for the overall safety performance of the agency outlined in Table 8.

Table 8: BT Safety Standards

Safety Standard	Fixed-Route Measure
Fatalities (total number of reportable fatalities per year)	0

Fatalities (rate per total vehicle revenue miles by model)	0
Injuries (total number of reportable injuries by year)	5
Injuries (rate per total vehicle revenue miles by mode)	Less than 0.5 injuries per 100,000 vehicle revenue miles
Safety events (total number of safety events per year)	10 (Fixed Route) 1 (Demand Response)
Safety events (rate per total vehicle revenue miles by mode)	Less than 1 reportable event per 100,000 vehicle revenue miles
Distance between Major Failures	10,000 miles
Distance between Minor Failures	3,200 miles

Table 9 and Table 10 show the total reportable events by NTD category as well as the rate for each category per 100,000 miles of service as established in the BT safety standards. Though accidents and reportable events have increased in FY 2022, the rate for injuries and events remains below 0.5 and 1.0 per 100,000 miles of vehicle revenue service. Total injuries also fall below the target of five per year. Demand response service has had no reportable events in the NTD data.

Table 9: NTD Safety Measure Rate Totals (Fixed Route)

NTD Safety Measure Totals	2017	2018	2019	2020	2021	2022
Reportable Events	3	1	0	3	1	3
Reportable Events Rate	*.31*	*.10*	-	*.28*	*.09*	*.28*
Fatalities	0	0	0	0	0	0
Fatalities Rate	-	-	-	-	-	-
Injuries	1	0	0	1	0	0
Injury Rate	*.11*	-	-	*.08*	-	-

Source: NTD

Table 10: NTD Safety Measure Totals (Demand Response)

NTD Safety Measure Totals	2017	2018	2019	2020	2021	2022
Reportable Events	0	0	0	0	0	0
Fatalities	0	0	0	0	0	0
Injuries	0	0	0	0	0	0

Source: NTD

Route Evaluation

Table 11 shows service performance by route for FY2022 Full Service Weekdays; when Blacksburg Transit runs the majority of its service during the Virginia Tech academic year. Rankings are provided to contextualize which routes have the most and least service per category. The metrics are also color coded with blue indicating favorable and red indicating higher and lower operating metrics of routes per category. Blue generally indicates better service with routes that rank highly

in the number of daily trips as a good indicator of importance to BT's overall system. Initial findings include:

- Routes such as the Corporate Research Center, Toms Creek, Harding Avenue, Main Street North, Main Street South, and University City Boulevard run the most daily revenue hours in the BT system all averaging above 25 daily revenue hours. These are distinct from all other routes in the system average around 11 daily revenue hours. Daily revenue hours are a product of each route's service span and the number of buses required to run the service, and with most of BT's routes running a minimum of 10-hour days, the differentiation between routes with high and low revenue hours most likely comes from the number of buses assigned to each route.
- Revenue Miles are also influenced by the number of vehicles and length of route. Longer BT routes such as the Corporate Research Center, Main Street North and Main Street South have higher daily revenue miles based off of the number of miles they accumulate when running a longer trip. Routes that have moderate to high revenue miles but shorter route lengths such as Toms Creek, Heathwood A and B represent routes that don't accumulate high revenue miles from route length, but rather the high frequency and level of service they have in a more confined area. These moderate length routes with high revenue miles should be treated as important as longer length routes with lower levels of service.
- Similarly routes with low levels of service and low revenue miles may not be the core of BT's network, but play a limited role in connecting neighborhoods and gaps during offpeak hours. If there is no penalty to operations and runtimes, combining these routes may help increase accessibility by offering less transfer and more direct trips for riders.
- The Toms Creek, Hethwood, Progress Street, Patrick Henry, and University City Boulevard routes have the highest number of daily trips in the system. The number of trips per route often indicates the importance of a route in a system, since it is a product of the headways, service span, and number of vehicles assigned to the route. Running a high number of trips typically is prioritized by the transit agency to ensure coverage for its core ridership.

Table 11: Service Performance by Route (Full Service Weekdays)

Route	Daily Revenue Hours		Daily Revenue Miles		Number of Daily Trips	
	Total	Rank	Total	Rank	Total	Rank
Campus Shuttle	11.3	17	125.7	18	51	17
Carpenter Boulevard	11.2	19	102.5	19	92	12
Corporate Research Center	29.9	1	385.0	1	120	11
Explorer Blue	11.3	18	159.2	13	11	20
Explorer Gold	10.79	20	151.3	14	11	20
Harding Ave	28.1	3	271.9	6	154	8
Hethwood A	25.3	6	297.6	2	177	2
Hethwood B	23.9	10	273.1	5	177	2
Hethwood D	2.8	21	33.4	21	14	19
Hokie Express	25.1	9	216.6	8	157	7
Main Street North	26.9	4	292.0	3	130	10
Main Street South	26.9	4	292.0	3	137	9
Main Street Givens	11.6	16	174.8	12	71	15
Patrick Henry	25.2	8	204.7	10	176	4
Patrick Henry B	11.7	13	98.2	20	92	12
Progress B	11.6	15	136.0	16	46	18
Progress Street	23.5	11	144.5	15	170	5
South Main Airport Road	11.7	14	135.6	17	75	14
Toms Creek	28.2	2	245.3	7	184	1
Two Town Trolley	14.2	12	210.0	9	60	16
University City Boulevard	25.3	7	197.8	11	170	5
Average	**18.9**		**197.5**		**108.3**	

Source: BT FY 2022 Service Data

Table 12 reports data used for the primary method of assessing the effectiveness of transit routes against BT's service standards: passengers per revenue hour for Full Service weekdays. As indicated in section 2.1, BT fixed route Full Service weekday passenger productivity performance standard is divided into four categories:

- Excellent (> 150 percent of Town of Blacksburg Full Service weekday average)
- Good (100 – 150 percent of Town of Blacksburg Full Service weekday average)
- Satisfactory (50 – 100 percent of Town of Blacksburg Full Service weekday average)
- Marginal (<50 percent of Town of Blacksburg Full Service weekday average

Additional breakouts for the Town of Christiansburg Explorer and Demand Response modes were also included to account for their differing service structures. While specific routes that did not meet their assigned service standard are identified in Table 14, BT's general productivity data included the following points:

- In FY 2022, Toms Creek had the best route productivity with 2,651 daily passengers, 94.1 passengers per revenue hour, and 10.8 passengers per revenue mile. Other routes such as the Hethwood routes, Main Street North, Progress Street, and University City Boulevard rank at the top in daily passengers and passengers per revenue hour and mile, illustrating that they are effectively serving passengers throughout the length of their route.
- Ridership is generally balanced between routes that run in similar areas such as Hethwood A and Hethwood B. However, there are some imbalances in passenger service efficiency between routes that serve similar corridors and segments such as Toms Creek and University City Boulevard, as well as Patrick Henry Drive and Patrick Henry B. These route imbalances, likely due to directional travel and rider preference, will be further explored in section 2.4.
- The worst performing routes for the entire system include Explorer Blue and Explorer Gold which average 1.9 passengers per revenue hour and 0.1 passengers per revenue mile. However, as noted in Table 15, these routes are subject to different route performance standards for the Town of Christiansburg.
- The worst performing of the Blacksburg-focused service includes the Campus Shuttle, South Main Airport Road, Main Street Givens and Progress Street B. All fall well below the system average of 37 passengers per service hour and 4.0 passengers per service mile. These routes could be examined for potential modifications in Chapter 3.

Table 12: Service Productivity by Route (Full Service Weekdays)

Route	Daily Passengers		Pass. /Rev Hour		Pass. /Rev Mile	
	Total	Rank	Total	Rank	Total	Rank
Campus Shuttle	47	19	4.2	19	0.4	19
Carpenter Boulevard	285	13	25.4	12	2.8	11
Corporate Research Center	538	12	18.0	14	1.4	14
Explorer Blue	22	20	1.9	21	0.1	21
Explorer Gold	22	20	2.0	20	0.1	20
Harding Ave	750	10	26.7	11	2.8	12
Hethwood A	1,928	2	76.1	2	6.5	5
Hethwood B	1,552	6	65.0	6	5.7	6
Hethwood D	52	18	18.7	13	1.6	13
Hokie Express	1,213	9	48.4	7	5.6	8
Main Street North	1,277	7	47.5	8	4.4	9
Main Street South	1,277	7	47.5	8	4.4	9
Main Street Givens	134	16	11.5	17	0.8	18
Patrick Henry	1,647	4	65.3	5	8.0	4
Patrick Henry B	554	11	47.2	10	5.6	7
Progress B	184	15	15.8	16	1.4	15
Progress Street	1,616	5	68.6	3	11.2	1
South Main Airport Road	134	16	11.4	18	1.0	17

Route	Daily Passengers		Pass. /Rev Hour		Pass. /Rev Mile	
	Total	Rank	Total	Rank	Total	Rank
Toms Creek	2,651	1	94.1	1	10.8	2
Two Town Trolley	236	14	16.6	15	1.1	16
University City Boulevard	1,657	3	65.4	4	8.4	3
Average	**846.4**		**37.0**		**4.0**	

Source: BT FY2022 Service and Ridership Data

System Accessibility

Route accessibility, or availability, is measured through population and employment coverage within a one-fourth to half a mile of transit stops. As discussed in the Transit Propensity section of 2.2, transit should also be accessible to subsets of the population who may be more reliant on transit for their daily transportation demands. Table 13 includes data on which population and demographic category are covered within one-fourth of a mile of BT stops by unique route. These categories include population, population density, minority and LEP populations as well as household and job attributes. The percentage for each category indicates how much of the route's total population or employment qualifies as that specific demographic.

Initial findings for route accessibility include:

- The lowest population reached among non-regional BT routes is Main Street South (MSS), which has high job density. If there is an opportunity to connect MSS to residential without forcing a route transfer, it could provide more direct connections to off-campus commercial and employment opportunities.
- The Hethwood routes have the highest concentration of minority and LEP populations; specific outreach and communications to these areas may be appropriate.
- Over 65 and under 18 populations are concentrated in the Town of Christiansburg primarily utilizing the Go Anywhere and BLU and GLD Explorer Routes.
- Low-income households are highest on the Hethwood routes as well as Patrick Henry, Toms Creek and University Boulevard routes averaging more than 60 percent of the route population, however a portion of the population on those routes are students.
- There is little coverage of zero-vehicle households, which may be under-reported because of the transient student population and permanent household data. However around 35 percent of households system-wide have access to one vehicle, with vehicles being most available on routes that run to communities on the periphery of the Town of Blacksburg such as Hethwood (HWA/HWB/HWD), South Main Airport Road (MSA), and the Two Town Trolley (TTT).
- The majority of routes in the Town of Blacksburg have average populations enrolled in college exceeding 75 percent, with some exceeding 85 percent. Longer routes, such as MSS and MSA serve a more varied population with only 61 percent enrolled in college.
- 75 percent of jobs that can be accessed via routes within the Town of Blacksburg are service jobs, the largest employer being VT. In the Town of Christiansburg, around 20 percent of jobs are accessible by the Explorer (BLU/GLD) or TTT.
- Most BT routes, excluding express and regional services, have stops placed slightly more frequently than the design standard for average passenger stop spacing of 1,000–1,200 feet.

Routes with stops exceeding this standard include: HDG, MSA, MSG, MSN, MSS, PHB, and PHD.

Table 13: Blacksburg Transit Route Accessibility (0.25 miles to stops)

Blacksburg Transit - American Community Survey (ACS) 2021 within .25 miles of stops																		
Route	Population	Population Density (per sq. mi.)	Minority	Hispanic	Limited English Proficiency	Over 65	Under 18	House-holds	Low Income	Zero Vehicle	One Vehicle	Jobs	Enrolled in College	Job Density (per sq. mi.)	Service	Commerical	Industrial	Avg. Stop Spacing (ft.)
BLU	6,745	1,924	14%	5%	1%	16%	20%	3,323	26%	5%	33%	7,521	8%	2,145	73%	23%	3%	1,830
CRB	9,074	8,689	29%	7%	2%	1%	1%	557	52%	11%	34%	1,349	95%	1,292	90%	7%	2%	1,579
CRC	10,196	4,561	28%	6%	2%	1%	1%	753	25%	3%	49%	4,199	93%	1,878	70%	3%	27%	1,618
GLD	5,313	1,916	14%	4%	1%	14%	20%	2,580	25%	5%	32%	6,710	7%	2,419	71%	22%	7%	2,282
HDG	8,196	7,208	25%	6%	2%	4%	4%	1,930	34%	5%	31%	1,655	79%	1,456	90%	8%	2%	758
HWA	8,917	6,043	30%	7%	5%	2%	6%	2,115	46%	5%	48%	1,458	80%	988	93%	5%	2%	1,612
HWB	11,942	7,843	29%	7%	4%	2%	4%	2,034	45%	5%	47%	1,493	85%	981	92%	6%	2%	1,503
HWD	9,879	5,788	30%	7%	5%	2%	6%	2,438	45%	5%	48%	1,575	78%	923	92%	6%	2%	1,510
HXP	9,590	8,227	29%	7%	2%	0%	1%	195	13%	3%	29%	4,311	100%	3,698	98%	1%	0%	1,225
MSA	7,496	4,437	23%	6%	2%	6%	9%	2,713	32%	5%	41%	2,830	61%	1,675	79%	17%	4%	836
MSG	9,725	7,015	27%	6%	2%	3%	7%	3,393	59%	9%	28%	2,624	71%	1,893	53%	11%	35%	918
MSN	10,077	6,831	27%	6%	2%	3%	7%	3,545	59%	9%	28%	2,765	71%	1,874	52%	11%	37%	854
MSS	7,514	3,820	23%	6%	2%	5%	9%	2,742	32%	5%	42%	4,197	61%	2,134	70%	12%	18%	909
PHB	16,517	11,109	30%	6%	2%	1%	5%	4,222	65%	10%	28%	2,318	84%	1,559	51%	11%	39%	964
PHD	10,086	7,467	28%	7%	2%	2%	6%	3,585	65%	9%	28%	2,687	76%	1,989	53%	11%	36%	858
PRG	9,990	8,537	29%	7%	2%	2%	7%	3,723	65%	11%	30%	2,557	78%	2,185	62%	9%	29%	1,011
TC	17,827	9,472	31%	6%	2%	2%	4%	4,194	64%	13%	31%	3,438	85%	1,827	72%	9%	20%	1,102
TTT	4,170	2,682	23%	7%	2%	8%	5%	995	32%	6%	41%	5,038	72%	3,240	74%	25%	1%	4,510
UCB	13,124	8,478	31%	6%	2%	2%	6%	4,172	66%	13%	30%	3,010	81%	1,944	65%	10%	24%	1,157
Total (19)	44,960	3,502.3	25.6%	5.8%	2.5%	6.4%	10.5%	16,955	42.3%	7.0%	35.1%	24,311	56%	1,894	75.0%	13.2%	11.8%	1,423

Source: ACS, 2021 and Blacksburg Transit GTFS

Bus Stop Evaluation

BT tracks its stop-level ridership through the Automatic Passenger Counter (APC) system. The data provides a summary of boardings and alightings per stop for each route, allowing BT to monitor, calculate where crowding might occur, or classify stops as boarding or alighting stops based on their usage.

This boarding data also can help determine the need for bus stop amenities based on utilization outlined in the service design guidelines. For example in the Town of Blacksburg, a stop with 200 percent of the average boardings during reduced service should qualify for a shelter, and a stop exceeding 100 percent of the reduced service boarding average should qualify for a bench. Similar metrics were established for the Town of Christiansburg based on the average stop boardings for the Town of Christiansburg stops.

The highest total boardings and alightings per stop arrival for APC data from October and July 2022 was analyzed. Additional data on boardings and alightings is contained in Appendix B Section 2.3.1. Ridership per stop arrival is normalized for the amount of service that each stop receives. This allows analysis into whether a stop requires more or less service based on its productivity, not just the number of passengers.

The average boarding and alighting for stops in July is 0.2, while the average in October, during full service, is 1.3. Notable stops and observations include:

- Stops identified as time checks, both on and off campus, retain high relative ridership during full and reduced service.
- Burruss Hall, the Village at Patrick Henry Westbound, Squires Eastbound have the highest number of boardings and alighting.

- Kelly Hall averages more alightings per service trip than boardings as seen in the total data.
- The ratio of boardings to alightings per trip during July reduced service is closer to 1:1 than in October full service at many of the stops in the network. During the school year, riders typically board throughout the route and ride the entire length of the route to campus, increasing average load on the bus throughout all stops. In the summer period, trip lengths are shorter and boardings are more intermittent.

Route Deviations

Route deviations on the Explorer routes were recorded from a period of October 2022 to January 2023. Total deviations averaged 17 per month. While the frequency of these deviations does not indicate the demand for fixed route service at this time, this should continue to be monitored. Locations of deviations include the following:

- Super 8 Motel–Roanoke Street
- Sheetz–North Franklin Street
- Fairview Street at Loret Lane
- Days Inn–Roanoke Street
- Haymaker Street
- Wingate Hotel–Roanoke Street
- Shell Station–Roanoke Street

2.3.2 Performance Based Opportunities for Improvement

The performance evaluation of routes shows us where there are underperforming routes that might require additional resources and attention in order to operate more efficiently and reliably.

As outlined in the performance standards in section 2.1, service for BT routes is considered excellent if it is greater than 150 percent of the full service weekday systemwide average in terms of passengers per revenue hour for a typical Full Service Weekday. The route is considered good if it is between 100-150 percent of the average. Satisfactory service ranges between 50-100 percent of the average. Marginal service is in cases where the passengers/revenue hour value for the route is less than 50 percent of the systemwide average. For Blacksburg, the Full Service Weekday system average is 49.1 for passengers per revenue hour.

The Town of Christiansburg service is considered excellent if it has more than 3.5 passengers per revenue hour, good between 2.5 and 3.5 passengers per revenue hour, and marginal at less than 2.5 passengers per revenue hour. Unlike Blacksburg's system average, this is recommended to be calculated for all service periods as service and ridership is distributed throughout the year.

The tables below show which category the routes fall in within the Town of Blacksburg and within the Town of Christiansburg. Those that are in the marginal category should be evaluated further to determine if service should continue or be modified on that route. Additional analysis and service justification may be required to continue the operations of these routes.

Table 14: Passenger Productivity Service Standard Adherence by Route–Town of Blacksburg

Route	Passengers/Rev Hour	Performance Standard
Campus Shuttle	4.2	Marginal
Carpenter Boulevard	25.4	Satisfactory
Corporate Research Center	18.0	Marginal
Harding Ave	26.7	Satisfactory
Hethwood A	76.1	Excellent
Hethwood B	65.0	Good
Hethwood	18.7	Marginal
Hokie Express	48.4	Satisfactory
Main Street North	47.5	Satisfactory
Main Street South	47.5	Satisfactory
Main Street Givens	11.5	Marginal
Patrick Henry	65.3	Good
Patrick Henry B	47.2	Satisfactory
Progress B	15.8	Marginal
Progress Street	68.6	Good
South Main Airport Road	11.4	Marginal
Toms Creek	94.1	Excellent
Two Town Trolley	16.6	Marginal
University City Boulevard	65.4	Good
Average	**49.1**	

Source: BT FY 2022 Ridership and Service Data

Table 15: Passenger Productivity Service Standard Adherence by Route – Town of Christiansburg

Route	Passengers/Rev Hour	Performance Standard
Explorer Blue	1.67	Marginal
Explorer Gold	1.86	Satisfactory
Average	**1.76**	

Source: BT FY 2022 Ridership and Service Data

The systemwide average, shown at the bottom of Table 14, is 49.1 passengers per revenue hour. In absolute terms, this would require excellent service to have more than 73.6 passengers per revenue hour, good service between 49.1 and 73.6 passengers per revenue hour, satisfactory service between 24.6 and 49.1 passengers per revenue hour, and marginal service classified as having less than 24.6 passengers per revenue hour.

Based on the outline benchmarks, these routes are underperforming at a marginal level for the Town of Blacksburg service. Specific modifications to these routes can be identified to improve performance in Chapter 3—Planned Improvements.

- The Campus Shuttle
- Corporate Research Center
- Hethwood
- Main Street Givens
- Progress B
- South Main Airport Road
- Two Town Trolley

For the Town of Christiansburg service performance standards, the Explorer Gold route operates within the passenger per revenue mile performance standard, while the Explorer Blue route is marginal.

2.4 | Operating and Network Efficiency Evaluation

2.4.1 Efficiency Evaluation

The operating and network efficiency evaluation provides a measurable baseline for BT that can be used to identify operational improvements to the system. Route speeds and On-time Performance (OTP) identify where scheduling and routing can be adjusted to provide passengers more reliable service. Data from BT's Automatic Passenger Counters (APC) is used to identify route and trip-level efficiency by time period as well as areas of passenger crowding to setup future reallocation of scheduling and operational resources to mitigate overloading.

Each efficiency metric will be evaluated against the Town of Blacksburg's adopted performance standards included in Chapter 1 and section 2.1. Opportunities for improvement at the route, trip, or time period level identified from the BT performance standards, will serve as the foundation for more detailed planned service modifications in Chapter 3.

Reliability

Transit service reliability is measured by On-Time Performance (OTP), which is affected by many factors, including scheduling optimization, routing, boarding delays, traffic, fleet reliability and breakdown frequency. Factors that affect OTP such as scheduling, routing, and fleet maintenance is often within a transit agency's controls and can be improved by building more recovery and buffer time in the schedules, improved communications, operator training, alternate routing that avoids congested segments, and improving the reliability of buses.

BT's performance standards indicate reliability is measured by four categories of schedule adherence: good (>90 percent), satisfactory (85 percent-90 percent), marginal (80 percent-85 percent), and unsatisfactory (<80 percent). A trip on a route is considered on time if it departs between one minute early and three minutes late. BT's OTP data is reported at the route level by month and includes the percentage of early and late departures.

Figure 9 shows system-wide on-time performance by months in FY 2022. Observations from the system reliability include:

- August 2021 is the only month to fall into the unsatisfactory range according to the performance standards, with an average on-time departure of 78.86 percent. In August, the low OTP is driven by 18.8 percent of trips by late departures, while only 2.3 percent of trips depart early. This could be caused by a combination of the return to full service during the school year from the reduced schedule during the summer and the overcrowding of buses from students increasing dwell times.
- The best-performing months for OTP in FY 2022 are January 2022 and May 2022, with an average of over 90 percent OTP.
- August 2021 through January 2022 represent an upward trend in OTP at the system level, from 78 percent in August or "unsatisfactory" to 90 percent or "good" performance in January. The "good" performance in January is mainly driven not by the drastic reduction in late departures but by non-existent early departures in the data.
- During periods of reduced service, May–July, OTP is reported as "satisfactory," which indicates opportunities for improvement in reliability. During periods of reduced service, the number of early departures is also at its highest system-wide, which indicate that there is potential to adapt the schedule during periods of reduced service to balance the early arrivals.

Figure 9: FY 2022 Average On-Time Performance by Month

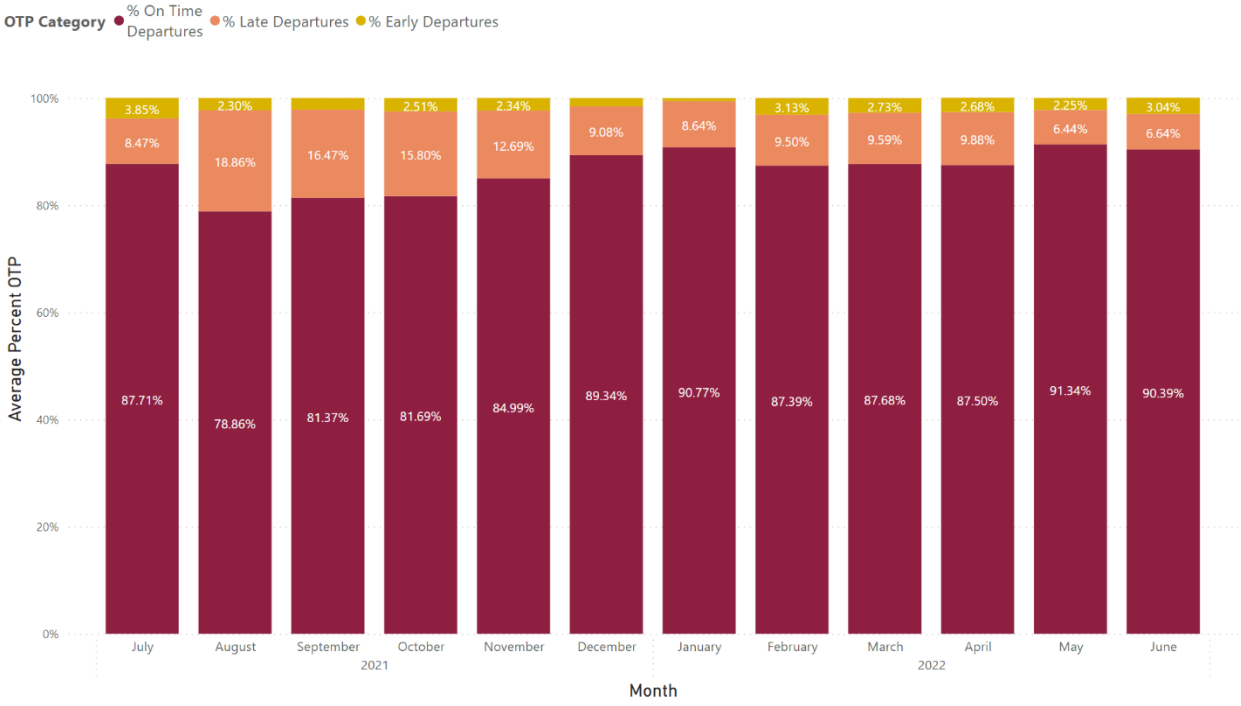


Figure 10 shows average OTP by route for FY 2022 including the percentage of on-time, late, and early departures. Areas where BT service is concentrated, such as Toms Creek, Main Street North, and Hethwood, generally report "satisfactory" to "good" on-time performance averages. However, differences in OTP are present between similarly scheduled routes that run shared patterns in the same areas such as Hethwood A and B, Patrick Henry Drive, and Patrick Henry B, as well as Progress Street and Toms Creek. While some of the variation between similar routes can be

explained by unique time periods and differences in service spans they serve, there is an opportunity to identify common areas where congestion and overloading affect BT routes.

Similar routes outside the downtown core of the Town of Blacksburg and VT have reported OTP lower than the system average, with most departing more than 10 percent late. This presents an opportunity to identify operational, technology, and scheduling enhancements for these routes, especially for those that operate less frequently, ensuring passengers do not miss essential connections.

The following routes' FY 2022 Average OTP are organized by performance into BT's adopted standards shown below:

- **Unsatisfactory:** Campus Shuttle, University Mall Shuttle, Progress B, and South Main Airport
- **Marginal:** Explorer Blue, Explorer Gold, and Two Town Trolley
- **Satisfactory:** Carpenter Blvd, Corporate Research Center, Hethwood, Hethwood A, Main Street North, Patrick Henry Drive, and Toms Creek
- **Good:** Harding Ave, Hethwood B, Hokie Express, Main Street South, Patrick Henry B, Progress Street, and University City Blvd.

Figure 10: FY 2022 Average Route OTP

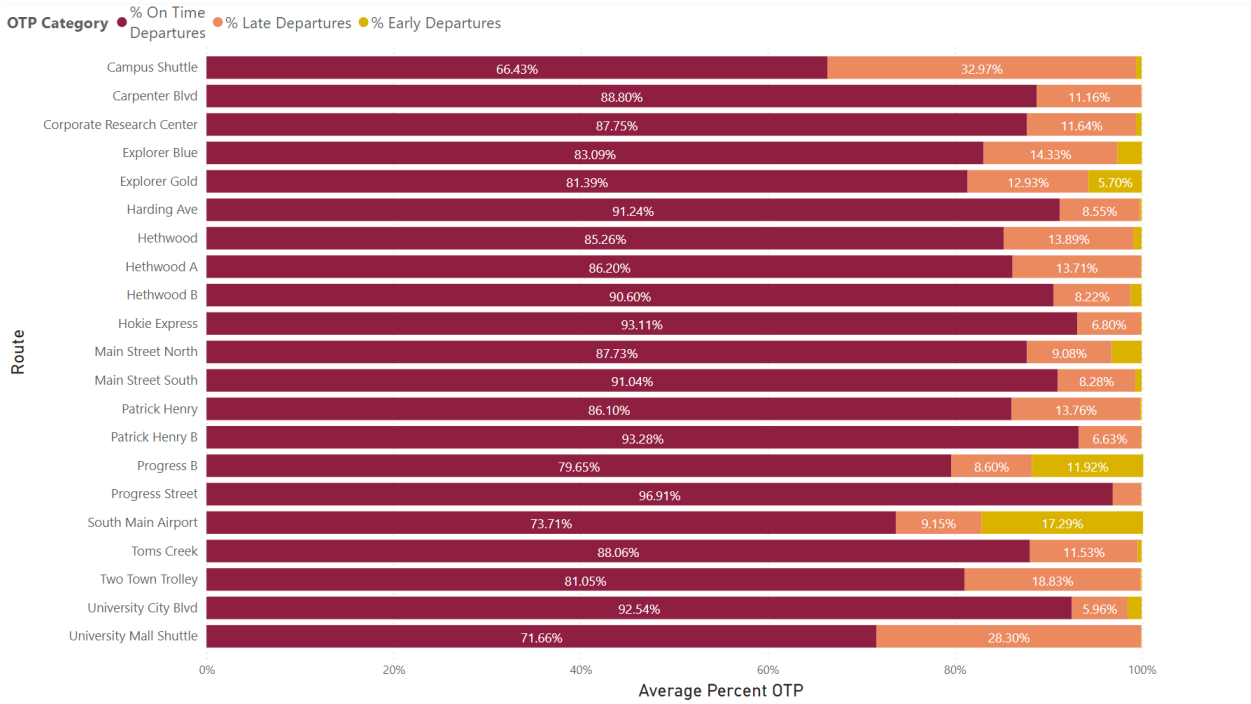


Table 16 shows Route OTP distribution by month for BT routes. The table reports average OTP per trip per route for each month, color-coded to fit into the BT performance standard categories of "unsatisfactory" (red), "marginal" (yellow), "satisfactory" (green) and "good" (blue).

Overall, OTP has been improving for all routes during FY 2022 with many routes reaching "satisfactory" or "good" levels of schedule adherence by January 2022. Some routes with lower OTP,

including the Campus Shuttle, was suspended in December of 2021 which improved system performance. Additional route-level observations include:

- Routes that serve downtown Blacksburg, the VT Campus, and neighborhoods such as McBryde, see degraded OTP between August and November of FY 2022. After January 2022, the OTP of these routes improves consistently to "satisfactory" or "good" levels. The trends reflect constraints experienced in the operating environment earlier in the fiscal year (staff shortages) and do not necessarily have a direct correlation with established operational or scheduling procedures.
- Routes such as the Explorer Blue, Explorer Gold, Hethwood, Progress B, South Main Airport, and Two Town Trolley increase in performance between August and December. Unlike the remainder of the system that continues to show improvement, these routes revert to "marginal" or "unsatisfactory" in January. The trends later in the fiscal year reflect route changes made out of necessity to address constraints in relation to staffing to continue service with the resources available and do not necessarily have a direct correlation with established operational or scheduling procedures.

Table 16: FY 2022 Monthly OTP by Route

	2021						2022					
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Campus Shuttle	76.9%	46.9%	64.5%	64.6%	79.2%							
Carpenter Blvd		79.1%	83.4%	86.7%	87.2%	89.1%	94.9%	91.9%	91.0%	90.6%	94.2%	
Corporate Research Center	89.1%	74.8%	80.3%	82.1%	85.9%	87.0%	93.8%	90.8%	92.6%	92.3%	94.1%	90.3%
Explorer Blue	95.5%	88.9%	83.1%	77.4%	83.9%	86.0%	82.2%	72.3%	69.5%	81.1%	88.0%	89.1%
Explorer Gold	61.7%	78.5%	82.5%	77.9%	77.2%	84.1%	95.4%	87.0%	81.0%	84.8%	84.5%	82.1%
Harding Ave	96.4%	81.9%	83.4%	87.7%	91.0%	94.6%	90.6%	90.3%	93.5%	92.6%	96.4%	96.6%
Hethwood	83.3%	87.4%	90.3%	75.7%	70.6%	89.3%	86.6%	87.5%	85.0%	79.5%	91.7%	96.4%
Hethwood A	90.9%	77.4%	74.1%	77.8%	85.0%	88.9%	84.0%	87.0%	89.0%	89.4%	94.8%	96.1%
Hethwood B	92.0%	82.1%	80.4%	87.4%	90.0%	94.3%	91.5%	92.5%	93.4%	94.3%	95.3%	94.1%
Hokie Express	90.0%	87.7%	92.7%	92.9%	92.3%	94.8%	94.1%	95.4%	96.1%	95.1%	94.5%	91.7%
Main Street North	93.8%	79.8%	79.8%	82.8%	88.7%	90.4%	89.6%	85.6%	89.4%	87.7%	91.9%	93.3%
Main Street South	96.6%	82.0%	85.5%	87.3%	90.3%	93.7%	91.3%	91.3%	92.3%	93.0%	94.0%	95.2%
Patrick Henry	80.7%	81.1%	80.4%	81.8%	86.0%	92.5%	88.2%	87.3%	87.4%	88.7%	90.7%	88.4%
Patrick Henry B		79.6%	90.7%	94.7%	95.0%	96.9%	90.3%	94.6%	95.5%	96.3%	99.2%	
Progress B	90.2%	79.3%	76.2%	76.5%	82.4%	89.9%	89.9%	71.6%	70.0%	70.4%	79.7%	79.9%
Progress Street	96.2%	95.6%	97.3%	96.8%	97.4%	97.9%	97.4%	97.6%	97.0%	97.7%	96.7%	95.4%
South Main Airport	76.4%	66.1%	65.1%	65.3%	69.5%	77.9%	86.6%	74.3%	75.1%	67.2%	79.0%	82.1%
Toms Creek	91.2%	78.7%	80.6%	81.2%	85.6%	88.4%	90.4%	91.5%	92.2%	88.5%	93.1%	95.2%
Two Town Trolley	86.8%	72.9%	79.3%	73.2%	81.3%	79.7%	93.6%	77.2%	80.1%	76.6%	83.6%	88.3%
University City Blvd	91.0%	84.9%	90.7%	93.5%	95.6%	96.0%	94.2%	94.9%	96.2%	96.9%	94.3%	82.3%
University Mall Shuttle		71.3%	68.5%	72.3%	70.9%	75.4%						

Unsatisfactory	Marginal	Satisfactory	Good

Ridership by Time Period and Service Span

BT typically operates service from 7:00 a.m. to 12:45 a.m. on weekdays, with extended service until 2:45 a.m. on Fridays. On weekends, service begins at 9:30 a.m. ends at 2:45 a.m. on Saturday and 10:45 p.m. on Sunday. Ridership during these times vary, as service transitions from commuter

service during the AM and PM peaks, to safe-ride home and essential trips service during evening and late-night hours.

Figure 11 shows FY 2022 ridership by month organized by time period for all BT routes. Overall, all months follow a similar trend of peak usage occurring during midday, matching BT's peak service levels. The highest ridership months occur when VT is in session and BT is operating on full service, from September to December and from February to April, totaling about 400,000 trips per month. During the summer and when VT is not in session, BT operates on reduced service, ridership declines to about 40,000 per month.

Figure 11: FY 2022 Ridership Total by Month and Time Period

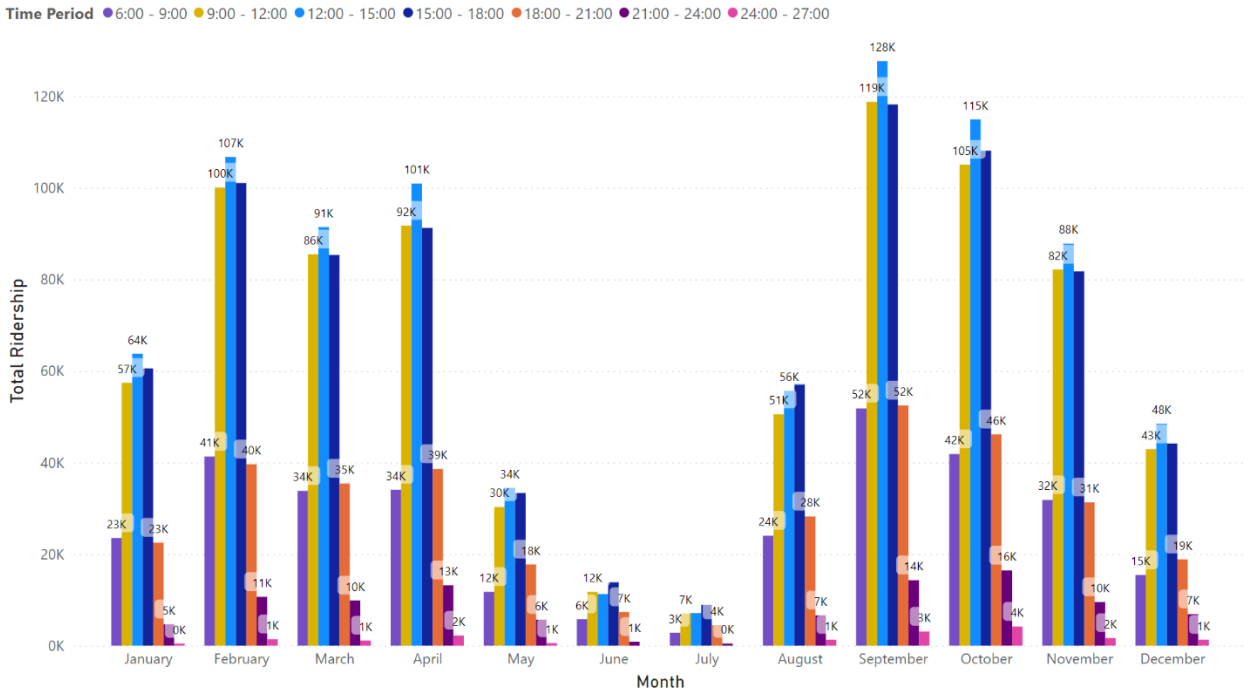
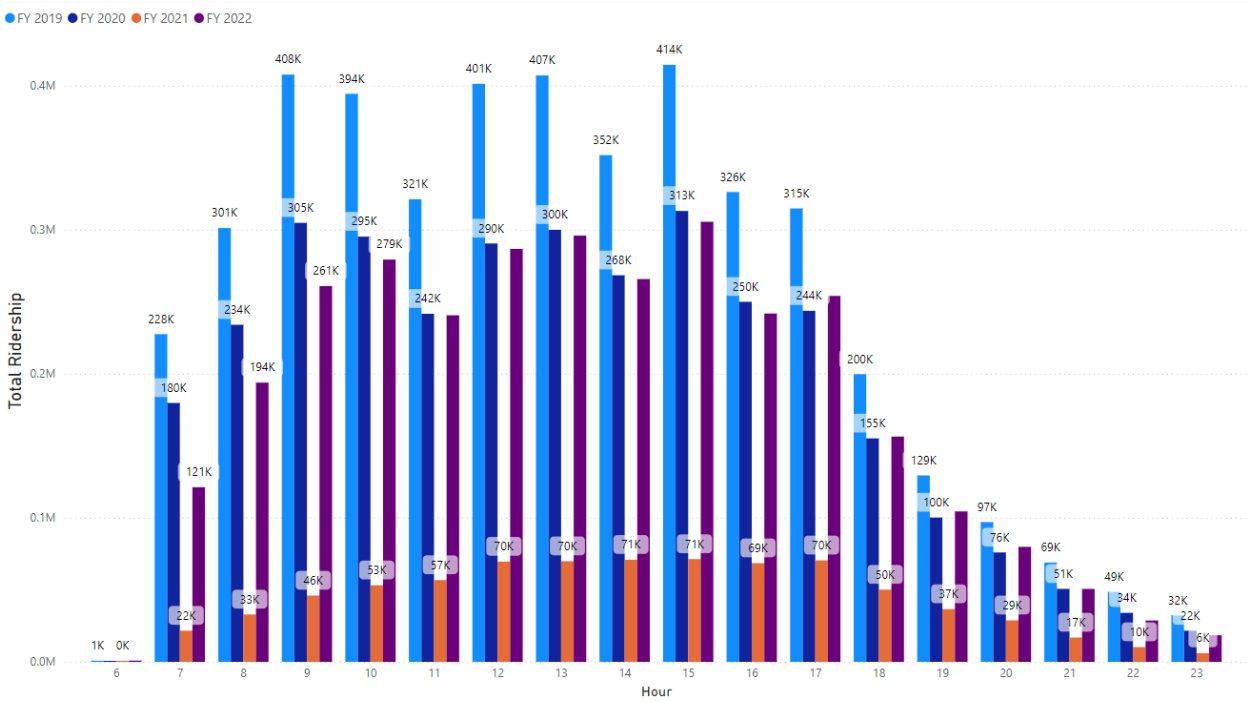


Figure 12 analyzes ridership from FY 2019 to FY 2022. Ridership was higher pre-pandemic in FY 2019 than FY 2022, however ridership continues to recover. Ridership during peak commuting hours of 8:00 a.m.–5:00 p.m., has not yet returned to pre-pandemic levels, largely because there is less service. However, service levels and ridership after 7:00 p.m. more closely match those pre-pandemic. While ridership should continue to recover, the swift recovery of late-night ridership could provide opportunities to focus on that ridership segment.

Figure 12: Ridership by Time of Day from FY 2019 to FY 2022



Service Overlap and Trip Load

BT operates multiple routes on the same major streets and corridors throughout its service area, allowing passengers to take different routes or transfer between routes to travel to their final destinations. These high-destination corridors often center around student housing and academic buildings with multiple routes, running through and stopping at the same locations.

BT staff have identified potential issues with the imbalance of passengers on similarly structured routes, where passengers may choose to allow the first route to pass and wait for another route despite two routes serving similar destinations on a particular corridor. This results in overcrowding on some trips, while other trips on routes with similar services have more capacity. This occurrence of overloading is particularly evident on trips to and from the VT campus during class change.

A service overlap analysis was completed to identify stops and times where there are imbalances between two complementary routes. Each route load was calculated as the running total on boardings and alightings throughout each unique trip. The maximum load was then extracted for all trips across unique routes to see if this exceeded the BT performance standard crush load. Time period filters were applied to differentiate the varying load factors during crush load (30 minutes before and after classes), peak, and non-peak periods. The results help identify possible route and corridor-level service alternatives developed in Chapter 3.

BT has identified six corridors to be analyzed for trip load imbalances:

- Prices Fork Road
- University City Boulevard
- Patrick Henry Drive
- Progress Street
- North Main Street
- Toms Creek Road

Figure 13 shows the average load on the two routes that serve Hethwood and Prices Fork by time of day. A large difference between bar heights clustered around the same time represents ridership imbalances between trips, which could be an opportunity to redirect ridership between the routes or be mitigated with service changes developed in Chapter 3.

Initial observations on the load factors reported on Hethwood and Prices Fork include:

- Hethwood A (HWA) consistently reaches a higher maximum capacity than Hethwood B (HWB) during all time periods, but specifically concentrated in the AM peak and morning crush load periods 30 minutes before classes start around 9:00 a.m. to 10:30 a.m. During these periods, the maximum load regularly exceeds 70 passengers. Depending on the type of bus and its available seats, this can exceed the seated and standing capacity for regular motor buses with a crush load approaching 1.5-2.0. For articulated buses that may be more historically run on Hethwood A, this crush load is approaching 1.0.
- Monday-Wednesday peak load during the crush load periods before and after classes occurs at different times than on Tuesday-Thursday service. Monday-Wednesday maximum load, 81, is reached more at the 10:00 a.m. to 12:00 p.m. timeframe, whereas Tuesday-Thursday maximum loads around 80 to 90 are reached before 9:00 a.m. and after 1:30 p.m. On all weekdays, the maximum load on Hethwood A is almost always associated with the point of minimum load on Hethwood B.
- It should also be noted that the combined Hethwood route, which runs after 9:30 p.m., inherits the combined ridership of the two routes Hethwood routes but rapidly declines to just under 35 in the night service period.

After a review of the data below and a comparison of the vehicle assignment, the higher trend for maximum capacity on Hethwood A appears appropriate to the lower trend for maximum capacity on Hethwood B. Hethwood A typically is assigned 60-foot articulated buses with a greater passenger capacity than the 40-foot buses typically assigned to Hethwood B. While the maximum peaks between Hethwood A and Hethwood B differ, the increase and decrease of the passenger capacity occurs at the same time which lends to not seeing the major trip load imbalance as previously thought. Additional service may be necessary to address capacity constraints in the Prices Fork corridor.

Figure 13: Hethwood A (HWA) vs Hethwood B (HWB) Max Load (All-Day Crush Period)

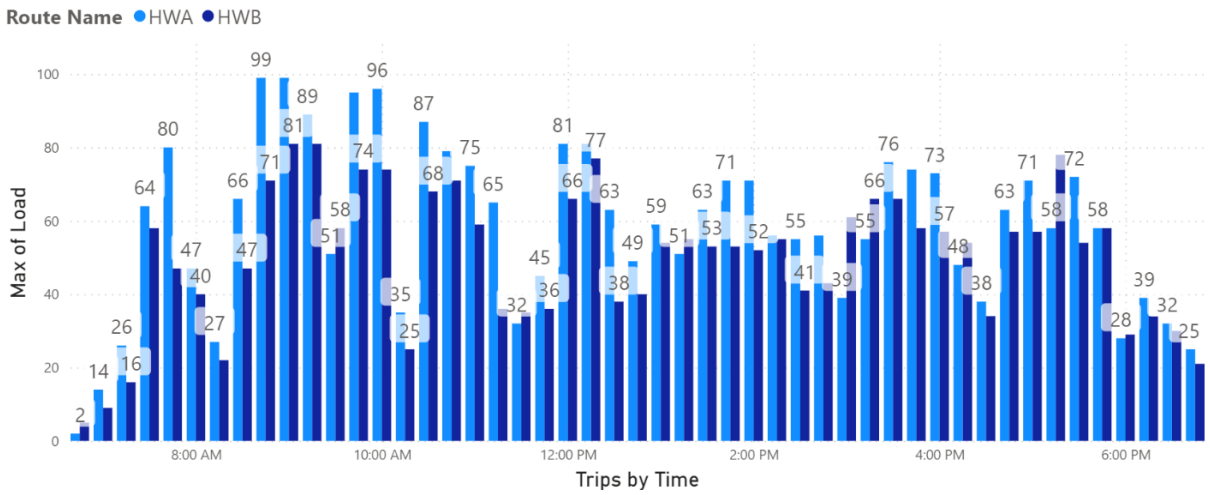


Figure 14 shows the average trip load by time of day for routes that make stops on University City Boulevard. Load data was pulled only for stops on University City Boulevard to isolate the load factor specifically for service on the corridor and not other locations where routes may run, such as Toms Creek or Patrick Henry. Initial observations for University City Boulevard (UCB) and Toms Creek (TOM) routes in this area include:

- In the a.m., there is a substantial imbalance between Toms Creek and University City Boulevard routes despite offering similar destination accessibility. From 7:30 a.m. onward, the load regularly exceeds 85, which would be a load factor of 2.0 on 40-foot buses and 1.0-1.5 on articulated buses. This could be because the direction of travel is heading to the VT campus in the a.m., whereas, in the p.m., neither route is overloaded, with UCB carrying more passengers than Toms Creek on to University City Boulevard stops. A potential solution is to restructure the routes so that UCB offers a similar directness to campus as Toms Creek.
- During non-crush and off-peak times, both routes experience moderate load, with a maximum load of 35–50 trips. After 8:00 p.m., both routes reach a maximum load of 25 trips.
- On Tuesday–Thursday crush times, UCB has a higher max load starting at 2:00 p.m., whereas the crush load for TOM is near zero. This could be related to the direction of travel for passengers leaving VT's campus and UCB being the more direct route to University City Boulevard.

Figure 14: University City Boulevard (UCB) vs Toms Creek (TOM)
Max Load (All-Day Crush Period)

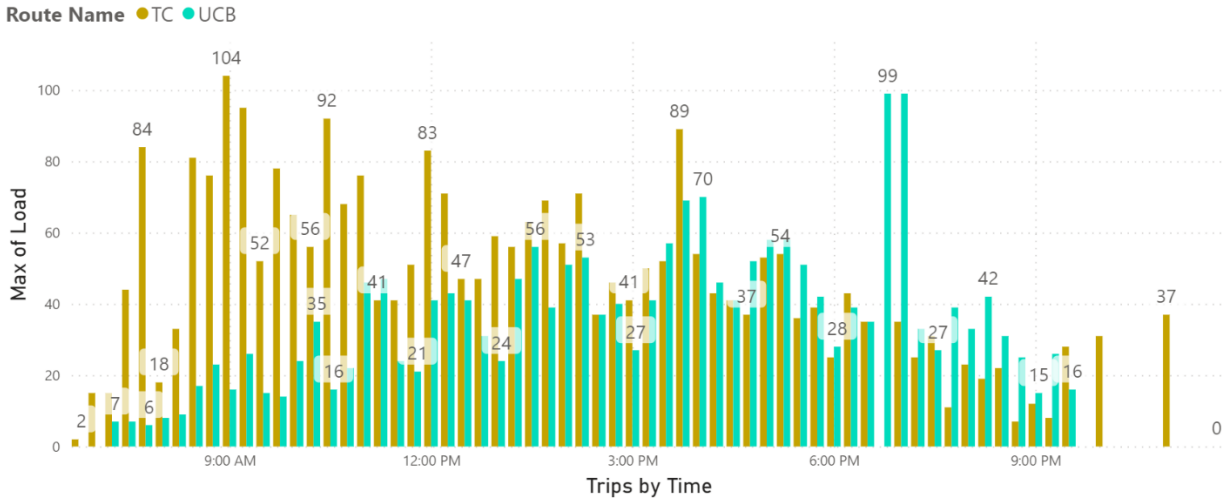


Figure 15 shows the maximum loads for four routes that serve the Patrick Henry Drive Corridor: Patrick Henry Drive (PHD), Patrick Henry B (PHB), Progress Street (PRO), and Toms Creek (TOM). Load data was only pulled for trips passing through stops on Patrick Henry to avoid skewing the data with load from other sections of routes that have high ridership. Initial findings include:

- The Progress Street route (PRO) sees the highest maximum load on the stops it serves on Patrick Henry Drive in the morning, reaching a maximum of around 96 passengers at 9:45 a.m. However, its high load diminishes by 12:00 p.m. and is replaced by the Patrick Henry Drive route (PHD), with maximum loads for PHD rising in the early evening around 5:00 to 6:00 p.m.

Figure 15: Patrick Henry Drive Maximum Load by Trip (All-Day Crush Period)

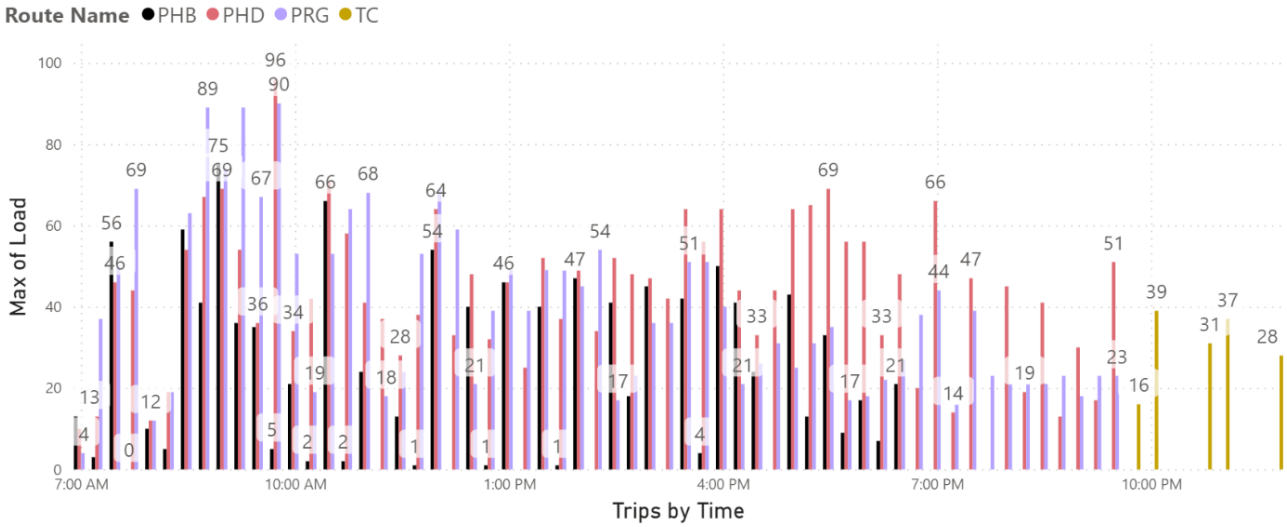


Figure 16 detail the maximum load per trip for the four routes that serve the Progress Street corridor: Patrick Henry Drive (PHD), Progress Street (PRO), Toms Creek (TOM) and University City Boulevard (UCB). Initial findings include:

- PHD and UCB have the highest maximum load on stops along Progress Street, concentrated mainly in the a.m. peak periods where the load factor exceeds the performance standard of 1.0 for a 40-foot bus capacity of 80 passengers.
- PHD and UCB serve the most southbound trips to campus on Progress Street in the morning and midafternoon, and the maximum load stays high until 5:00 p.m. The PRO route only sees northbound maximum load increasing significantly after 1:00 p.m., but still does not compete with two combined southbound routes. Southbound all-day service on Progress Street is recommended to be maintained or increased. While there is the potential to alter the PRO route to be more productive in the a.m. when northbound travel on Progress Street is low, the existing loop that provides more service on the Toms Creek South corridor is needed because of the high load factor southbound during the a.m. and p.m.

Figure 16: Progress Street Maximum Load by Trip (All-Day Crush Period)

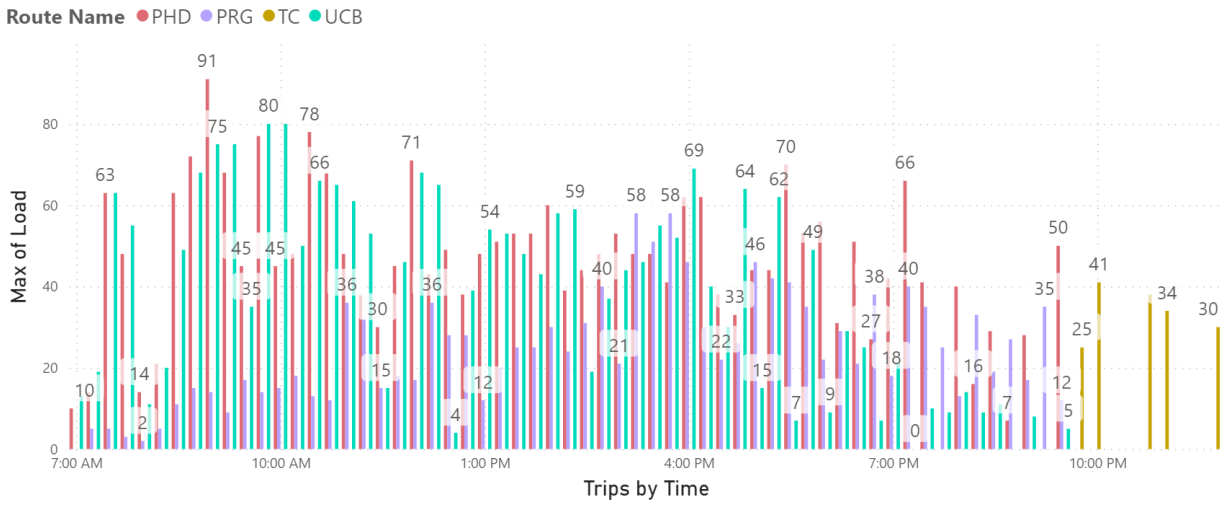


Figure 17 illustrates the maximum load by trip for routes that serve Main Street North: Main Street Givens (MSG), Main Street North (MSN), Patrick Henry B (PHB), and Progress Street (PRO). Initial findings include:

- MSG and MSN run similar services with different route pattern segments that deviate onto parallel streets such as Giles Street and Givens Lane. In the early morning, from 7:00 a.m. to 8:00 a.m., the maximum load is higher on MSN than MSG. However, MSG experiences higher maximum loads throughout the rest of the day. From 9:30 a.m. onwards, MSG experiences a load of 67 or above 1.0 for 40-foot buses and greater than 0.5 for articulated buses. Demand peaks for MSG around 11:45 a.m. For the afternoon and off periods MSN experiences higher loads. In the evening, the maximum MSG load is picked up again at around 4:00 p.m. This may indicate the potential for the load to be balanced between the two routes based on the time of day.
- MSN is underutilized during peak commute or late morning times, especially during class commute times, when MSG is overloaded, approaching maximum loads of 50–60 during the 9:00 a.m. to 11:00 a.m. before class time rush. This is most likely in the segment of Main Street between Northview Drive and the VT campus as the PHB route also serves that southbound travel experiences similar high loads. This could warrant the restructuring of routes to serve the peak southbound travel demand more efficiently in the AM.

Figure 17: Main Street North Maximum Load by Trip (All-Day Crush Period)

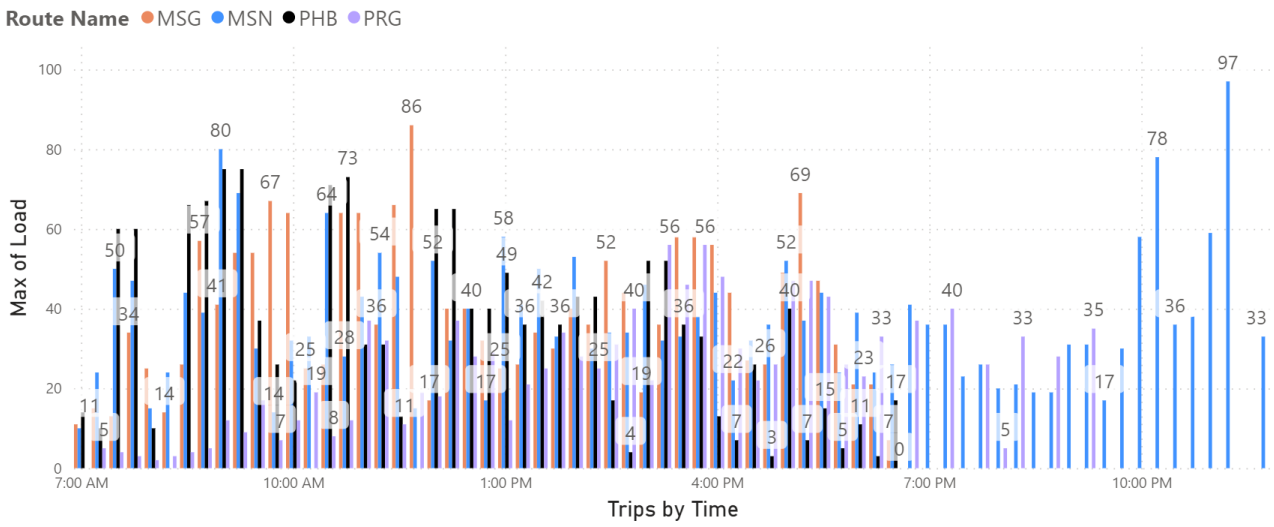
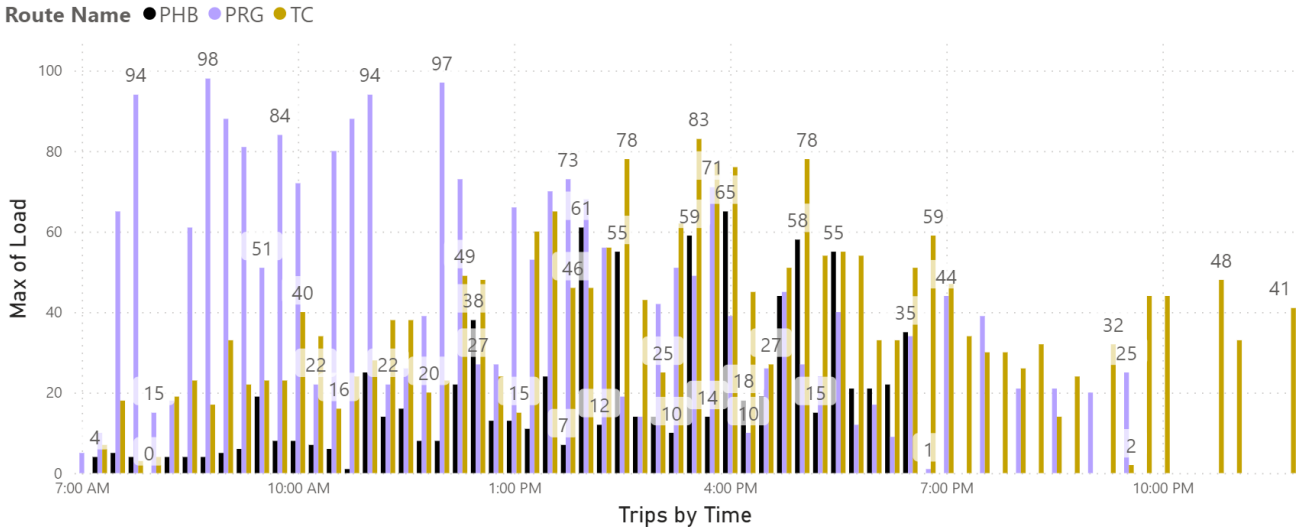


Figure 18 shows the maximum load by trip for those routes that serve Toms Creek Corridor: Patrick Henry B (PHB), Progress Street (PRO) and Toms Creek (TOM). Routes PHB and TOM run northbound on Toms Creek while PRO runs southbound so it is expected that maximum load will vary depending on the direction of travel during the a.m. and p.m. periods. Initial findings include:

- PRO is approaching overloaded in the a.m. with a consistent load greater than 80 for both peak, non-peak, and crush load periods. This would exceed the crush loads of 2.0 for a 40-foot bus and 1.0 to 1.5 for an articulated bus on PRO on all trips from 7:00 a.m. to 12:00 p.m.
- PM peak and afternoon maximum load is concentrated on the TOM route, not the PHB route. This could be partially explained by the TOM route serving enough of the residential complexes along Broce Drive and continuing onto westbound University City Boulevard, where passengers ultimately travel, thus carrying load throughout the Toms Creek stops northbound.

Figure 18: Toms Creek Maximum Load by Trip (All-Day Crush Period)



2.4.2 Efficiency-Based Opportunities for Improvement

This section provides a review of the efficiency-based opportunities for improvements identified above. Efficiency-based opportunities may require a combination of technological, infrastructure, scheduling, and operations solutions at a granular level. For example, degraded on-time performance could be remedied by schedule adjustments, rerouting, installing transit signal priority or infrastructure, and technology improvement to provide real-time route arrivals to allow passengers to plan their travel better. Trip imbalances may be addressed with operational adjustments or more bus capacity, as well as optimizing the spacing of bus stops to avoid overcrowding or variable scheduling to provide better peak travel service.

A summary of overall findings for the efficiency data includes:

- Most local route on-time performance (OTP) averages "satisfactory" to "good" if averaged the entire year. However, if monthly averages are examined, as in Figure 9, many routes follow a pattern of starting full service in August arriving late, and slowly improving their OTP throughout the year, peaking in January through May. Meanwhile, cross-jurisdictional routes follow the opposite trend of starting the year with low schedule adherence, improving until January, then falling back to "unsatisfactory" or "marginal" performance. There may be an opportunity to balance services and resources in the Spring, when more routes stabilize, to build more resiliency into routes with lower OTP throughout the year.
- Total ridership by time period is mostly concentrated during the daytime between 9:00 a.m. and 6:00 p.m. However, FY 2022 ridership has not quite recovered to pre-pandemic FY 2019 levels during these hours. In the PM periods from 7:00 p.m. onwards, FY 2022 total ridership is nearly equivalent to FY 2019, potentially signaling that night and off-peak service periods for BT are driving the recovery in ridership. This supports increasing effort during the midday to recover previously lost ridership while keeping service for the night periods constant to serve rider needs.
- On many corridors analyzed for trip imbalances, such as Toms Creek and Progress Street, there is a distinct preference to route direction with passengers depending on the time period. The a.m. maximum load data shows that passengers choose the most direct route

southbound to campus, driving the load to exceed the maximum load for buses. These times where the maximum load is exceeded for southbound routes include crush load periods defined as 30 minutes before and after class and during class times. Maximum load moderates in the p.m., with more even trip distribution among routes that share stops on popular corridors.

- Specific recommendations are included above to reroute some underutilized services in the a.m. and crush periods to alleviate routes experiencing load factors of 2.0 or more. The following corridors and routes are priority for targeted route improvements:
    - University City Boulevard: Toms Creek (TOM)
    - Main Street North: Main Street Givens (MSG)
    - Progress Street: Patrick Henry Drive (PHD) and University City Boulevard (UCB)
    - Toms Creek: Progress Street (PRO)

2.5 | Analysis of Opportunities to Collaborate with Other Transit Providers

This section details the transit service providers operating in or near the Towns of Blacksburg and Christiansburg. Section 2.5.1 identifies the providers, while the Section 2.5.2 provides details on potential collaboration.

2.5.1 Collaboration Analysis

A list of regional public transit providers and public ride matching services that serve the New River Valley and for which BT service intersects, as well as existing service partnerships and initiatives, are listed in **Chapter 1.1.2.** These service providers consist of:

- Radford Transit
- Virginia Breeze
- Pulaski Area Transit
- Smart Way (Greater Roanoke Transit Company)
- Amtrak
- Community Transit
- Ride Solutions

2.5.2 Collaboration-Based Opportunities for Improvement

There are several potential collaboration efforts that could serve to improve, expand, and enhance transit service and overall mobility in the New River Valley region. Opportunities for improvement include:

- **Transit Center:** The planned Transit Center will add 17 new bus bays on VT's campus, providing a central hub for public transportation. The additional capacity provided by the Transit Center allows VT's campus to host multiple transit agencies, thus expanding the potential area BT passengers can access via transit and increasing the ease to transfer onto other transit agencies' services. Virginia Breeze and the Smart Way buses are already planned to stop at the Transit Center, but BT should coordinate with other regional transit agencies to evaluate the opportunities and trade-offs of allowing additional transit services into the Transit Center.
- **Amtrak:** A new Amtrak station is planned for Town of Christiansburg which is set to begin Northeast Regional service in the future. The exact location of a station is unknown upon

publication of this document. The station will serve as a regional transportation hub with multiple transit agencies, such as Radford Transit, modifying their service to accommodate the station once it begins operations. BT should schedule services to align with the arrivals and departures of Amtrak trains at the planned station.

- **Giles County Transit:** Giles County is planning on starting a transit service with the idea of operating on-demand transit service into the Town of Blacksburg and Montgomery County. While this study is still in the feasibility and testing phase, consultation with Giles County should be done to understand Giles County's transit services operating hours and potential pick-up/drop-off geo-fenced locations, if any.
- **Private Intercity Transit Providers:** VT's large student population has a large demand for intercity travel, especially during times where VT goes on extended break. As a result, multiple private intercity transit providers serve VT or stop within BT's service area either year-round or during these peak periods. The stops for these transit providers are spread throughout Montgomery County with common stops being Lane Stadium, Exit 118 Park and Ride in the Town of Christiansburg, Squires Student Center, or other areas on VT's campus. BT currently provides service to the common pick-up areas, but opportunities are present to coordinate and provide more targeted service to these stop locations around the timetable of these transit providers, especially during periods of peak demand.

Chapter 3

Planned Improvements and Modifications

Contents

Chapter 3 identifies and prioritizes service and capital improvements for Blacksburg Transit (BT). It begins with a discussion of operational considerations, costs and constraints, ridership, and existing and future needs. Chapter 3 is organized as follows:

- **Section 3.1: Planned Service Improvements** describes specific service change recommendations for each route.
- **Section 3.2: Prioritization of Planned Service Improvements** outlines the anticipated timeframe and associated costs of each project, classified as Short-Term, Mid-Term, or Long-Term.
- **Section 3.3: Service Development** summarizes service hours and miles and evaluates policies and planning actions required for each project's implementation.
- **Section 3.4: Additional Recommendations** outlines other studies and initiatives that should be considered in the strategic planning.

The intention of this chapter is to identify all expected service improvement projects for BT during the next 10 years. All projects are financially constrained and reasonably achievable during the Transit Strategic Plan (TSP) timeframe; based on expected funding and available grant programs. Projects that can reasonably be implemented beyond the 10-year timeframe of the TSP will be included in the unconstrained category and documented in the Appendix. As with any planning effort, the degree of uncertainty for implementation increases over time. Although all projects outlined here have been examined and prioritized, the execution of each project may change due to evolving circumstances and other forces outside of BT's control. The service plan will be updated regularly during the annual TSP update process.

Identified improvements are based on:

- Existing route performance
- Trend and gap analysis presented in Chapter 2
- Existing local and regional plans for BT service
- Workshops with BT staff and operators
- Input received from the public, including community survey results
- Input received from stakeholder meetings

3.1 | Planned Service Improvements

This section presents specific route improvements based on the needs identified in Chapter 2 and discussions with BT staff. Each project begins with a description of service changes followed by details on how the project fulfills the transit system's needs. Operating statistics and estimates for ridership are included for each project. Projects are prioritized and shown by timeline in later sections of the chapter. For new routes or service, ridership is shown in raw numbers. For modifications to existing routes or service, ridership is shown as a percentage increase with the raw number increase shown in parentheses.

Each project in this section is financially constrained, meaning that funding for it could reasonably be secured in the future. However, including a project in this section does not guarantee that it will be implemented. Financial conditions and transit needs are likely to evolve over time, causing projects to change or be eliminated.

The service described in this plan represents the best estimates at the time of recommended development and subject to change due to funding availability, concurrent planning efforts, and changing demand. BT will update the implementation and potential service destinations during the annual updates to the TSP.

Service improvements are identified for the three different horizon periods:

- **Short-Term** projects are planned to be implemented within 1–3 years.
- **Mid-Term** projects are expected to be completed within 3-7 years.
- **Long-Term** projects are estimated to be completed in 7-10 years.

Section 3.2 describes funding and cost strategies for service improvement development by horizon year. Routes with planned service improvements across multiple horizon years will present all planned improvements in the earliest horizon year; planned improvements in specific future horizon years will only be referenced in the initial summary for that horizon year.

The planned service improvements are presented in route profiles to distinguish each proposed service. Each route profile sheet contains:

- A description of the planned service improvements.
- Justifications for the planned service improvements, based on findings from the System Performance and Operations Analysis completed in Chapter 2.
- A table showing the route's service classification (Town of Blacksburg vs. Town of Christiansburg).
- A table showing the route's origins and destinations.
- A table showing the service span and headways intended to be provided in comparison to the existing service (as operated during full service).
- A table showing the impact on annual hours, miles, and ridership for each service improvement.
- A map showing the planned service improvements.

3.1.1 Existing System Service Statistics

The Short-Term Horizon encompasses planned service improvements slated for implementation between 1-3 years from the time of the TSP's publication. Short-Term improvements include changes to existing routes and the introduction of new routes. Short-Term service improvements include rerouting existing service from the Drillfield to the Transit Center, introducing a new campus circulator, and targeting pre-COVID service levels. Route profiles are included when a service is introduced or an existing service is enhanced. Route profiles are not included when the existing alignment was only rerouted from the Drillfield to the Transit Center in the Short-Term. Table 1 is a summary of Short-Term planned improvements.

Table 1: Summary of Short-Term Planned Service Improvements

Short-Term Service Improvements	Routes Impacted
New Service	• **Campus Circulator** • **Meadowbrook Zone** • **Progress Street Clockwise**
Modified Service	• **Carpenter Boulevard**: Realignment • **Hokie Express**: Realignment • **Main Street North**: Route Consolidation • Toms Creek: Frequency Improvement
Existing Alignment Rerouted from Drillfield to Transit Center	• Corporate Research Center* • Harding Avenue* • Hethwood* • Hethwood A* • Hethwood B* • Main Street South* • Patrick Henry B* • Patrick Henry Drive* • Progress Street* • South Main Airport Road* • Two Town Trolley* • University City Boulevard*

Bold services include maps in this section.
*Services are rerouted from Drillfield to Transit Center in the Short-Term and do not include a map or a route profile in the TSP document.

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Campus Circulator

Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	The Transit Center / Stanger Street / West Campus

Level of Service			
Span			
		Existing	**Proposed**
Weekday		N/A	7:00 a.m. – 9:45 p.m.
Saturday		N/A	9:30 a.m. – 6:45 p.m.
Sunday		N/A	9:30 a.m. – 6:45 p.m.
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	10 min
	Off-Peak	N/A	15 min
Saturday	All-Day	N/A	30 min
Sunday	All-Day	N/A	30 min

Notes
Should be implemented concurrently with other routes rerouted to the Transit Center.

Service Improvement

Short-Term: Introduce Campus Circulator Service.

☑ **Meets Identified Demand**	☑ **Performance Improvement Opportunity**	☐ Efficiency Improvement Opportunity	☐ Alignment with Service Standards

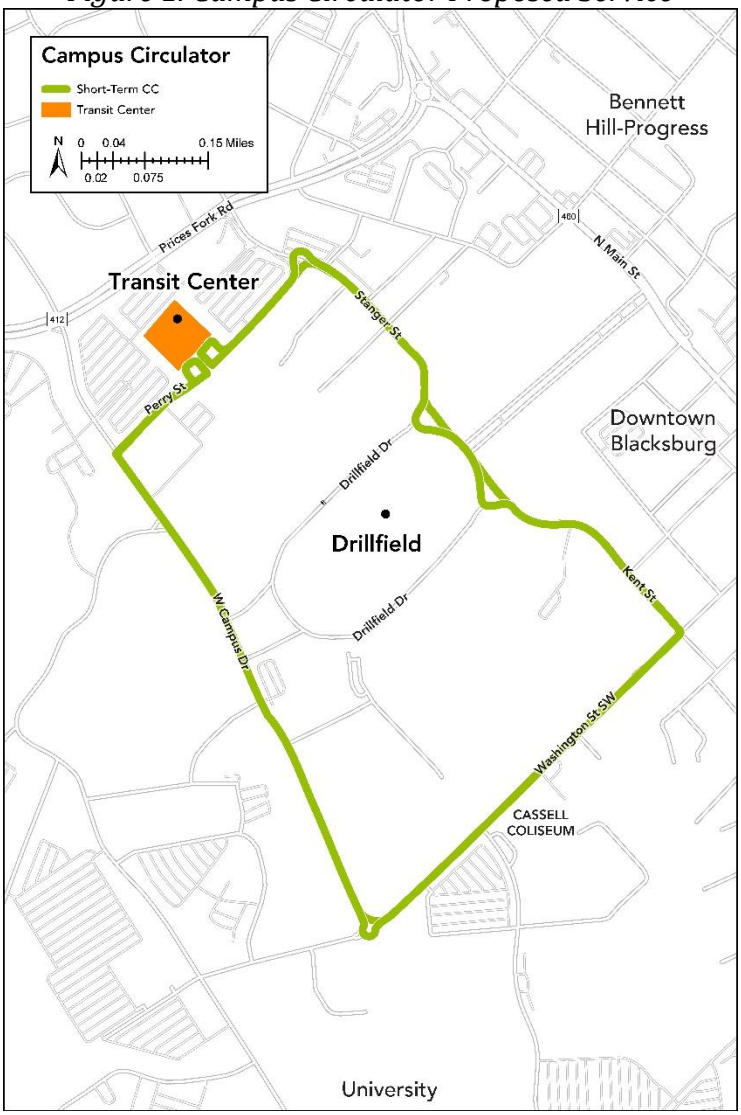
Justification

- The opening of the Transit Center will re-route existing bus service from the Drillfield to the Transit Center. This service improvement will provide connections from the Transit Center to the remainder of campus.
- There is an established travel market demand to provide more service in and around Virginia Tech.
- Introducing this service will support the improvement of service and performance of other routes. Routes, such as Toms Creek, will eliminate their cross-campus connection, allowing for greater frequency on the off-campus portion of their routes.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership***
Short-Term	Introduce the new Campus Circulator route with 10-minute headways operating on weekdays between 7:00 a.m.- 6:45 p.m., and 15-minute headways between 7:00 p.m. - 9:45 p.m. On weekends, the route will operate between 9:30 a.m. - 6:45 p.m. with 30-minute headways	+ 14,793	+ 92,264	+ 166,682

NOTE:
**Projected ridership for new service.*

Figure 1: Campus Circulator Proposed Service



Meadowbrook Zone

Glade Road & Meadowbrook Community

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	Meadowbrook Drive / Glade Road

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 7:00 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	On-Demand
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Short-Term: Introduce an on-demand service zone that serves the mobile home community on Meadowbrook Drive, Heritage Community Park, Glade Road, and the surrounding area. Drop-off points would be within the zone or designated locations outside of the zone for connections to existing fixed routes.

☑ **Meets Identified Demand**	☐ Performance Improvement Opportunity	☐ Efficiency Improvement Opportunity	☑ **Alignment with Service Standards**

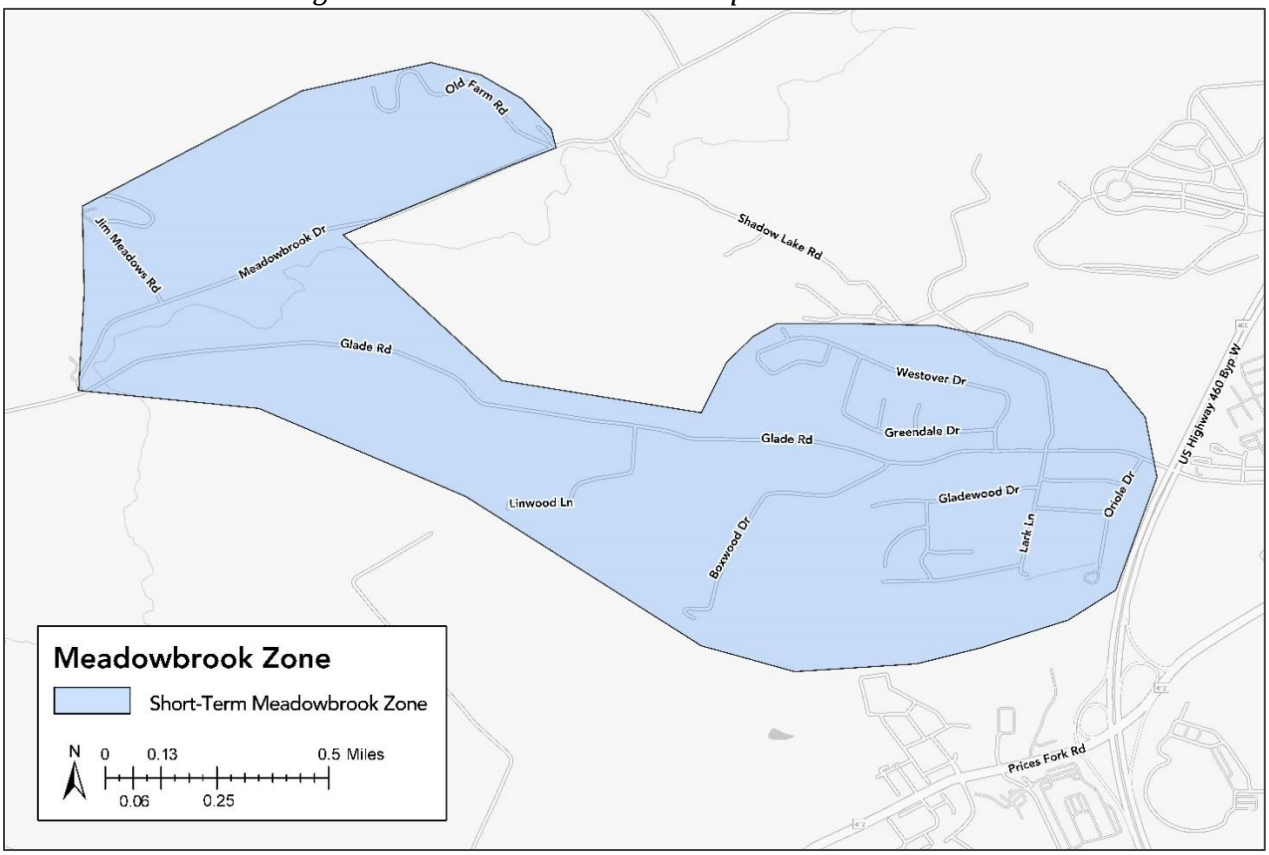
Justification

- Introducing the Meadowbrook on-demand service zone will address an existing service gap in the BT service area.
- This service area represents a geographic area where zero-car households are more concentrated than in the BT service area.
- This zone will include the Meadowbrook Community and other neighborhoods near Glade Road.
- Service will provide more mobility options for areas with higher concentrations of populations disproportionately affected by a lack of transportation choices and address Blacksburg Transit's goals for creating more accessible transportation options for all Town of Blacksburg residents.

Service Improvement Phasing			
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**	
		Revenue Hours	**Ridership***
Short-Term	Introduce the Meadowbrook Drive on-demand zone with connections to existing fixed routes.	1,250	+ 2,900-5,900

***NOTE**: *Projected ridership range for new service.*

Figure 2: Meadowbrook Zone Proposed Service Area



Progress Street Clockwise

Toms Creek, Patrick Henry and Progress Street Area to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	The Transit Center / Patrick Henry Drive

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 9:30 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	15 min
	Off-Peak	N/A	30 min
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Short-Term: Introduce a new Progress Street Clockwise service pattern that spans from 7:00 AM to 9:30 p.m. weekdays. The route will have two dedicated vehicles and a 30-minute run time.

☐ Meets Identified Demand	☑ **Performance Improvement Opportunity**	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

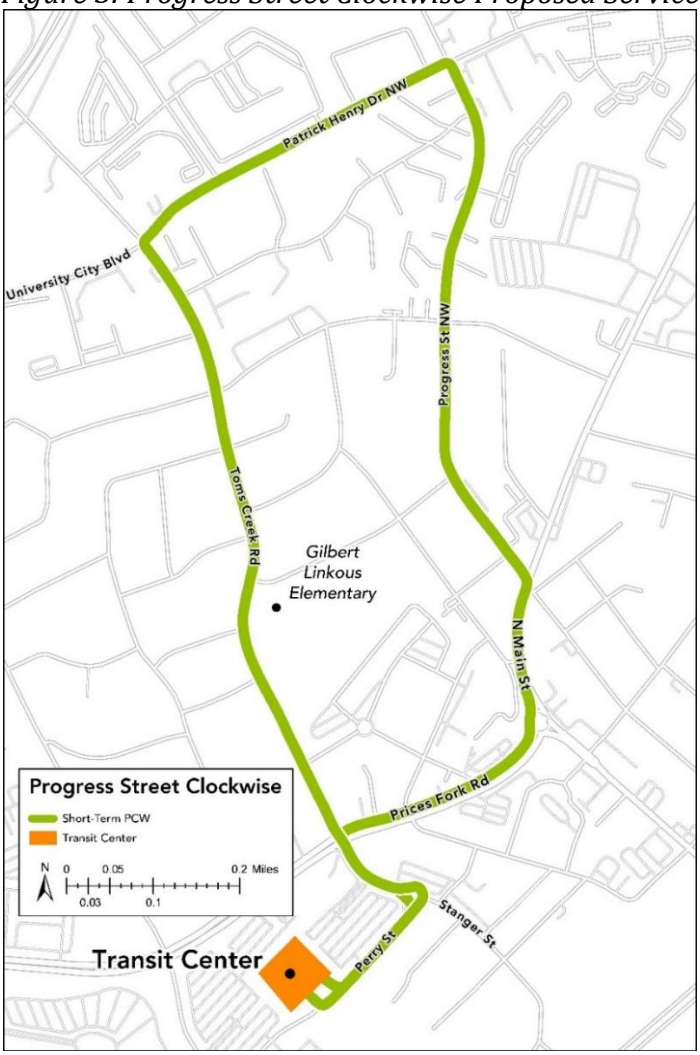
Justification

- Adding more service in a clockwise loop on Toms Creek, Patrick Henry and Progress Street is one solution for addressing the overloaded buses on the Progress Street route in the morning during weekday service.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership ***
Short-Term	Introduce the new Progress Street Clockwise service pattern that spans from 7:00 a.m. - 9:30 p.m. weekdays. The route will have two dedicated vehicles with a 30-minute run time	+ 6,605	+ 37,150	+ 272,000

***NOTE**: *Projected ridership for new service.*

Figure 3: Progress Street Clockwise Proposed Service



Carpenter Boulevard

Prices Fork Area to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	The Drillfield / The Retreat	The Drillfield / The Retreat / Hethwood

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 a.m. – 6:45 p.m.	7:00 a.m. – 6:45 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	30 min	30 min
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Short-Term: Modify the Carpenter Boulevard route to also serve the Hethwood community.

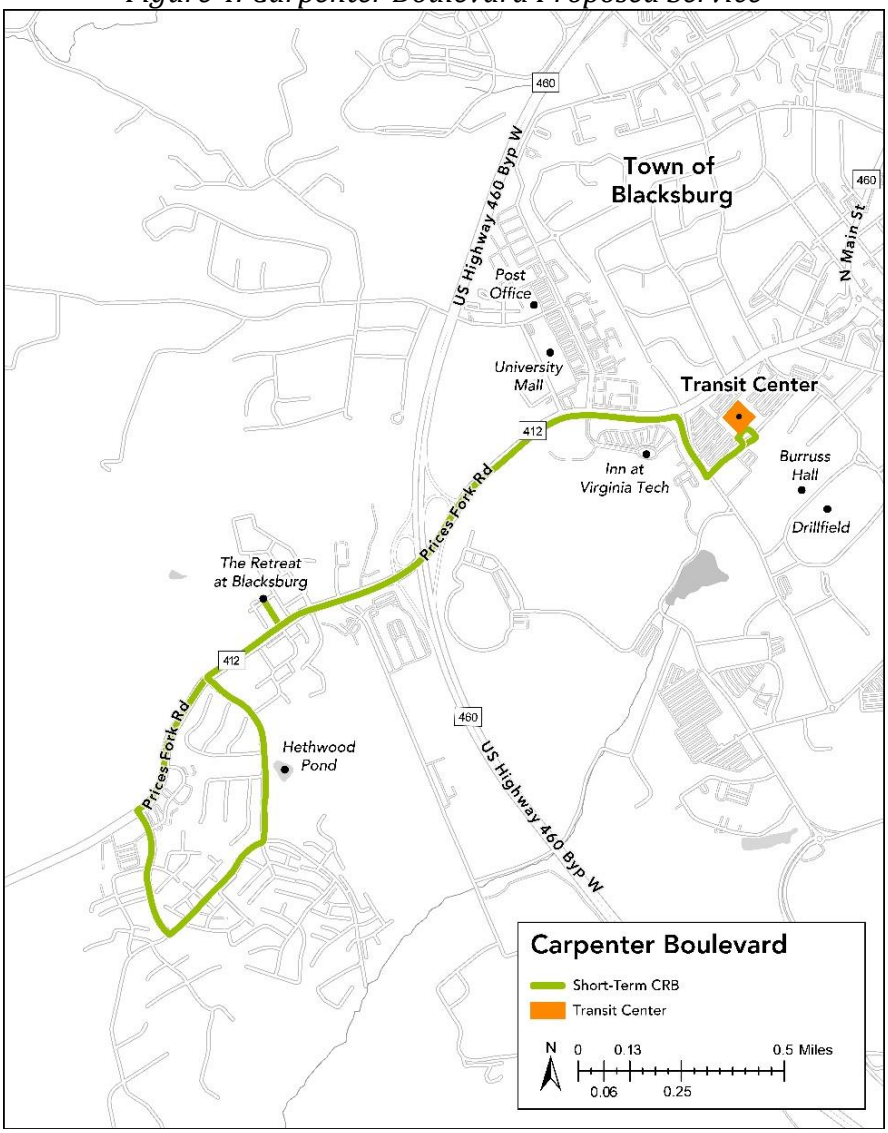
☐ Meets Identified Demand	☐ Performance Improvement Opportunity	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

Justification

- The opening of the Transit Center will shorten the routes serving the Hethwood area, including the Carpenter Boulevard route. The time saved by using this modified route can be used to extend the service to Hethwood, which will provide more overlapping service and increased effective headways in the Hethwood corridor.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership**
Short-Term	Extend the Carpenter Boulevard route to serve Hethwood.	0	+ 880	+29% (+12,613)

Figure 4: Carpenter Boulevard Proposed Service



Hokie Express

Oak Lane Community

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Drillfield / Oak Lane	Stanger Street / Oak Lane South

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 am – 12:45 a.m. (2:45 a.m. Fri)	7:00 am – 12:45 a.m. (2:45 a.m. Fri)	
Saturday	9:30 a.m. – 2:45 a.m.	9:30 a.m. – 2:45 a.m.	
Sunday	9:30 a.m. – 10:45 p.m.	9:30 a.m. – 10:45 p.m.	
Headways			
		Existing	**Proposed**
Weekday	Peak	15 min	15 min
	Off-Peak	30 min	30 min
Saturday	All-Day	30 min	30 min
Sunday	All-Day	30 min	30 min

Notes
Must be implemented concurrently with Campus Circulator route.

Service Improvement

Short-Term: Modify route to serve Chicken Hill lot and east side of VT campus as a compliment to the Campus Circulator service.

Long-Term: Modify route to serve new Student Life Village. The route will provide direct service via the proposed realigned Duckpond Road to the western portion of the new Transit Center.*

**This long-Term improvement is contingent upon Duckpond Road being realigned as proposed.*

☐ Meets Identified Demand	☐ Performance Improvement Opportunity	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

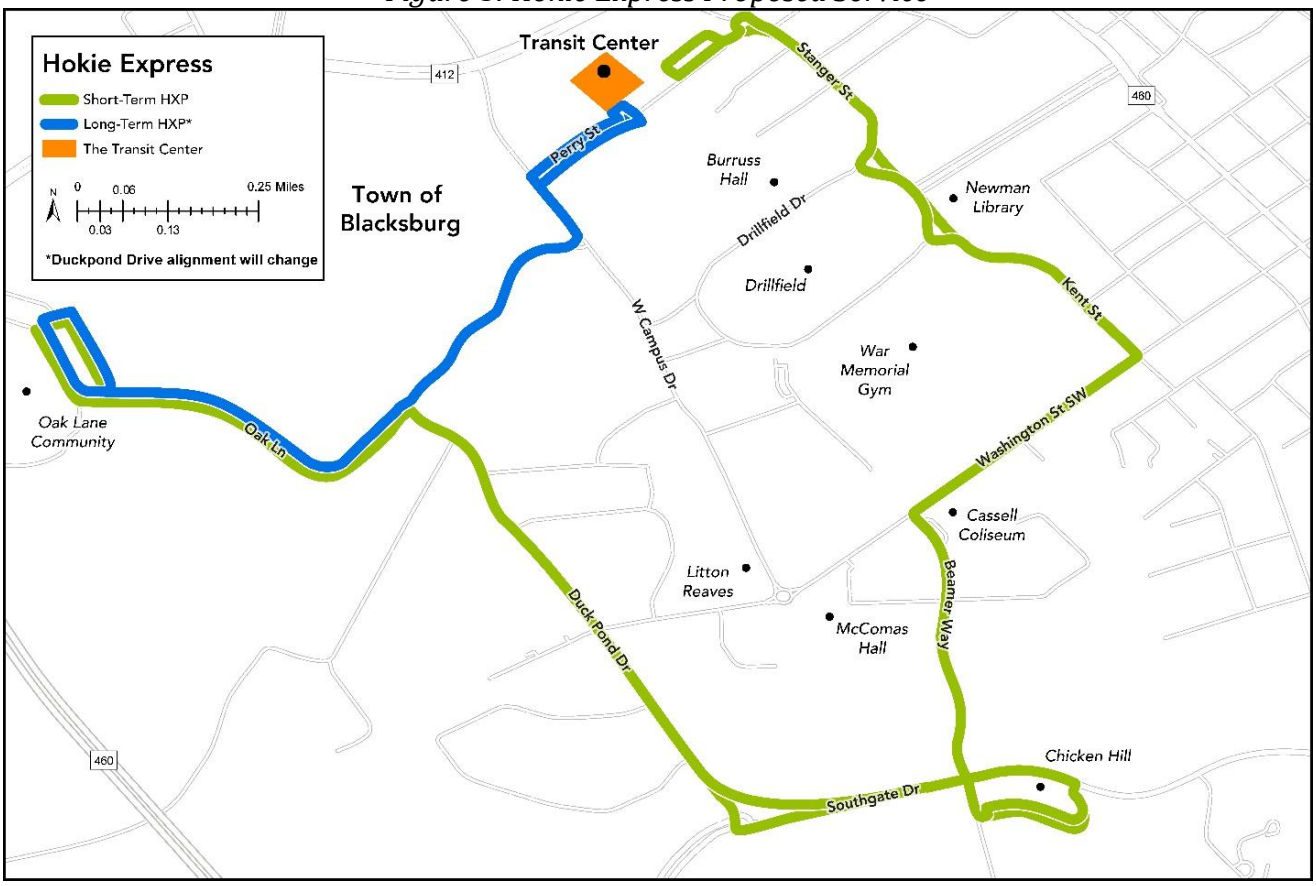
Justification

- Short-Term: Provides additional circulation around campus, including areas not serviced by the new Campus Circulator. This modification will aid in overall shorter waiting and on-the-bus riding times which contribute to positive rider experience.
- Long-Term: provide direct service between Transit Center and new Student Life Village.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership***
Short-Term	Modified to serve Chicken Hill lot and east side of VT campus as a compliment to the Campus Circulator service.	+ 2,174	+ 17,280	+ 72% (+ 59,051)
Long-Term	Modified to serve new development west of West Campus Drive. The route will provide direct service via the realigned Duckpond Road to the western portion of the new Transit Center.	-1,935	- 16,049	-32% (-46,490)**

NOTE:
**Hokie Express in the Long-Term does not fully account for increased demand from full buildout of future student village.*
***Long-term ridership change is based on short-term estimate and does not account for potential ridership generated from the new residential development currently planned due to uncertainty of construction timeline.*

Figure 5: Hokie Express Proposed Service



Main Street North

North Main area of Blacksburg to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Squires Westbound / Whipple Drive	Transit Center / Givens Lane

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 a.m. – 12:45 a.m. (2:45 a.m. Fri)	7:00 a.m. – 12:45 a.m. (2:45 a.m. Fri)	
Saturday	9:30 a.m. – 2:45 a.m.	9:30 a.m. – 2:45 a.m.	
Sunday	9:30 a.m. – 10:45 p.m.	9:30 a.m. – 10:45 p.m.	
Headways			
		Existing	**Proposed**
Weekday	Peak	30 min	15 min
	Off-Peak	30 min	30 min
Saturday	All-Day	30 min	30 min
Sunday	All-Day	30 min	30 min

Notes
None

Service Improvement

Short-Term: Combine Main Street Givens and Main Street North.

Mid-Term: The Woodbine neighborhood will be added to fixed route service on the Main Street North route.

☐ Meets Identified Demand	☑ **Performance Improvement Opportunity**	☐ Efficiency Improvement Opportunity	☐ Alignment with Service Standards

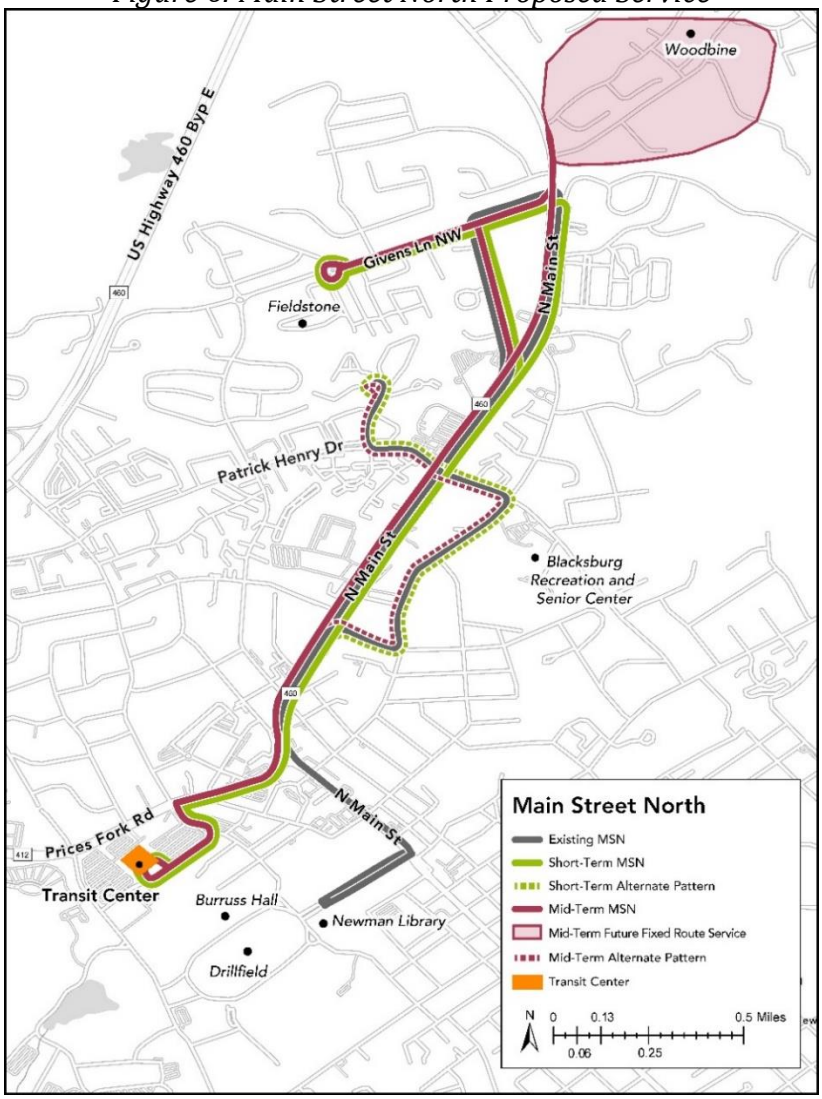
Justification

- Short-Term: Combining the two routes that provide service to Main Street North will reduce redundancy and maintain connectivity to Givens Lane.
- Long-Term: Incorporating the Woodbine neighborhood into the Main Street North route will increase mobility options for residents in neighborhoods in the northern part of Town of Blacksburg.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership**
Short-Term	Short-Term: Existing Main Street Givens is combined with Main Street North.*	0	0	0% (0)
Mid-Term	The Woodbine neighborhood loop will be added to the Main Street North route.	+ 133	+ 4,253	+ 8% (+21,660)

NOTE: **Metrics* for this route will encompass existing *metrics* and *metrics* from the consolidated route.

Figure 6: Main Street North Proposed Service



Toms Creek

Toms Creek, University City Blvd, to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Residential side of Campus / Toms Creek Rd / University City Blvd	Transit Center / Toms Creek Road / University City Blvd.

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 a.m. – 12:45 a.m. (2:45 a.m. Fri)	7:00 a.m. – 12:45 a.m. (2:45 a.m. Fri)	
Saturday	9:30 a.m. – 2:45 a.m.	9:30 a.m. – 2:45 a.m.	
Sunday	9:30 a.m. – 10:45 p.m.	9:30 a.m. – 10:45 p.m.	
Headways			
		Existing	**Proposed**
Weekday	Peak	15 min	10 min
	Off-Peak	30 min	30 min
Saturday	All-Day	30 min	30 min
Sunday	All-Day	30 min	30 min

Notes
Must be implemented concurrently with Campus Circulator route.

Service Improvement

Short-Term: The frequency of service on weekdays will be increased to 10 minutes.

Long-Term: Toms Creek service in the long term will remain unchanged. The new Glade Road and Progress Street Clockwise routes will supplement Toms Creek service.

☐ Meets Identified Demand	☐ Performance Improvement Opportunity	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

Justification

- According to Chapter 2, there is a substantial maximum trip load imbalance on the multiple BT routes serving the Toms Creek Road corridor. Increased frequency on the Toms Creek route on a shorter route (no circulation around campus) will help better distribute the trip load during the Short-Term.
- Long-Term the service on Toms Creek can be supplemented by the addition of the Glade Road route. The Glade Road route can add options for passengers to travel in an opposite direct on Toms Creek and University City Boulevard.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles***	**Ridership**
Short-Term	Route modified to serve the new Transit Center and peak frequency increases.	+ 1,034	- 913	+ 19% (+ 116,018)

***NOTE**: *Decrease in revenue miles is due to shorter distance traveled by only serving the Transit Center.*

Mid-Term Horizon

The Mid-Term Horizon encompasses planned service improvements that are slated for implementation between 3-7 years from the time of the TSP's publication. Mid-Term service improvements primarily focus on improving connectivity between the Town of Blacksburg and the Town of Christiansburg and extending fixed route service into new geographic areas. Route profiles are included when a new service is introduced or an existing service is enhanced. Table 2 is a summary of Mid-Term planned improvements.

Table 2: Summary of Mid-Term Planned Service Improvements

Mid-Term Service Improvements	Routes Impacted
New Service	• **Clay Street**
Modified Service	• **460 Express:** Realignment • **Explorer Blue:** Realignment • **Explorer Gold:** Realignment • Main Street North*: Realignment • **Main Street South:** Realignment • **South Main Airport Road:** Realignment • **University City Boulevard:** Realignment

Bold services include maps in this section.
*Map and route profile is included in the Short-Term horizon section.

Clay Street

Clay Street area to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	Clay Street area/ The Transit Center

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 6:45 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	20 min
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Mid-Term: The new fixed route will serve new and existing development in the Clay Street area. This will be a weekday-only service with one dedicated vehicle anticipated.

☐ Meets Identified Demand	☐ Performance Improvement Opportunity	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

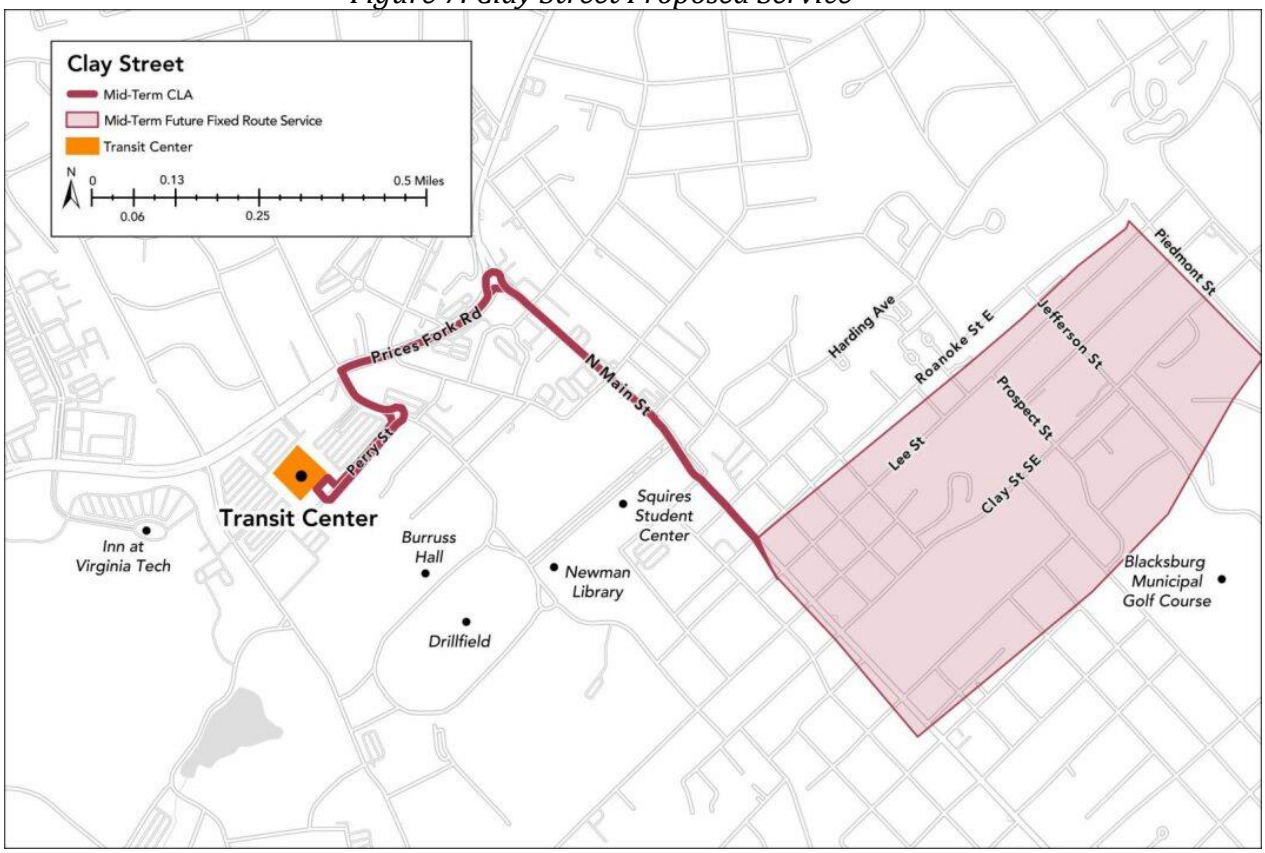
Justification

- Introducing a new route to provide additional transportation options in an underserved area east of Main Street South.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership***
Mid-Term	The new route will serve the new and existing development in the Clay Street area east of Main Street South. This will be a weekday-only service with 1 dedicated vehicle anticipated.	+ 9,185	+ 57,482	+ 33,663

***NOTE**:*Projected ridership for new service.*

Figure 7: Clay Street Proposed Service



460 Express

Virginia Tech/Blacksburg to Christiansburg Uptown Mall/Spradlin Farm Area

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Squires East / Uptown Mall area	The Transit Center / Uptown Mall / Spradlin Farms

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7: 00 a.m. – 9:15 p.m.	7: 00 a.m. – 9:15 p.m.	
Saturday	10:00 a.m. – 9:15 p.m.	10:00 a.m. – 9:15 p.m.	
Sunday	10:00 a.m. – 6:15 p.m.	10:00 a.m. – 6:15 p.m.	
Headways			
		Existing	**Proposed**
Weekday	Peak	60 min	60 min
	Off-Peak	60 min	60 min
Saturday	All-Day	60 min	60 min
Sunday	All-Day	60 min	60 min

Notes
Must be implemented concurrently with the Main Street South and Explorer Blue route improvements.

Service Improvement

Mid-Term: Modifying the existing Two Town Trolley to provide an express service from the Transit Center to the Uptown Mall, Walmart and Spradlin Farm Shopping Center in Christiansburg.

☐ Meets Identified Demand	☑ **Performance Improvement Opportunity**	☐ Efficiency Improvement Opportunity	☐ Alignment with Service Standards

Justification

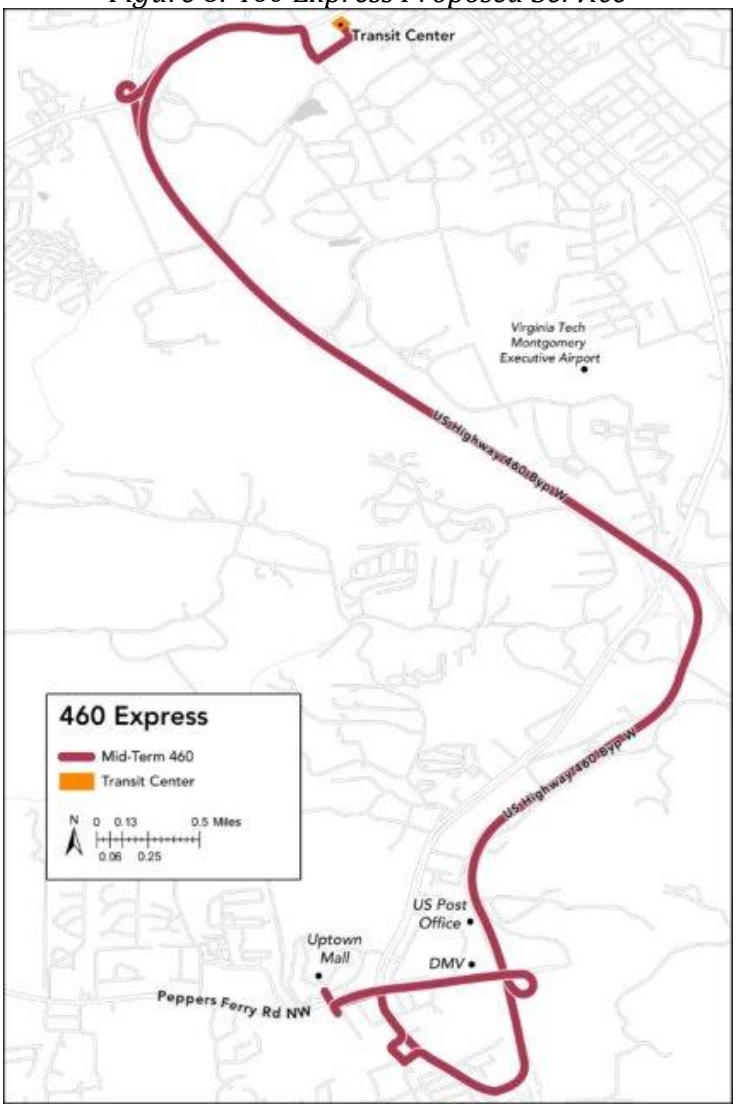
- The 460 Express service will increase connectivity options between the Virginia Tech campus and the shopping district in Christiansburg. Additionally, this will offer increased connectivity for Christiansburg residents traveling to the Virginia Tech campus.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)***		
		Revenue Hours	**Revenue Miles**	**Ridership**
Mid-Term	Modify the existing Two Town Trolley to travel on the 460 bypass to connect the new Transit Center to the shopping district in Christiansburg.	0	0	0% (0)

NOTE:

**Metrics for this route will encompass existing metrics and metrics from the consolidated route.*

Figure 8: 460 Express Proposed Service



Explorer Blue

Franklin & Roanoke Street Area to Uptown Mall area

Service Classification
Town of Christiansburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Uptown Mall/Radford Street	LewisGale Hospital Montgomery / Radford Street

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 a.m. – 6:45 p.m.	7:00 a.m. – 6:45 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	60 min	60 min
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
Must be implemented concurrently with the Main Street South, 460 Express route, and Explorer Gold route improvements.

Service Improvement

Mid-Term: Modify the Explorer Blue to provide a direct North-South connection for Christiansburg residents. This service will connect with the Main Street South, and 460 Express routes and supplemented by the Explorer Gold route.

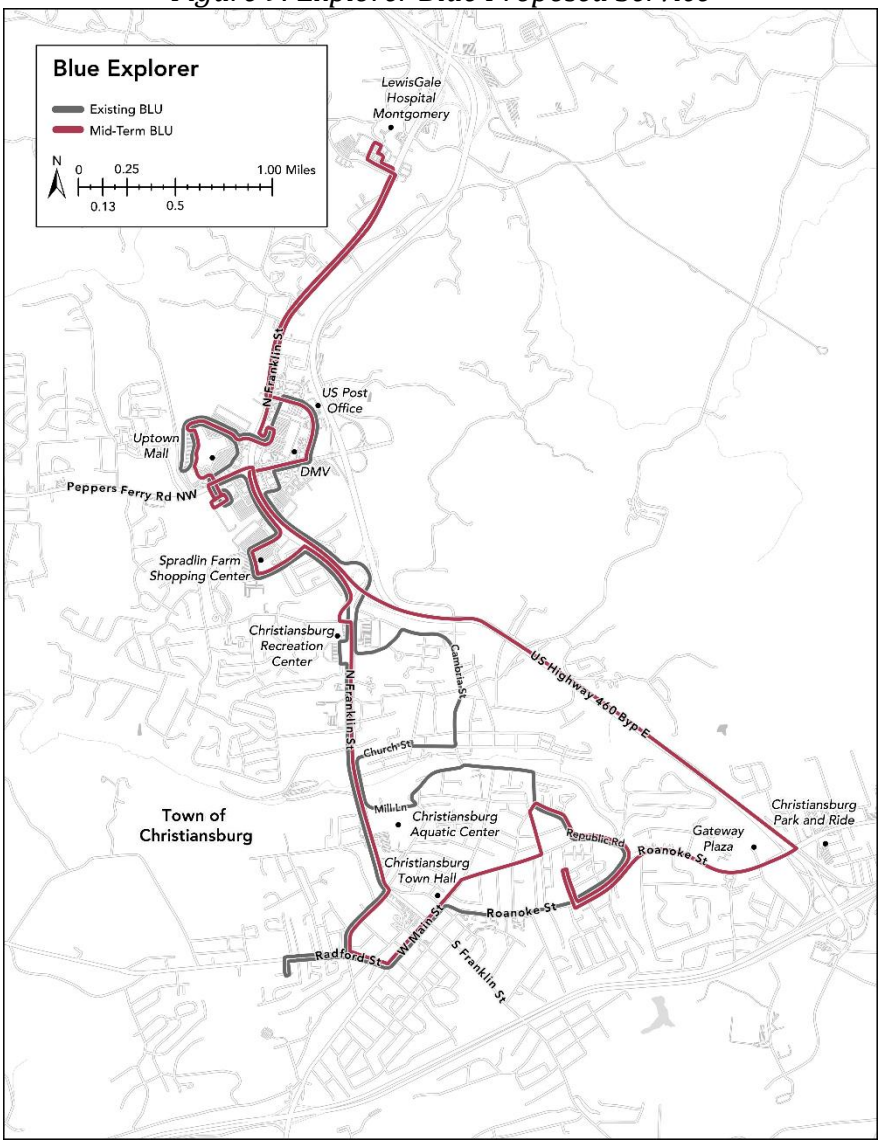
☐ Meets Identified Demand	☐ **Performance Improvement Opportunity**	☑ **Efficiency Improvement Opportunity**	☐ **Alignment with Service Standards**

Justification

- The Explorer Blue increases connectivity to Blacksburg via the new 460 Express and the extended Main Street South.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership**
Mid-Term	Modify the existing Explorer Blue to provide a direct North-South connection and expanded connectivity to Blacksburg for Christiansburg residents.	0	+ 5,172	0% (0)

Figure 9: Explorer Blue Proposed Service



Explorer Gold

Franklin & Roanoke Street Area to Uptown Mall area

Service Classification
Town of Christiansburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Uptown Town of Christiansburg/Linden Green	Uptown Town of Christiansburg/Linden Green

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 a.m. – 6:45 p.m.	7:00 a.m. – 6:45 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	60 min	60 min
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
Must be implemented concurrently with the Explorer Blue route improvements.

Service Improvement

Mid-Term: The Explorer Gold route will be altered to provide neighborhood-to-neighborhood connections to support the Explorer Blue's North/South connecting line.

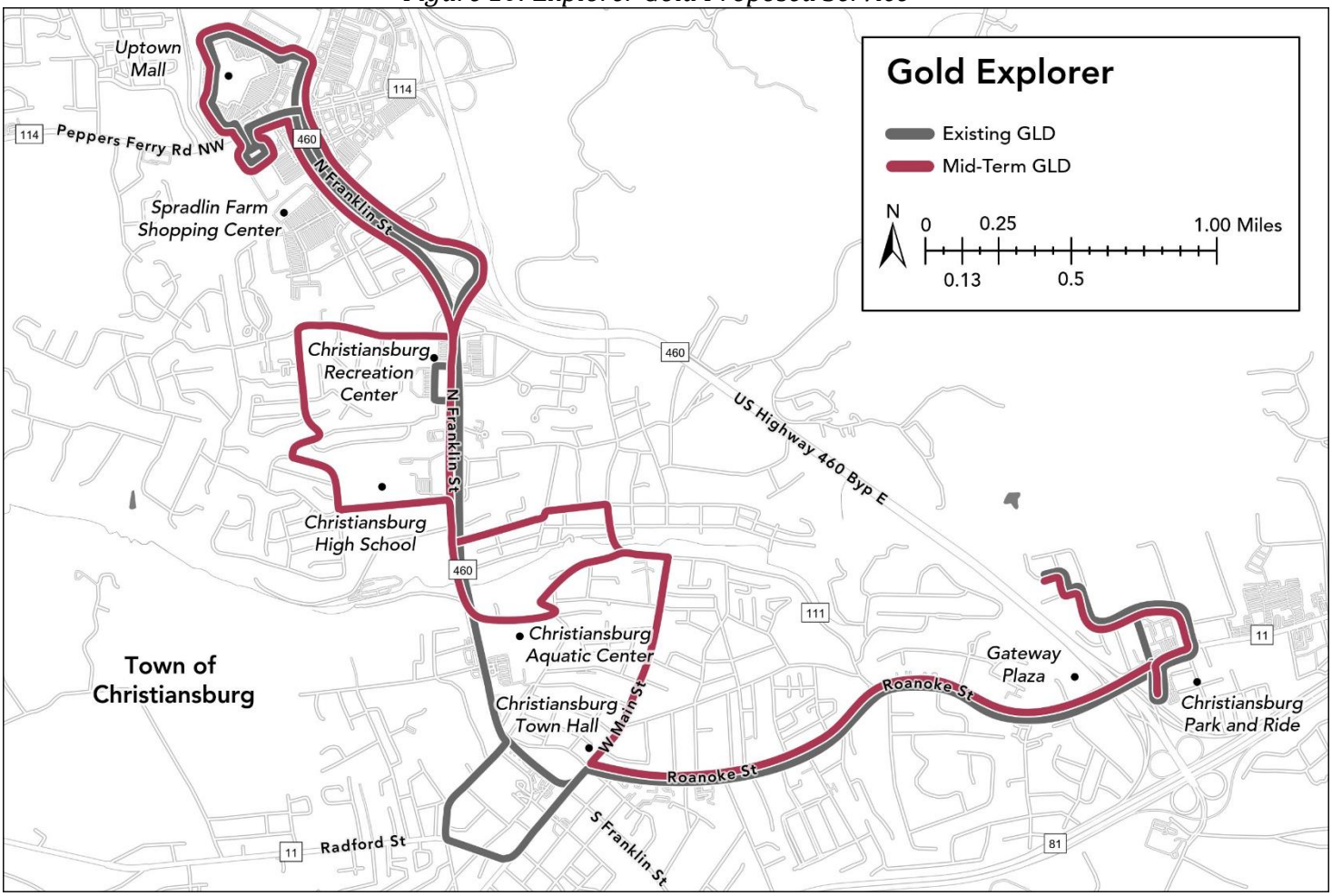
☐ Meets Identified Demand	☐ Performance Improvement Opportunity	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

Justification

- Providing more neighborhood-to-neighborhood connections to support the Explorer Blue line and will improve mobility opportunities for residents to move within Christiansburg.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership**
Mid-Term	The Explorer Gold route is altered with the intention to provide neighborhood-to-neighborhood connections to support the Explorer Blue's North/South connecting line.	0	-13,002	0% (0)

Figure 10: Explorer Gold Proposed Service



Main Street South

South Main Street to downtown Blacksburg and Virginia Tech campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Squires East/Fairfax Road	Transit Center/LewisGale Hospital Montgomery

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 a.m. – 12:45 a.m. (2:45 a.m. Fri)	7:00 a.m. – 12:45 a.m. (2:45 a.m. Fri)	
Saturday	9:30 a.m. – 2:45 a.m.	9:30 a.m. – 2:45 a.m.	
Sunday	9:30 a.m. – 10:45 p.m.	9:30 a.m. – 10:45 p.m.	
Headways			
		Existing	**Proposed**
Weekday	Peak	30 min	30 min
	Off-Peak	30 min	30 min
Saturday	All-Day	30 min	30 min
Sunday	All-Day	30 min	30 min

Notes
Must be implemented concurrently with the improvements of the Explorer Blue route and the 460 Express route.

Service Improvement

Mid-Term: Extend the existing route to the LewisGale Hospital Montgomery.

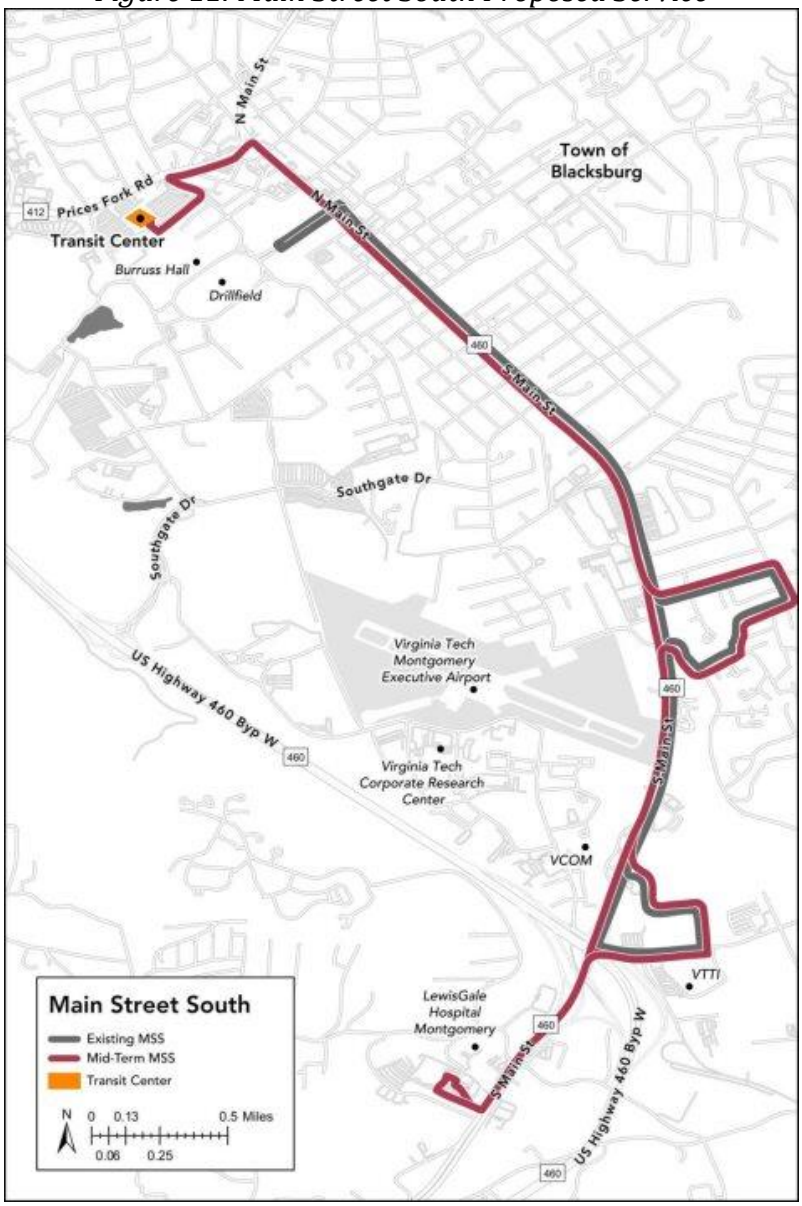
☐ Meets Identified Demand	☑ **Performance Improvement Opportunity**	☐ Efficiency Improvement Opportunity	☐ Alignment with Service Standards

Justification

- Extending the existing Main Street South route to the LewisGale Hospital Montgomery will increase connectivity for Blacksburg residents to reach the hospital and will provide an additional connection between Christiansburg and downtown Blacksburg.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership**
Mid-Term	Extend the existing route to the LewisGale Hospital Montgomery.	+ 243	+ 14,310	+ 22% (+ 14,291)

Figure 11: Main Street South Proposed Service



South Main Airport Road

Airport Acres to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	Squires East / Airport Rd / Fairfax Rd.	The Transit Center/Airport Rd / Fairfax Rd.

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:15 a.m. – 6:30 p.m.	7:15 a.m. – 6:30 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	30 min	30 min
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Mid-Term: Reroute the existing South Main Airport route through campus to Beamer Way and Southgate Drive.

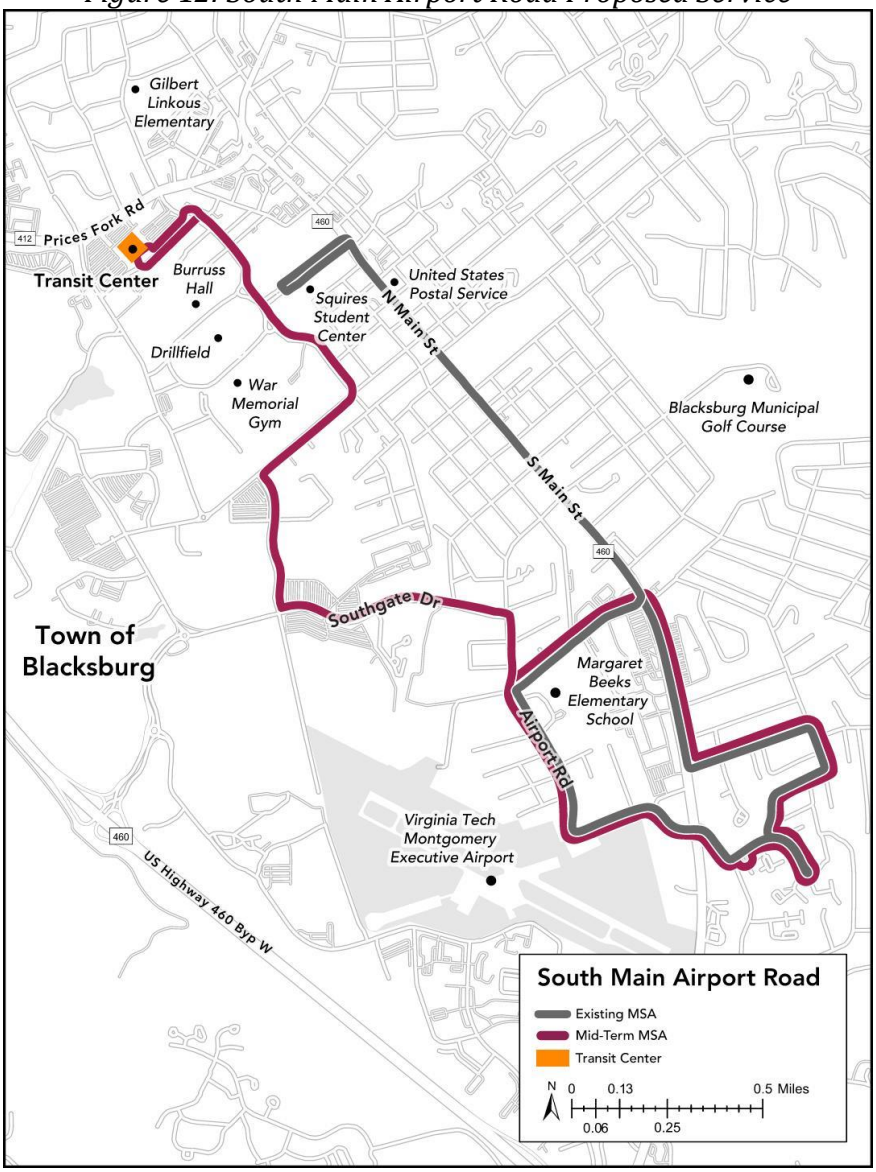
☐ Meets Identified Demand	☑ **Performance Improvement Opportunity**	☐ Efficiency Improvement Opportunity	☐ Alignment with Service Standards

Justification

- Rerouting the existing South Main Airport route to serve Southgate Drive and Beamer Way will increase mobility options from the Virginia Tech campus to residential areas on the south end of Blacksburg.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership**
Mid-Term	Reroute the existing South Main Airport route through campus to Beamer Way and Southgate Drive.	+ 0	+ 1,421	+23% (+ 15,202)

Figure 12: South Main Airport Road Proposed Service



University City Boulevard

University City Boulevard to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	The Drillfield / University City Blvd / Patrick Henry Drive	Transit Center / University City Blvd / Patrick Henry Drive/North Main Street

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	7:00 a.m. – 9:45 p.m.	7:00 a.m. – 9:45 p.m.	
Saturday	9:30 a.m. – 9:45 p.m.	9:30 a.m. – 9:45 p.m.	
Sunday	9:30 a.m. – 6:45 p.m.	9:30 a.m. – 6:45 p.m.	
Headways			
		Existing	**Proposed**
Weekday	Peak	15 min	15 min
	Off-Peak	30 min	30 min
Saturday	All-Day	30 min	30 min
Sunday	All-Day	30 min	30 min

Notes
None

Service Improvement

Mid-Term: The University City Boulevard loop will extend to Main Street, and no longer serve Progress Street.

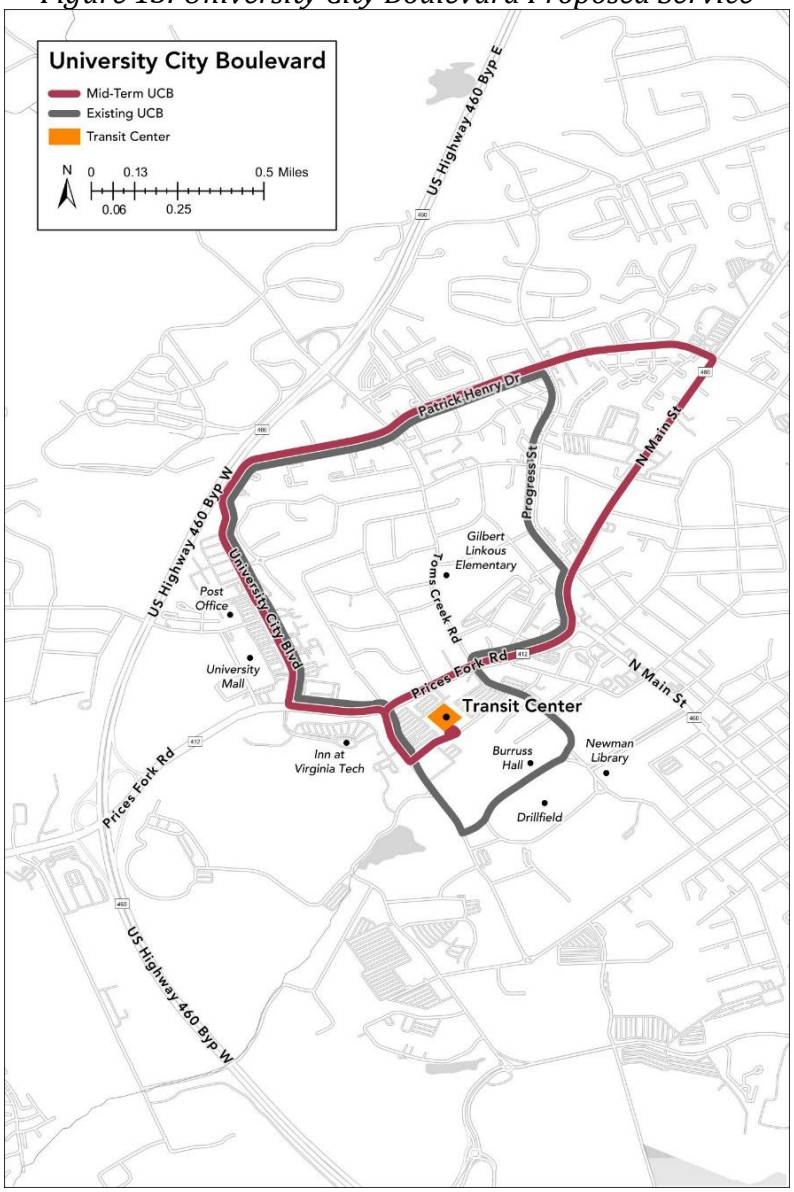
☐ Meets Identified Demand	☑ **Performance Improvement Opportunity**	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

Justification

- Extending the University City Boulevard route to Main Street will provide increased mobility options for those looking to travel to the Virginia Tech campus.
- Introducing overlapping service with Patrick Henry will support the existing service in the area.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership**
Mid-Term	The University City Boulevard loop will extend to Main Street.	+ 120	+ 4,794	+ 10% (+36,265)

Figure 13: University City Boulevard Proposed Service



Long-Term Horizon

The Long-Term Horizon encompasses planned service improvements slated for implementation between 7-10 years from the time of the TSP's publication. Long-Term improvements include new on-demand transit service for lower-density areas and changes to existing routes to support continued growth within the Town of Blacksburg and Virginia Tech communities. Route profiles are included when a new service is introduced or an existing service is enhanced. Table 3 is a summary of Long-Term planned improvements.

Table 3: Summary of Long-Term Planned Service Improvements

Long-Term Service Improvements	Routes Impacted
New Service	• **Glade Road** • **Highland Park Zone** • **North Main Zone** • **Prices Fork Zone** • **Harding Avenue University City**
Modified Service	• Hokie Express: Route Realignment*

Bold services include maps in this section.
*Map and route profile is included in the Short-Term horizon section.

Glade Road

Glade Road/Westover Hills Neighborhood to Virginia Tech Campus

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	Glade Road/Westover Hills/The Transit Center

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 6:45 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	30 min
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Long-Term: The new Glade Road route will provide fixed route service to the neighborhood west of University City Boulevard.

☐ Meets Identified Demand	☑ **Performance Improvement Opportunity**	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

Justification

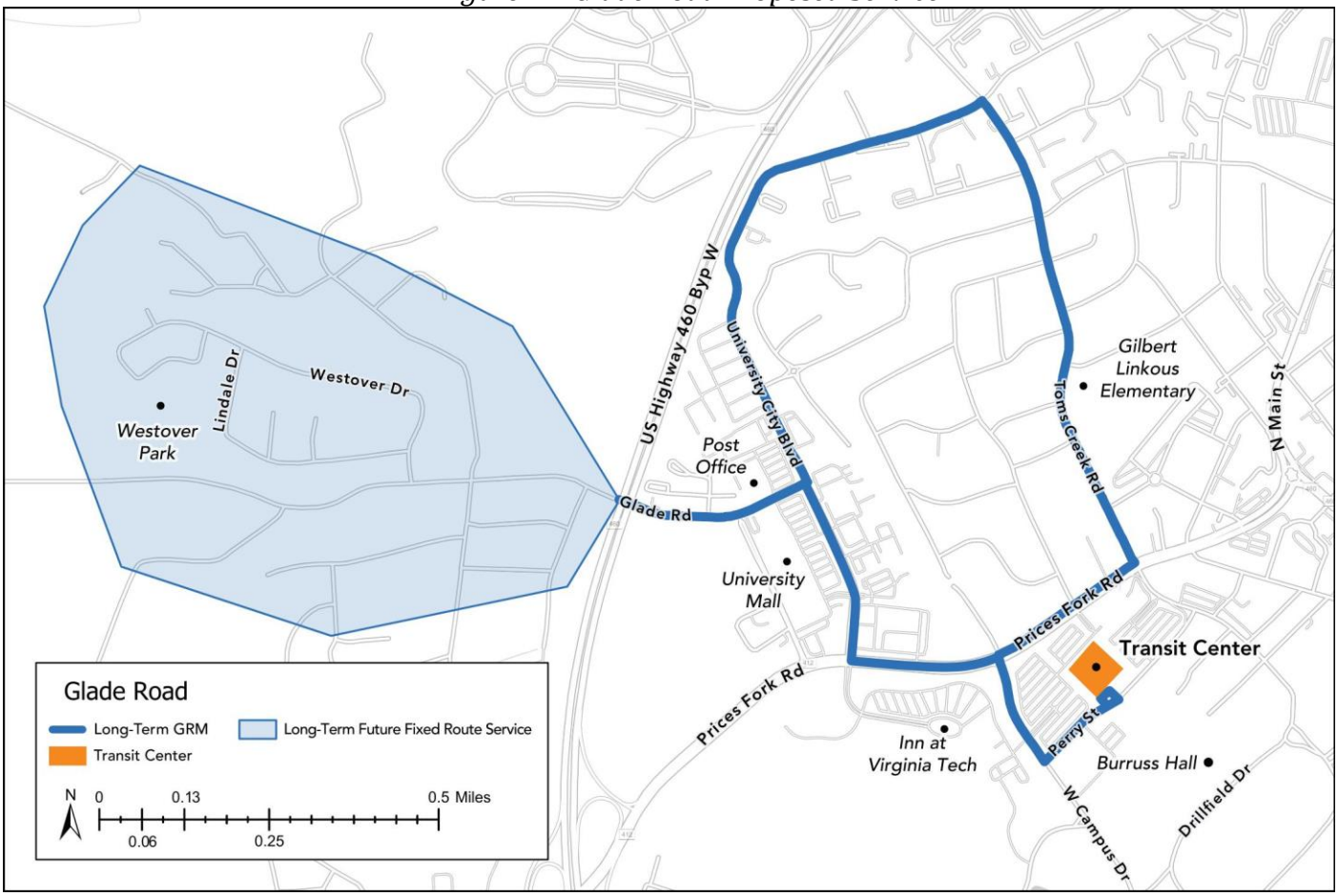
- Implementing the Glade Road route will expand service and improve frequency in the University City Boulevard and Toms Creek corridors.
- Additionally, this route will serve the new housing development planned off of Glade Road.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership***
Long-Term	The new Glade Road route will provide fixed route service to the neighborhood west of University City Boulevard.	+ 3,973	+ 20,159	+ 17,230

NOTE:

**Projected ridership for new service.*

Figure 14: Glade Road Proposed Service



Highland Park Zone

Grissom/Highland Park Neighborhood Area

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	Highland Park Neighborhood / South Main Street

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 7:00 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	On Demand
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Long-Term: Introduce an on-demand service zone that provides service to the Highland Park neighborhood and extends to the edge of service provided on South Main Street.

☐ Meets Identified Demand	☐ Performance Improvement Opportunity	☐ Efficiency Improvement Opportunity	☑ **Alignment with Service Standards**

Justification

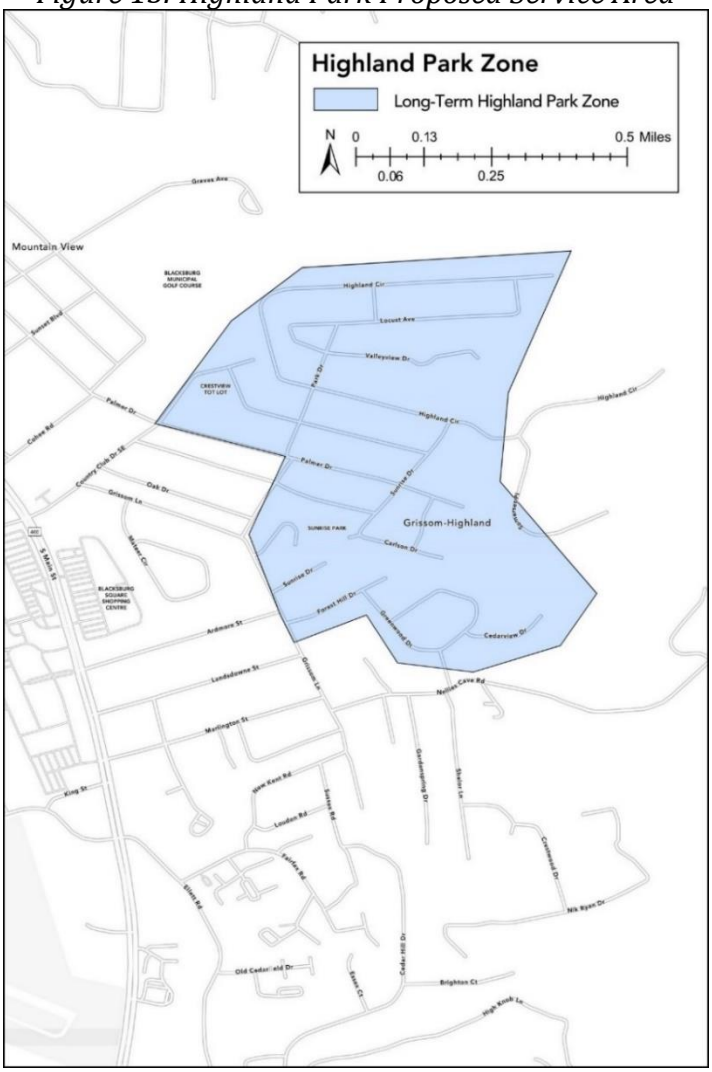
- Creating increased mobility options for areas with higher concentrations of households with zero or one car available.

Service Improvement Phasing			
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**	
		Revenue Hours	**Ridership***
Long-Term	Introduce an on-demand service zone that provides service to the Highland Park neighborhood and extends to the edge of service provided on South Main Street.	1,250	+ 2,400-4,700

NOTE:

**Projected ridership for new service.*

Figure 15: Highland Park Proposed Service Area



North Main Zone

Mount Tabor/Wyatt Farms/Kinloch Neighborhood Area

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	Mount Tabor / Kinloch /North Main Street

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 7:00 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	On Demand
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Long-Term: Introduce an on-demand service zone that provides service to the neighborhoods on the north end of the Town of Blacksburg along North Main Street to 460 Bypass, including Mount Tabor Village, Wyatt Farms, Kinloch, etc. with connections to existing fixed routes outside of the zone.

☐ Meets Identified Demand	☐ Performance Improvement Opportunity	☐ Efficiency Improvement Opportunity	☑ **Alignment with Service Standards**

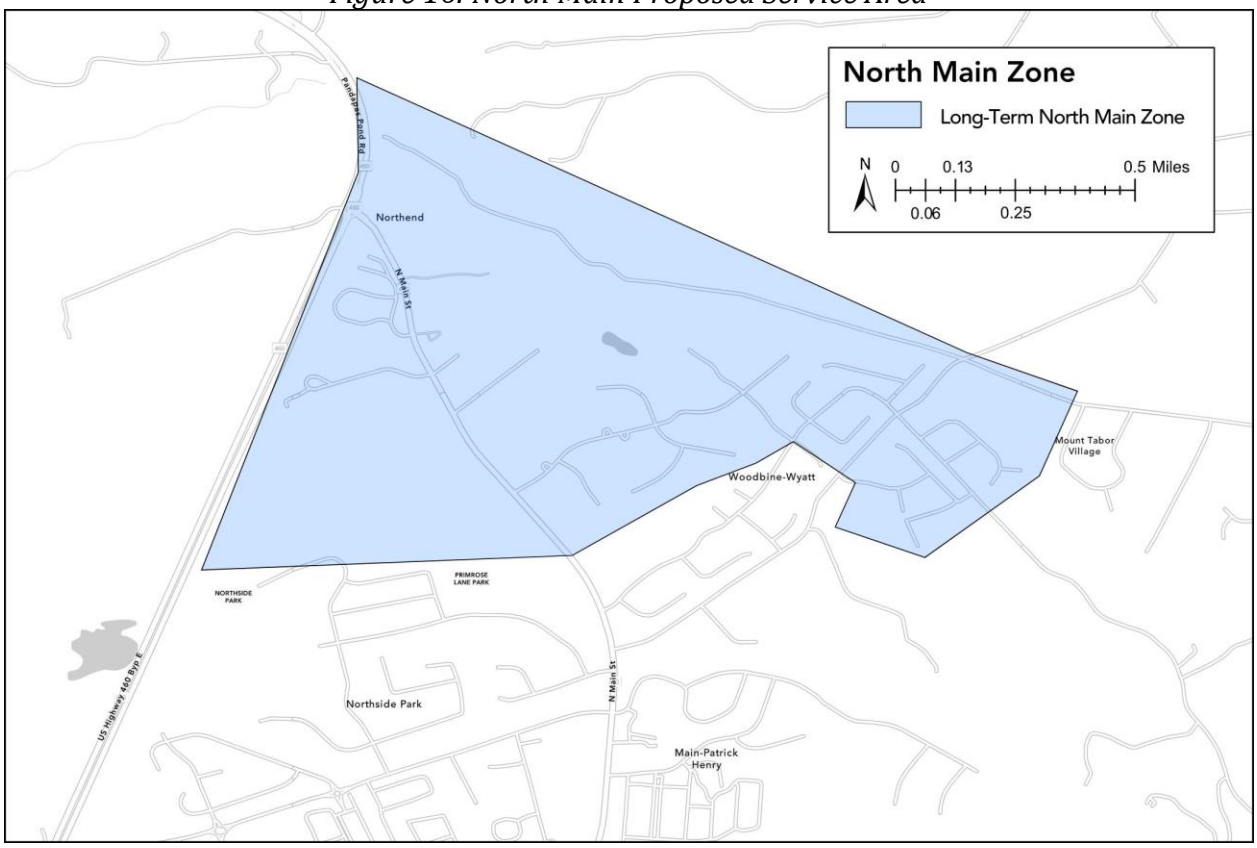
Justification

- This geographic area is not currently dense enough to warrant fixed route service. With the gradual growth expected to occur in the area, on-demand service will meet the travel demands.

Service Improvement Phasing			
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**	
		Revenue Hours	**Ridership***
Long-Term	Introduce an on-demand service zone that provides service to the Mount Tabor, Wyatt Farms, and Kinloch neighborhoods with connections to existing fixed route service	1,250	+ 2,200-4,300

NOTE:
**Projected ridership for new service.*

Figure 16: North Main Proposed Service Area



Prices Fork Zone

Blacksburg Middle & High School, Westhill and The Old School

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	Prices Fork Road / Hethwood

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 7:00 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	On Demand
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Long-Term: Introduce an on-demand zone that serves the Blacksburg High School, the new developments on Westhill Parkway and Kyle's Way, and the old Prices Fork Elementary School that connects to existing fixed routes in Blacksburg.

☑ **Meets Identified Demand**	☐ Performance Improvement Opportunity	☐ Efficiency Improvement Opportunity	☑ **Alignment with Service Standards**

Justification

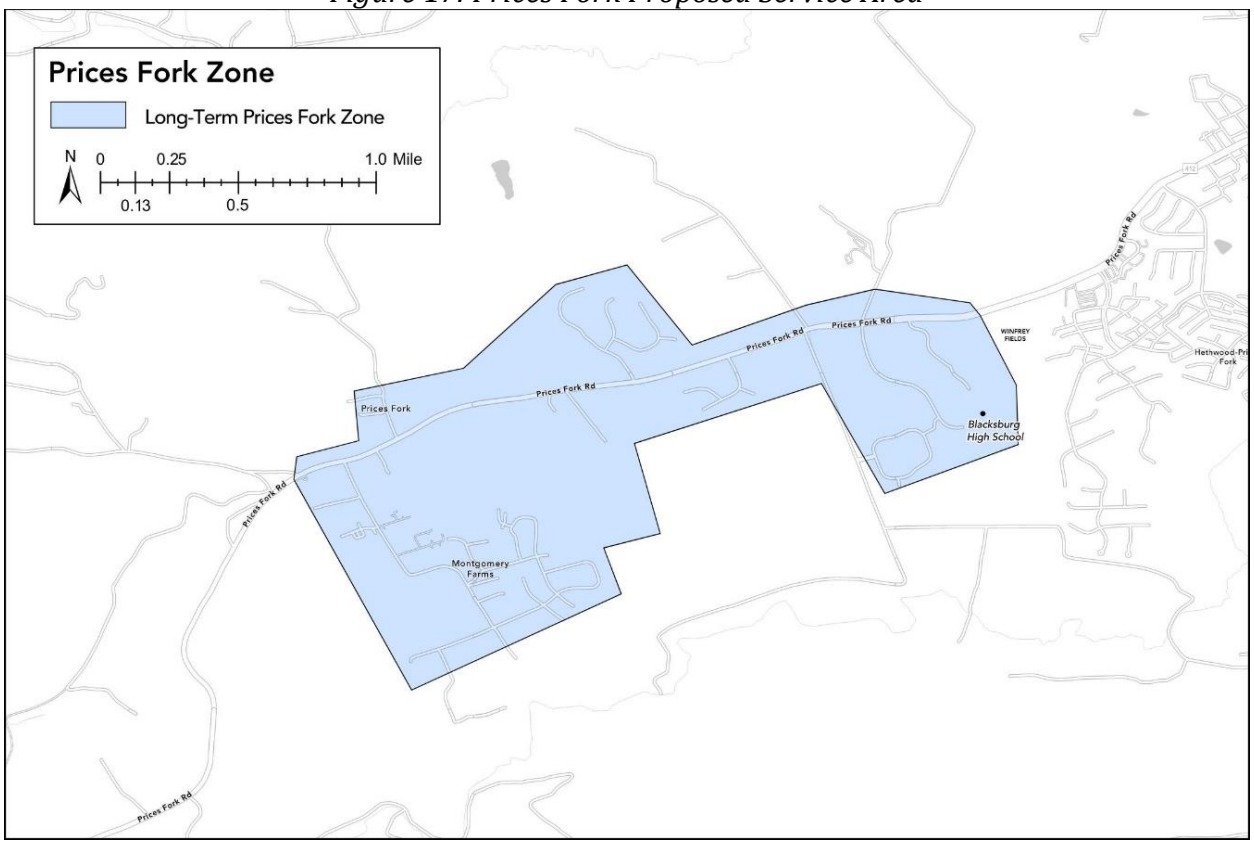
- The area on and surrounding Prices Fork Road has been identified as an area of high population growth resulting from projected increased employment opportunities.
- There is a current need for mobility options along Prices Fork Road for underserved communities. In the future, this need will grow with increased development west of Merrimac Road and the old Prices Fork Elementary School as a community hub.
- Additionally, new planned housing developments in this area will also be served by this service zone.

Service Improvement Phasing			
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**	
		Revenue Hours	**Ridership***
Long-Term	Introduce an on-demand zone that serves Blacksburg High School, the new developments on Westhill Parkway and Kyle's Way, and the old Prices Fork Elementary School that connects to existing fixed routes in Blacksburg.	1,250	+ 8,100-16,300

NOTE:

**Projected ridership for new service.*

Figure 17: Prices Fork Proposed Service Area



Harding Avenue University City

Harding Avenue to University City Boulevard.

Service Classification
Town of Blacksburg

Origins and Destinations Served		
	Existing	**Proposed**
To / From	N/A	Patrick Henry Drive / The Transit Center

Level of Service			
Span			
	Existing	**Proposed**	
Weekday	N/A	7:00 a.m. – 6:45 p.m.	
Saturday	N/A	N/A	
Sunday	N/A	N/A	
Headways			
		Existing	**Proposed**
Weekday	Peak	N/A	30 min
	Off-Peak	N/A	N/A
Saturday	All-Day	N/A	N/A
Sunday	All-Day	N/A	N/A

Notes
None

Service Improvement

Long-Term: New service to create a deliberate connection surrounding the north side of the VT Campus extending to the Blacksburg Community Center and neighborhoods east of 460 bypass. The route will serve the location of the old Blacksburg High School, which is anticipated to be redeveloped. This creates additional overlapping services on Patrick Henry. A dedicated vehicle is anticipated for this route.

☑ **Meets Identified Demand**	☐ Performance Improvement Opportunity	☑ **Efficiency Improvement Opportunity**	☐ Alignment with Service Standards

Justification

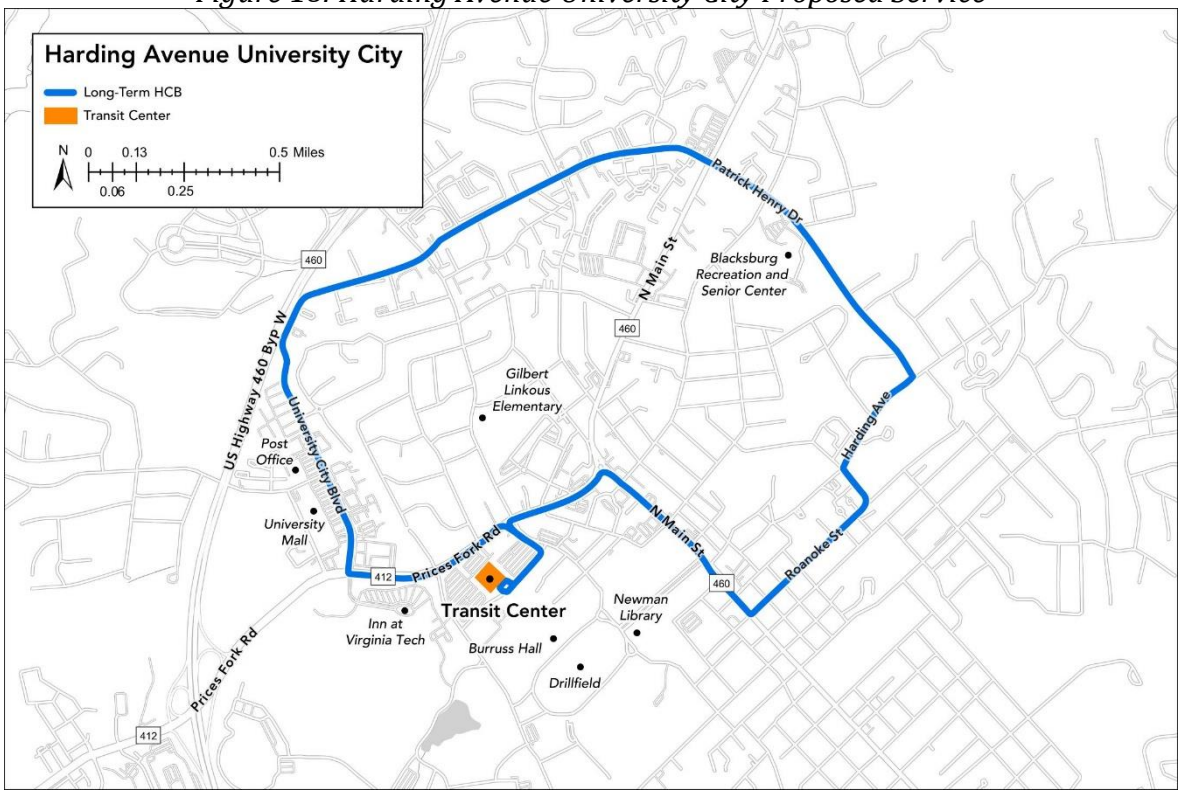
- This additional service will increase mobility options for residents living East of the 460 Bypass and increase connectivity surrounding the north side of the VT campus to the Blacksburg Community Center and surrounding neighborhoods.
- This additional service in the Long-Term horizon will improve wait time for passengers and encourage cross town travel within the Town of Blacksburg.

Service Improvement Phasing				
Horizon	**Improvement**	**Estimated Change from Existing (Annual)**		
		Revenue Hours	**Revenue Miles**	**Ridership***
Long-Term	Introduce new service providing cross town connections from Harding Avenue to University City Boulevard via Patrick Henry Drive.	8,024	81,353	+ 264,507

NOTE:

**Projected ridership for new service.*

Figure 18: Harding Avenue University City Proposed Service



3.2 | Prioritization of Planned Service Improvements

The proposed projects outlined in Section 3.1 are prioritized into a service plan based on several factors including cost, implementation feasibility, and needs fulfillment. In placing projects into the ten-year TSP timeframe, BT has outlined the financial requirements for carrying these projects forward.

Table 4 shows each project's implementation horizon and associated additional operating and maintenance costs. It must be noted, however, that these plans are accurate as of the development of the TSP but are subject to change as funding availability and service needs may change.

Projects that do not fit within the constrained funding, but that may be implemented if funding is identified during the ten-year horizon, are labeled as unconstrained. Any unconstrained projects not existing in the BT Strategic Plan FY 2025 - FY 2035 (TSP) will be added after adoption of the TSP.

- **Short-Term horizon: 1-3 years implementation (FY 2025 to FY 2028)**
- **Mid-Term horizon: 3-7 years implementation (FY 2029 to FY 2032)**
- **Long-Term horizon: 7-10 years implementation (FY 2033 to FY 2035)**

Table 4: Summary of Prioritized Service Improvements

Timeframe	Project Description	Additional Annual O&M Cost[1]
Short-Term	Campus Circulator - New Service	$1,820,279
Short-Term	Meadowbrook Zone - New On-Demand Service	$153,813
Short-Term	Progress Street Clockwise - New Service	$812,745
Short-Term	Carpenter Boulevard - Realignment	$0
Short-Term	Hokie Express - Realignment	$267,511
Short-Term	Main Street North - Route Consolidation	$0
Short-Term	Toms Creek - Frequency Improvements	$127,234
	TOTAL Short-Term	**$3,181,581**
Mid-Term	Clay Street - New Service	$1,272,066
Mid-Term	460 Express Route - Realignment	$0
Mid-Term	Explorer Blue - Realignment	$0
Mid-Term	Explorer Gold - Realignment	$0
Mid-Term	Main Street South - Realignment	$33,654

[1] Short-term OE/VRH rates based on FY25 proposed budget. Mid-term and Long-term rates escalated for inflation.

Timeframe	Project Description	Additional Annual O&M Cost[1]
Mid-Term	South Main Airport Road - Realignment	$0
Mid-Term	University City Boulevard - Realignment	$16,619
Mid-Term	Main Street North – Realignment	$18,420
	TOTAL Mid-Term	**$1,340,759**
Long-Term	Glade Road – New Service	$619,296
Long-Term	Highland Park Zone - New On-Demand Service	$194,845
Long-Term	North Main Zone - New On-Demand Service	$194,845
Long-Term	Prices Fork Zone - New On-Demand Service	$194,845
Long-Term	Harding Avenue University City - New Service	$1,250,749
Long-Term	Hokie Express - Realignment	($301,620)
	TOTAL Long-Term	**$2,152,960**

Unconstrained service improvements that can reasonably be implemented beyond the 10-year timeframe of the TSP are listed in Appendix C.

3.2.1 Capital Projects Supporting TSP Implementation

Electrification infrastructure

Blacksburg Transit is transitioning its fleet to zero-emission vehicles. By the year 2035, BT plans to completely transition its fleet to 100% battery-electric buses. As part of this process, each bus loop of the Transit Center is being designed to incorporate an on-route electrical charger to extend the range and service capabilities of BT's battery-electric buses (BEBs).

Opening of the Transit Center

The new Transit Center will serve as a central transportation hub for the Town of Blacksburg and the university and is expected to begin operation in 2024. The facility will host multiple public transit and transportation services, including BT, Smart Way Bus, Virginia Breeze, and Radford Transit. The facility will improve BT's efficiency and improve the safety and convenience for pedestrians and transit passengers.

3.3 | Service Development

Table 5 details the high-level operational impacts of the proposed projects by phase.

Table 5: Operational Impacts

Timeframe	Projects	Annual Service Hours Change	Annual Service Miles Change
Short-Term	• Campus Circulator - New Service • Meadowbrook Zone - New On-Demand Service • Progress Street Clockwise - New Service • Carpenter Boulevard – Realignment • Hokie Express - Realignment • Main Street North - Route Consolidation • Toms Creek - Frequency Improvements	+ 25,826	+ 146,661
Mid-Term	• Clay Street - New Service • 460 Express Route - Realignment • Explorer Blue - Realignment • Explorer Gold - Realignment • Main Street North - Realignment • Main Street South - Realignment • South Main Airport Road - Realignment • University City Boulevard - Realignment	+ 9,681	+ 74,430
Long-Term	• Glade Road - New Service • Highland Park Zone - New Service • North Main Zone - New Service • Prices Fork Zone - New Service • Harding Avenue University City - New Service • Hokie Express - Realignment	+ 13,812	+ 85,463

Title VI

As a recipient of federal funds, BT must adhere to Title VI of the Civil Rights Act of 1964 and its associated executive orders, which collectively prohibit discrimination in the provision of transit service based on race, color, national origin, and income. Major service changes such as those outlined in the TSP must be evaluated to determine whether they have a disparate or disproportionate impact on minority and low-income populations.

Title VI Review Methodology

A high-level analysis of U.S. Census Bureau data and American Community Survey demographic data (i.e., poverty and minority populations), using the Remix transit planning software, was conducted. The Remix planning tool calculates these boundaries based on a buffer. The route

geometries for the Long-Term recommended service improvements were compared with the poverty and minority population data for the BT service area and from here, analyzed to determine which groups would be disproportionately affected by these proposed changes.

Table 6 shows the results of this review.

Table 6: Title VI Review

Title VI Review		
	% Minority	**% Poverty**
Existing Route Network	21.4%	35%
Long-Term Route Network	20.5%	35%

Additional analysis will be required at the time of implementation to better understand Title VI impacts and identify potential mitigation strategies if warranted. However, the proposed changes in this TSP are not anticipated to have major impacts on minority or low-income populations.

3.4 | Additional Recommendations

In order to work toward the goals and objectives set forth in Chapter 1 and to implement the planned service improvements described in this chapter, a few additional recommendations should be considered for implementation during the 10-year TSP timeframe.

Bolstered marketing efforts for BT's app – BT's app provides real-time bus information and service updates.

Incorporate connections to the Transit Center – create more connections to the Transit Center to increase regional connectivity for Radford, Town of Blacksburg, and Town of Christiansburg residents.

Regional Rail Connectivity – as future rail service continues to grow in the area in the coming years, BT will coordinate with future partners to connect to those rail stations.

Coordinate Future Service with Montgomery County – With additional on-demand zones recommended for Prices Fork in Montgomery County, Blacksburg Transit should consider regular coordination with Montgomery County on funding and service opportunities.

Chapter 4

Implementation Plan

Contents

The Implementation Plan lists steps required by an agency to carry out the operations and services described in Chapter 3 Planned Improvements and Modifications. The Implementation Plan should also reference the approved Transit Asset Management (TAM) plan to guide the schedule for replacing and increasing rolling stock and existing facilities to maintain State of Good Repair (SGR).

4.1 | Asset Management

The Virginia Department of Rail and Public Transportation (DRPT) sponsored a group TAM plan for Tier II agencies to ensure all transit agencies in Virginia remain in a State of Good Repair. DRPT classifies Blacksburg Transit (BT) as a Tier II agency which denotes rural and small urban transit agencies operating fewer than 100 vehicles across all fixed-route services. BT was included in the Group TAM Plan for Tier II agencies in December 2021, a document that remains effective until FY 2025. Blacksburg Transit inventory, useful life benchmarks, and replacement schedules adhere to the state-wide standards outlined in DRPT's biannual Virginia Group Tier II Transit Asset Management Plan (TAMP) and are detailed below.

4.1.1 Vehicle Fleet Replacement and Retirement Policies

Useful Life is defined by FTA as the minimum acceptable period a capital asset purchased with FTA funds should be used in service. Useful Life standards can be expressed in terms of minimum age and/or mileage and set the minimum threshold that must be met and surpassed before the asset is eligible to be remove from service and replaced or decommissioned.

Table 1 below displays the FTA's guidelines for Useful Life standards (UL) for vehicles. Transit agencies that utilize federal funding from FTA for vehicle purchases are required to meet the useful life standard for a vehicle in years or miles before decommissioning the vehicle. Consequently, the stated useful life standards below are used as a baseline for replacing existing vehicles in Blacksburg Transit's fleet.

Table 1: Useful Life for Blacksburg Transit's Fleet

Vehicle Category	Useful Life	
	Years	Miles
Articulated Bus (60')	12	500,000
Large Bus (35'-40')	12	500,000
Cutaway	5	150,000
Van	8	100,000
Automobile (non-revenue)	4	100,000

Source: Federal Transit Administration

Useful Life Benchmarks (ULB) is defined by FTA as the expected lifecycle of a capital asset for a particular transit provider's operating environment, or the acceptable period of use in service for a particular transit provider's operating environment. ULB is not the same as an assets Useful Life. Assets which exceed their ULB are not considered to be in a state of good repair.

Table 2 identifies the ULB and annual performance targets set by DRPT for each asset class of vehicles in Blacksburg Transit's fleet. The established ULB match the default ULB provided by FTA. The performance targets are established in the DRPT sponsor group TAM and set the maximum percentage of vehicles exceeding the ULB that is considered acceptable. There is no penalty for exceeding this target, it simply identifies that a certain asset class has exceed what is considered acceptable for exceeding the ULB.

BT achieved the DRPT FY 2022 revenue annual performance targets for articulated buses, and vans since none of the vehicles were beyond their useful life benchmark. However, in the 2022 Tier II TAM plan, one cutaway was beyond its useful life benchmark representing 6 percent of cutaways of the fleet.

In addition, 14 Heavy Duty Transit buses reach their ULB in FY 2024, and an additional 9 will in FY 2025.

Table 2: Useful Life Benchmarks and Targets for BT's Revenue Fleet

Asset Class	ULB (Years)	Target	# in BT Fleet	Number of Vehicles Exceeding ULB	Years Over ULB
Revenue Fleet			**71**	**28**	
Articulated Bus	14	5%	13	0	0
Bus	14	15%	40	27	+ 1 year(s)
Cutaway	10	10%	16	1	+2 year(s)
Van	8	20%	2	0	0
Non-Revenue Fleet			**23**	**0**	
Automobile	8	30%	17	8	NA
Truck	14	30%	6	3	NA

Source: Virginia Group Tier Transit Assessment Management Plan FY 2022-FY 2025, FY 2023 BT Fleet List

4.1.2 Facilities Maintenance

Blacksburg Transit's main Operations and Maintenance Facility at 2800 Commerce Street contains administrative offices, a dispatch center, operator lounge, training facilities, interior bus storage facility, wash bay, vehicle garage, and fueling facilities.

The DRPT Transit Asset Management Plan (TAMP) establishes an annual performance target of fewer than 10 percent of administrative and maintenance facilities (for all group members) rating below 3.0 by the standards of the FTA Transit Economic Requirements Model (TERM) Scale. Table 3 describes the TERM scale in greater detail.

Table 3: FTA's Term Classifications

Term Rating	Condition	Description
Excellent	**4.8 – 5.0**	No visible defects; new or near new condition; may still be under warranty if applicable
Good	**4.0 – 4.7**	Good condition, but no longer new; may be slightly defective or deteriorated, but is overall functional

Term Rating	Condition	Description
Adequate	**3.0 – 3.9**	Moderately deteriorated or defective, but has not exceeded useful life
Marginal	**2.0 – 2.9**	Defective or deteriorated; in need of replacement; exceeded useful life
Poor	**1.0 – 1.9**	Critically damaged or in need of immediate repair; well past useful life

Source: Virginia Group Tier II Transit Asset Management Plan FY 2022-FY 2025

4.1.3 Passenger Facilities

The DRPT Transit Asset Management Plan (TAMP) establishes a performance target of fewer than 15 percent of passenger facilities rating below 3.0 by the standards of the FTA TERM scale.

The new Transit Center opening in Fall of 2024 is the product of the planned efforts of the Town of Blacksburg in close coordination with Virginia Tech. The facility will serve as a central transportation hub for multiple modes of alternative and regional transportation, including Blacksburg Transit, Smart Way, Virginia Breeze, and Radford Transit. The Transit Center includes a 13,000 square foot building, two bus loops with 17 bus bays, 13 passenger shelters, and infrastructure for the installation of two rapid electric bus chargers. The building includes a passenger waiting area, restrooms, break area and offices for staff and bike repair area.

4.1.4 Technology and ITS

Blacksburg Transit has been at the forefront of ITS technology since the early 1990s, when BT was among the first in the nation to install GPS equipment on buses as part of an FTA-funded research project. BT partnered with the VT Center for Transportation Research, the forerunner of VTTI—Virginia Tech Transportation Institute. BT has partnered with VTTI on multiple projects over the last 30 years to increase the body of knowledge for transit ITS deployment and use.

In 2018, ITS staff worked with CCS – Communications and Customer Support staff to develop a Customer Communications and ITS Strategic plan to guide investments through FY2026. While the COVID-19 pandemic has led to some delay in deployments, this plan has allowed BT to focus ITS deployments on improving customer experience by delivering simple, accurate, and timely information across multiple channels.

4.2 | Capital Implementation Plan

The Capital Implementation Plan (CIP) provides an outline for BT to meet its capital needs over the next 10 years. The CIP determines when to replace or expand assets such as revenue vehicles, non-revenue vehicles, facilities, and equipment. Fleet replacement is based on the asset's useful life standard, and any fleet expansion would be directly related to the service improvements described in Chapter 3. Furthermore, the CIP outlines BT's planned transition to zero-emission buses and the accompanying infrastructure improvements to support a zero-emissions fleet. The CIP details funding avenues for asset replacement, expansion, and transition to zero-emissions.

4.2.1 Revenue Vehicle Fleet

BT's current revenue fleet consists of 71 vehicles, as shown in Table 2. BT is scheduled to replace 37 revenue vehicles and add two expansion vehicles to its fleet during the ten-year Capital

Implementation Plan. As shown in Table 4, the replacement schedule is based on schedules in the Six-Year Improvement Program (FY 24-FY 29), the 2022 BT Fleet Electrification Plan, and FY 25-FY 29 Town of Blacksburg CIP. The expansion schedule is based on service improvements identified in Chapter 3. Revenue vehicles are scheduled for implementation two years after the procurement. BT currently conducts mid-life battery replacements for its electric fleet. All replacement full-sized buses include funding projections for battery electric within the CIP, but the Body-on-Chassis will reflect funding for gasoline-powered in this document. As technology improves with battery electric for Body-on-Chassis, BT will explore converting that fleet. Funding sources for replacement revenue fleet vehicles include MERIT State of Good Repair grants and federal capital formula funding.

No expansion vehicles were identified in the short-term and mid-term service improvements. The two expansion vehicles identified in the long-term service improvements are associated with new routes being added to the system. Service improvements planned during the short and mid-term horizons in Chapter 3 requiring additional vehicles will be supported by the existing fleet. The state funding source for revenue fleet expansion includes MERIT grants and BT will identify federal funding from existing programs or discretionary programs.

Table 4: Revenue Fleet Replacement Schedule by Purchase Year

	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34
Replacement – Heavy Duty	-	6	-	9	-	-	4	-	2	-	-
Replacement – BOC	-	-	3	2	1	5	5	5	-	-	-
Replacement - Total	-	6	3	11	1	5	9	5	2	-	-
Expansion – Heavy Duty	-	-	-	-	-	-	-	-	2	-	-
Total Fleet Size	71	71	71	71	71	71	71	71	73	73	73

4.2.2 Non-Revenue Vehicle/Equipment Fleet

BT's non-revenue fleet includes 17 automobiles and six trucks/other rubber tire vehicles, including trailers, floor sweepers, two forklifts, a scissor lift, a trailer, and an ATV. These vehicles are used for administration, maintenance, and operations. Eight automobiles (47 percent) and three trucks/other (50 percent) were beyond their useful life benchmarks in the 2022 Tier II TAM plan. Consequently, BT missed the DRPT FY 2022 non-revenue performance target of 30 percent for equipment.

BT is scheduled to replace 14 non-revenue vehicles over the next 10 years, as shown in Table 5. However, BT is not expected to expand its non-revenue fleet during that timeframe. Battery electric non-revenue replacement vehicles may be implemented if adequate funding is available. Funding sources for replacement non-revenue fleet vehicles include MERIT State of Good Repair grants and federal capital formula funding.

Table 5: Non-Revenue Vehicle Replacement Schedule

	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34
Replacement	-	-	1	1	1	6	2	-	-	-	-
Expansion	-	-	-	-	-	-	-	-	-	-	-
Total Fleet Size	23	23	23	23	23	23	23	23	23	23	23

4.2.3 Facilities

BT owns and maintains the Operations, Administration and Maintenance Facility at 2800 Commerce Street. The facility has a rating above 3.0 on the TERM scale and is not in immediate need of repair, however, the facility is no longer large enough to meet BT's daily needs. The maintenance portion of the facility will be expanded to include an additional working bay with a 3-point in ground lift and pit to accommodate 60-ft buses, new parts/storage facilities, new offices and expanded bus storage facilities in addition to a new two-lane wash bay facility.

Improvements to electric bus charging infrastructure are planned over the next 10 years in accordance with the BT Fleet Electrification Plan and Town of Blacksburg Capital Improvement Program (FY 2025-FY 2029). Depot chargers are used at BT's facility to charge out of service buses, with plans to add two on-route chargers at the Transit Center on Virginia Tech's campus to charge buses in service. Replacement and expansion schedules for depot and on-route chargers are outlined in Table 6. Potential funding sources include local funding, DRPT Minor Enhancement (MIN) capital assistance grants, and FTA Low or No Emission Grants.

Table 6: Depot and On-Route Chargers Implementation Schedule

Facility	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33	FY 34
Depot Chargers (Replacement)	-	-	-	2	-	2	-	4	2	-	-
Depot Chargers (Expansion)	-	2	-	-	-	-	-	-	-	-	-
Total Depot Chargers	8	10	10	10	10	10	10	10	10	10	10
On-Route Chargers (Replacement)	-	-	-	-	-	1	-	-	1	-	-
On-Route Chargers (Expansion)	-	-	1	-	-	-	-	-	-	-	-
Total On-Route Chargers	1	1	2	2	2	2	2	2	2	2	2

Additionally, new bus pull-offs and bus pull-off extensions to accommodate 60-foot buses are planned for design and construction between FY 2025 and FY 2029. These pull-offs are located on University City Blvd and Patrick Henry Drive, and the funding source includes DRPT Minor Enhancement (MIN) capital assistance grants.

Additional planned improvements to the BT Facility in future years include bus lot security fencing, parking lot refinishing and re-striping, replacement floor sweeper, abrasive blast cabinet, and other small miscellaneous equipment. Funding is sourced through DRPT Minor Enhancement (MIN) capital assistance grants.

4.2.4 Technology and Equipment

Upgrades and expansion to BT's Intelligent Transportation Systems (ITS) within the CIP over the 10-year TSP horizon include a battery electric bus management system, IT upgrades, advanced traffic management systems, customer communications, and systems updates.

Additional technology and equipment improvements include vehicle support equipment, automatic data processing (ADP) hardware, and ADP software. Vehicle support equipment upgrades are funded through DRPT Minor Enhancement (MIN) capital assistance grants and include shop equipment and radio replacements. Upgrades to ADP hardware include customer communications, replacement core network switch, ITS system plan replacement and expansion, advanced traffic management system hardware, wireless access points, storage area network (SAN) replacement, and wireless data equipment. ADP software upgrades include customer communications, replacement software core network, advanced traffic management system. Improvements for ADP hardware and software are funded through State of Good Repair grants with federal and local contributions.

4.2.5 Transition to Zero-Emission Fleet

Federal climate change mitigation goals outlined in the FTA and Federal Highway Administration (FHWA) Planning Emphasis Areas include reducing greenhouse gases 50-52 percent below 2005 levels by 2030, and net-zero emissions by 2050.

Blacksburg Transit outlined its transition to a zero-emission fleet in the 2022 Fleet Electrification Plan. BT has begun to replace its diesel fuel and hybrid-electric fleet with battery electric buses, and is scheduled to complete the transition to battery electric by FY 2035. During that time frame, BT will expand its depot charging and on-route charging infrastructure to accommodate additional battery electric buses. BT will pursue funding for zero-emission buses and charging infrastructure will through discretionary grant opportunities where possible and unmet needs will be funded through state and federal formula funds with a local match.

Chapter 5

Financial Plan

Contents

Chapter 5 of the Transit Strategic Plan presents the financial plan and provides projections of the anticipated expenditures and revenues over the 10-year TSP timeframe. This chapter is organized into two sections:

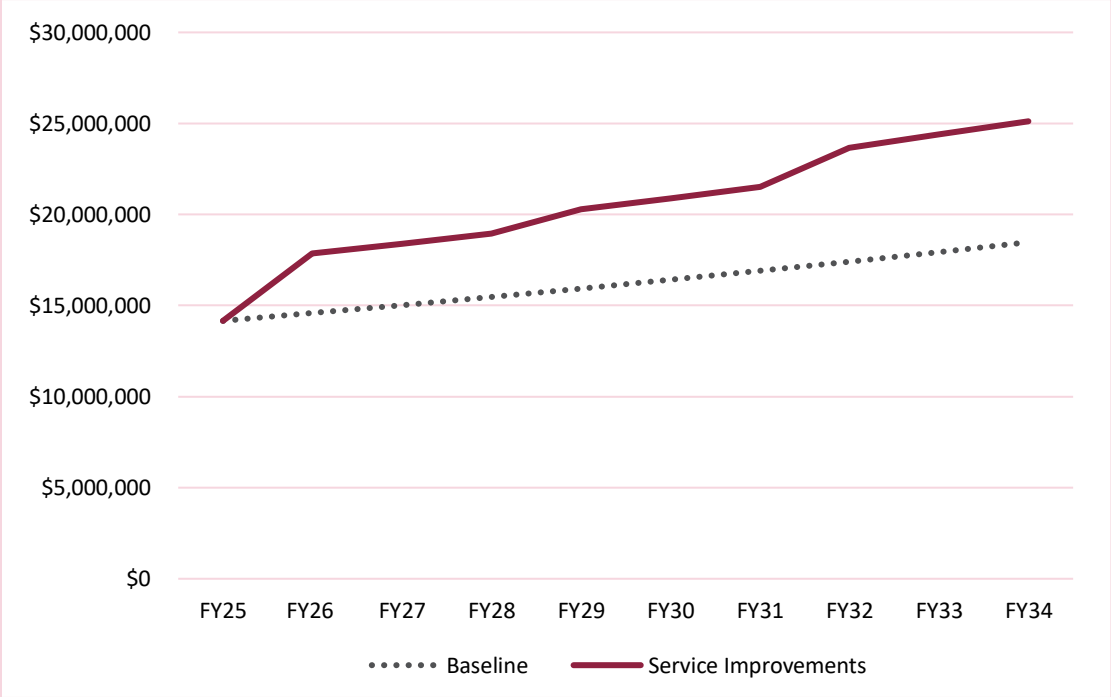
- Section 5.1 Operating and Maintenance Costs and Funding Sources discusses the projected operating and maintenance costs and funding sources.
- Section 5.2 Capital Costs and Funding Sources discusses the costs of vehicle purchases and facility improvements.

5.1 | Operating and Maintenance Costs and Funding Sources

5.1.1 Revenue Assumptions

Two 10-year financial plan scenarios were developed for the TSP: a baseline scenario and a service change scenario. The baseline scenario assumes no service changes are implemented during the TSP timeframe, and BT's revenue hours were held constant at FY 2025 levels. However, the service change scenario assumes the service improvements discussed in Chapter 3 are implemented, and BT's revenue hours are projected to increase after the short-, mid-, and long-term improvements are implemented. Projected operating expenses for both scenarios reflect an assumed three percent escalation rate each year. The revenue assumption also assumes that any new service outside of Blacksburg and Christiansburg would require additional support from Montgomery County. Additional operating expenses are calculated for service increases, as shown in Figure 1.

Figure 1: BT's Annual Operating Expenses Over Ten-Year Transit Strategic Plan Timeframe



Source: Blacksburg Transit Strategic Plan Chapter 3

The values presented in each section are based on data provided by BT and the Town of Blacksburg. Projections for future years are calculated using a combination of forecasts provided by BT's FY 2025 projected budget, the FY 2025 DRPT Six Year Improvement Program (SYIP), and standard escalation rates. As with any projection, it is important to note that the uncertainty increases through time; therefore, values and figures are subject to change over time. All costs in this chapter have been inflated to year of expenditure dollars (YOE$), accounting for the minimum three percent annual escalation factor specified in the DRPT TSP Guidelines. For a retrospective look into BT's annual costs and funding sources, refer to Appendix C.

BT's operating and maintenance revenue is grouped into six categories: contract service, advertising revenue, federal funding, state funding, local funding, and other income. Future years beyond the already budgeted FY 2025 are based on the following assumptions.

5.1.1.1 Farebox Revenue

In 2020, BT began operating fare-free service in response to the COVID-19 pandemic. In 2022, the Blacksburg Town Council voted unanimously to make fare-free service permanent. Accordingly, no farebox revenue is projected for future operations.

5.1.1.2 Advertising Revenue

Advertising revenues are expected to gradually rebound as the Town of Blacksburg and BT recover from pandemic-related impacts. The proposed FY 2025 BT budget estimates $120,000 in advertising revenue. For projection purposes, advertising revenues will increase by a three percent escalation rate from FY 2025 through FY 2034 in both the baseline and service change scenario, shown in Table 3 and Table 4.

5.1.1.3 Federal Funding

Federal funding for BT comes from FTA Section 5307 funding, which BT uses to support operating expenses. For urbanized areas of 50,000 to 199,999 in population, the allocation is based on population and population density. Performance-based Small Transit Intensive Cities (STIC) funding is available in addition to formula funding from FTA Section 5307. The proposed FY 2025 budget accounts for $4,104,976 in total federal funding. BT's federal funding is projected to escalate three percent annually in both scenarios to account for population growth and future density. Federal funding projections are shown in Table 3 and Table 4.

5.1.1.4 State/DRPT Funding

BT's state funding is comprised of DRPT Operating Assistance funding. The DRPT FY 2025 SYIP allocates $3,606,217 in Urban Operating Assistance for BT. Future DRPT Operating Assistance allocation depends on the total amount of State Operating Assistance funding available. Changes to the DRPT Operating Funding pool are projected in the FY 2025 SYIP and shown in Table 1.

For the baseline scenario, DRPT Operating Assistance funding is anticipated to change proportionally to the total DRPT Operating Funding pool. From FY 2031 to FY 2034, DRPT Operating Assistance funding is assumed to increase at two percent. The baseline state funding projections are shown in Table 3.

5.1.1.5 Virginia Tech Contract Service

Virginia Tech (VT) pays annually for BT service, and their annual contribution in the proposed FY 2025 budget is $7,250,000. In the baseline scenario, VT's contribution is expected to remain

at the FY 2025 level with it being escalated by three percent year over year to account for inflation, as shown in Table 3.

In the service change scenario, several routes servicing VT's campus will receive frequency and service improvements as part of the TSP's short-, mid-, and long-term recommendations. VT's annual contribution is escalated proportionally with the increase in operating expenses for service improvements to VT's campus. This increase will be incremental year over year, and projections can be seen in Table 4.

Table 1: Annual Change in DRPT Operating Funding Estimates

Year	Percent Change from Previous Year
FY 2025 to FY 2026	-10.5%
FY 2026 to FY 2027	2.3%
FY 2027 to FY 2028	2.3%
FY 2028 to FY 2029	2.1%
FY 2029 to FY 2030	2.5%

Source: DRPT FY 2025 SYIP

The DRPT Operating Assistance funds in the proposed FY 2025 SYIP provides a basis to project BT's future state funding, but the exact allocation from the state will vary year to year. This is due to the Virginia General Assembly passing a statute[1] in 2018, requiring transit grant funding be based on performance. Performance-based allocation of state transit operating funding, which began in FY 2020, accounts for both the size of the agency and three years of performance trends. Sizing metrics are used to correlate funding allocations with the size of the agency and include operating cost (50 percent), ridership (30 percent), revenue vehicle hours (10 percent), and revenue vehicle miles (10 percent). The sizing allocation is then adjusted based on a comparison of the performance trends of the agency to the statewide trends for five performance metrics:

- Passengers per Revenue Vehicle Hour
- Passengers per Revenue Vehicle Mile
- Operating Cost per Revenue Vehicle Hour
- Operating Cost per Revenue Vehicle Mile
- Operating Cost per Passenger

For the service change scenario, the DRPT Operating Assistance was calculated using DRPT's MERIT allocation formula. BT's anticipated increases in ridership, revenue miles, revenue hours, and operating costs for each TSP timeframe (short-term, mid-term, and long-term) were put into the formula. Since the DRPT Operating Assistance is based on a performance-based allocation, the future performance of Virginia's other transit agencies needs to be calculated. Future performance was calculated using each agency's FY 2022 input variables and escalated them by the assumptions listed in Table 2.

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[1] Section 33.2-1526.1 of the Code of Virginia

Table 2: Escalation Assumptions for DRPT's MERIT Inputs

Input	Annual Assumption
Ridership	1.5% increase
Revenue Miles	3% increase
Revenue Hours	3% increase
Operating Cost	3% increase
Operating Cost Sizing	2021's Split

BT's estimated increase in DRPT Operating Assistance over the 10-year TSP horizon is outlined in Table 4.

5.1.1.6 Town of Christiansburg Funding

The Town of Christiansburg pays annually for BT service, and its annual contribution in FY 2025 is projected to be $665,000. In the baseline scenario shown in Table 3, Christiansburg's payment is expected to remain at the FY 2025 level and escalate by three percent annually to account for inflation.

In the service change scenario, the payment from Christiansburg will follow the same three percent escalation factor year over year. Additional funding from the town of Christiansburg is projected to supplement the town's service improvements outlined in Chapter 3. The Town of Christiansburg's projected funding changes due to service improvements are shown in Table 4.

5.1.1.7 Local Funding Needs

Any budget surplus or deficit is distributed proportionally to the local funding partners, currently VT and the Town of Christiansburg, respectively for the services they fund. When services are added outside the towns of Blacksburg or Christiansburg within Montgomery County, Montgomery County will be responsible for funding the services within their jurisdiction.

These assumptions were continued for 10-year financial plan scenarios. In Table 3 and Table 4, the projected budget surpluses will be redistributed to VT and Christiansburg (or Montgomery County), and any budget deficit will need supplemental funding from VT and Christiansburg, (or Montgomery County).

Table 3: Projected BT Operation Costs and Revenues Under the Baseline Scenario ($1000s, YOE$)

	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34
Revenue Hours	115,092	115,092	115,092	115,092	115,092	115,092	115,092	115,092	115,092	115,092
Total Operating Cost	$14,162	$14,587	$15,025	$15,475	$15,940	$16,418	$16,910	$17,418	$17,940	$18,478
Expected Operating Revenue Sources										
Federal	$4,105	$4,228	$4,355	$4,486	$4,620	$4,759	$4,902	$5,049	$5,200	$5,356
State	$3,606	$3,227	$3,301	$3,376	$3,449	$3,535	$3,606	$3,678	$3,751	$3,826
VT	$7,250	$7,468	$7,692	$7,922	$8,160	$8,405	$8,657	$8,917	$9,184	$9,460
Christiansburg	$665	$685	$706	$727	$749	$771	$794	$818	$843	$868
Montgomery County	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Advertising	$120	$124	$127	$131	$135	$139	$143	$148	$152	$157
Budget Surplus	$1,584	$1,145	$1,156	$1,167	$1,173	$1,191	$1,191	$1,191	$1,190	$1,188

1. Revenue hours remain constant under the baseline scenario.
2. Total operating costs are based on BT's FY 2025 proposed budget. Future-year operating costs are escalated by three percent annually.

Table 4: Projected BT Operation Costs and Revenues Under the Service Change Scenario ($1000s, YOE$)

	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34
Revenue Hours	115,092	140,918	140,918	140,918	150,599	150,599	150,599	164,411	164,411	164,411
Total Operating Cost	$14,162	$17,860	$18,396	$18,948	$20,289	$20,897	$21,524	$23,677	$24,387	$25,119
Expected Operating Revenue Sources										
Federal	$4,105	$4,228	$4,355	$4,486	$4,620	$4,759	$4,902	$5,049	$5,200	$5,356
State	$3,606	$4,154	$4,249	$4,346	$4,719	$4,837	$4,934	$5,507	$5,618	$5,730
VT	$7,250	$8,941	$9,209	$9,485	$10,156	$10,461	$10,775	$12,020	$12,436	$12,865
Christiansburg	$665	$704	$725	$747	$769	$792	$816	$953	$982	$1,011
Montgomery County	$0	$0	$0	$0	$0	$0	$0	$194	$199	$207
Advertising	$120	$124	$127	$131	$135	$139	$143	$148	$152	$157
Budget Surplus	$1,584	$290	$269	$247	$111	$91	$45	$0	$0	$0

1. Revenue hours remain constant under the baseline scenario.
2. Total operating costs are based on BT's FY 2025 proposed budget. Future year operating costs are escalated three percent annually.

Table 5: Projected Operating and Maintenance Costs for Service Additions ($1000s, YOE$)

	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34
Existing System										
Revenue Hours	115,092	115,092	115,092	115,092	115,092	115,092	115,092	115,092	115,092	115,092
Total Operating Cost	$14,162	$14,587	$15,025	$15,475	$15,940	$16,418	$16,910	$17,418	$17,940	$18,478
Service Additions										
Additional Revenue Hours	-	25,826	-	-	9,681	-	-	23,493	-	-
Additional Operating Costs	-	$3,273	-	-	$1,341	-	-	$2,153	-	-
Totals										
Total Revenue Hours	115,092	140,918	140,918	140,918	150,599	150,599	150,599	164,411	164,411	164,411
Total Operating Cost	$14,162	$17,860	$18,396	$18,948	$20,289	$20,897	$21,524	$23,677	$24,387	$25,119
Difference										
Operating Costs Difference	$0	$3,273	$3,371	$3,473	$4,349	$4,480	$4,614	$6,260	$6,447	$6,641

1. Costs are stated in the year of expenditure dollars, with the assumed annual escalation rate of three percent.
2. Operational changes include only changes that incur additional operating costs.

5.2 | Capital Costs and Funding Sources

The anticipated capital costs presented in this section are driven by the implementation plan presented in Chapter 4 and are grouped into vehicle purchase costs, facility costs, and other capital costs. Chapter 4 should be referenced for additional information regarding the planning of these capital purchases.

5.2.1 Vehicle Purchase Costs and Funding Sources

BT's vehicle replacement schedule show the anticipated new vehicle needs for each year in the TSP timeframe. The anticipated vehicle costs by year are shown in

Table 7.

The capital funding for vehicle purchases is split between federal, state, and local sources. BT's replacement bus purchases will be placed in the State of Good Repair (SGR) category for DRPT's Making Efficient and Responsible Investments in Transit (MERIT) capital assistance funding. Expansion bus purchases are placed in the Minor Enhancement (MIN) category, and two expansion buses are projected to be purchased in FY 2032 to support the long-term service improvements. The distribution of SGR and MIN capital funding is shown in Table 6.

Table 6: MERIT Capital Funding Contributions

MERIT Category	Federal Funding	State Funding	Local Funding
State of Good Repair	22%	68%	10%
Minor Enhancement	22%	68%	10%

Table 7: Financial Plan for Funding Vehicle Purchases ($1000s, YOE$)

Vehicle Classification[2],[3]	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34
40-ft BEB	$5,156	-	$9,845	-	-	$5,626	-	-	-	-
60-ft BEB	$3,836	-	$4,001	-	-	-	-	$3,925	-	-
Expansion 40-ft BEB	-	-	-	-	-	-	-	$2,638	-	-
BOC	-	$644	$292	$230	$1,170	$1,205	$1,241	-	-	-
Support Vehicles	-	$49	$61	$114	$335	$130	-	-	-	-
Total Vehicle Costs[4]	$8,992	$692	$14,200	$344	$1,505	$6,961	$1,241	$6,563	-	-
Anticipated Funding Source										
Federal	$1,978	$152	$3,124	$76	$331	$1,531	$273	$1,444	-	-
State	$6,114	$471	$9,656	$234	$1,024	$4,733	$844	$4,463	-	-
Local	$899	$69	$1,420	$34	$151	$696	$124	$656	-	-

[2] Vehicle purchases through State of Good Repair Funding assumes 22 percent funding through FTA (Section 5339 program), 68 percent from State, and the remaining 10 percent from local.
[3] Vehicle purchases through Minor Enhancement Funding assumes 22 percent funding through FTA, 68 percent from State, and the remaining 10 percent from local.

Source: Vehicle costs identified in Chapter 4 of the Transit Strategic Plan

5.2.2 Facility Improvement and Other Capital Costs and Funding Sources

In addition to vehicle costs, BT has capital needs to improve facilities, passenger amenities, and technology throughout the Transit Strategic Plan life cycle as described in Chapter 4. Table 8 shows the anticipated capital cost by category and by year, as well as anticipated revenue from federal, state, and local funding sources.

Table 8: Financial Plan for Funding Facility Improvements and Other Capital Costs ($1000s, YOE$)

	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34
Anticipated Costs										
Facilities										
Depot Charger	$875	-	$425	-	$450	-	$900	$475	-	-
On-Route Charger	-	$1,100	-	-	$1,175	-	-	$1,200	-	-
Passenger Amenities										
Passenger Shelters	-	$50	$20	$50	$20	-	-	-	-	-
Bus Pull-Off	-	$25	$75	$30	$95	-	-	-	-	-
Equipment										
Portable Radios	$56	$33	$35	$35	$37	-	-	-	-	-
Facility Maintenance	$695	$55	$175	$250	$250	-	-	-	-	-
Technology										
ADP Hardware	$518	$569	$432	$342	$343	-	-	-	-	-
ADP Software	$274	$274	$293	$274	$343	-	-	-	-	-
Total	$2,418	$2,106	$1,455	$981	$2,713	$0	$900	$1,675	$0	$0
Anticipated Funding Source[5] [6]										
Total										
Federal	$532	$463	$320	$216	$597	$0	$198	$369	$0	$0
State	$1,644	$1,432	$989	$667	$1,845	$0	$612	$1,139	$0	$0
Local	$242	$211	$146	$98	$271	$0	$90	$168	$0	$0

[5] State of Good Repair funding assumes 22 percent funding through federal, 68 percent funding through State, and the remaining 10 percent funding from local.

[6] Minor Enhancement funding assumes 22 percent funding through federal, 68 percent funding from State, and the remaining 10 percent funding from local.

Blacksburg TRANSIT

Appendix A

History, Governance, Organizational Structure, and More

A.1 | History

In 1983, Blacksburg Transit (BT) was established as a department of the Town of Blacksburg. Initially, maintenance facilities were shared with the town's Department of Public Works. The first fixed route services consisted of three local routes with a hub on the Virginia Tech (VT) campus. After the start of fixed route service, complementary door-to-door paratransit service (BT Access) was added for qualified riders within Blacksburg.

Throughout the 1980s additional routes were added to further connect other parts of town to the VT campus. In 1991, service was expanded into Christiansburg with the Two-Town Trolley providing fixed-route service between the two towns. BT now operates 20 fixed-routes, 2 deviated-fixed routes, and two demand response services.

In 1991, BT also moved into a new standalone administrative and maintenance facility. The facility remains in use today, undergoing a major facility-wide renovation and expansion in 2006. The maintenance facility is scheduled to be expanded and renovated in 2025, adding a 2 lane wash bay facility, another service bay with a pit and lift to accommodate 60 ft buses, expanded parts storage and new offices.

BT has been at the forefront of technology since developing an Automated Vehicle Location (AVL) system on its vehicles in the 1990s. The goal was to provide information for dispatching and reporting, and ultimately to share the information with riders.

In 1998, BT received the first of 15 New Flyer vehicles, representing BT's first wheelchair-accessible buses, and among the first heavy-duty low floor coaches to run in the Commonwealth of Virginia. In 2010 BT added 9 diesel-electric hybrid buses to its fleet, including BT's first two articulated buses. In 2021 BT received five battery-electric buses with a goal to transition the fixed-route fleet to 100% battery electric by FY 2035.

In 2001, BT's director received the Virginia Transit Association (VTA) Outstanding Public Transportation Service Award for progressing from a transit start up to a national model for transit in small urban university communities. Over the years BT has won numerous other awards, including the 2017 APTA Outstanding Public Transportation Marketing Award and APTA's Small System of the Year Award in 2019.

Prior to the COVID-19 pandemic, BT experienced unprecedented ridership growth of 32 percent in three years, surpassing 4.6 million passenger trips in FY 19. As a result of the pandemic, ridership dropped to below 1 million. BT has continued to rebuild staffing and ridership levels and anticipates returning to Pre-COVID-19 levels in FY 25.

In 2021 BT broke ground on the Transit Center, a multi-modal transit facility, located on the Virginia Tech Campus. The Transit Center is made up of a 13,000 SF building and two loops with 17 bus bays, shifting the hub of BT's system from the Drillfield to the center of the northern Academic district. The Transit Center is expected to open in FY 25.

A.2 | Governance

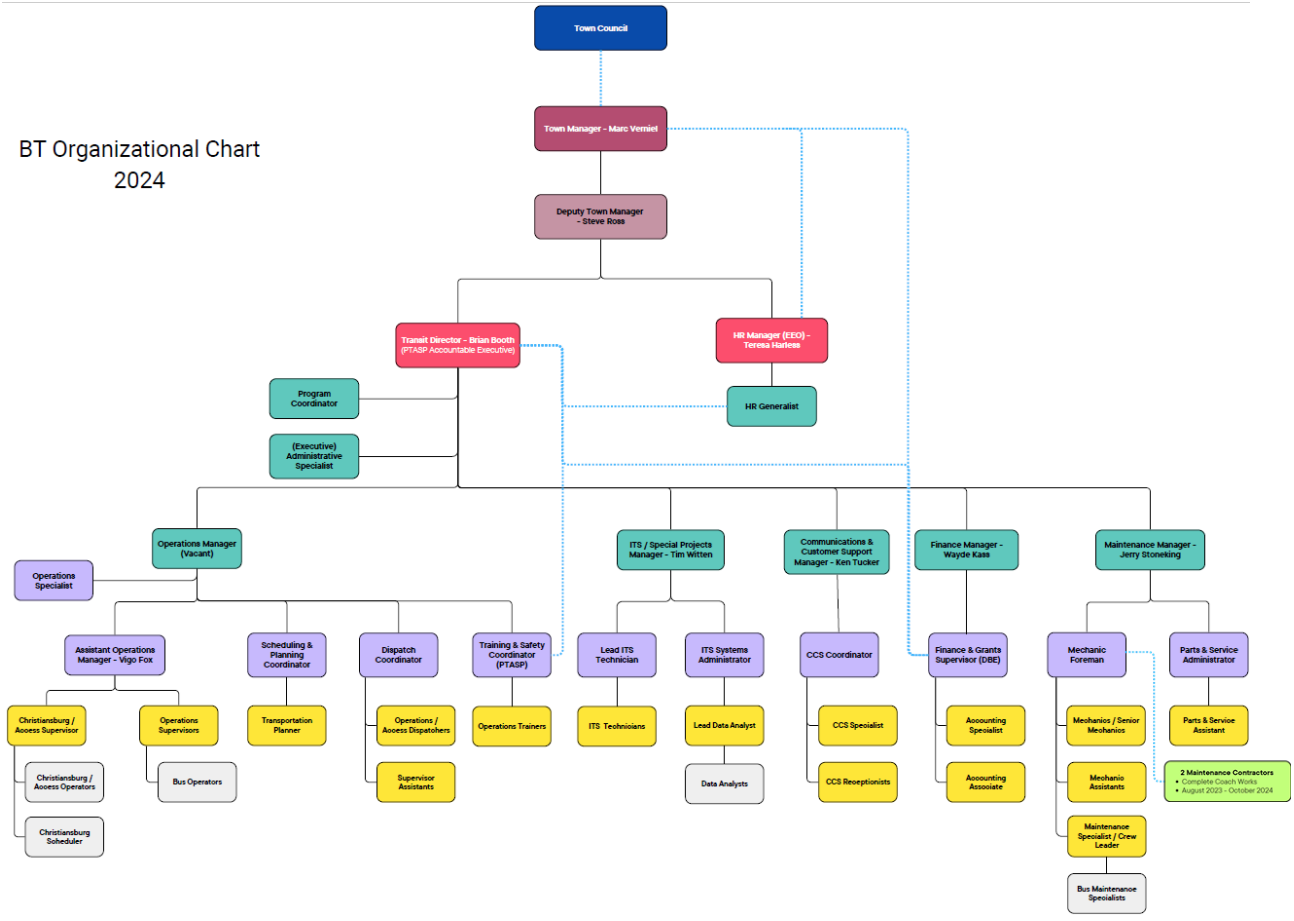
Blacksburg Transit forms its own department within the Town and is administered by Blacksburg's Town Council. The seven-member Blacksburg Town Council is led by a mayor and elected to staggered four-year terms.

- **Leslie Hager-Smith, Mayor** - Term expires December 31, 2025
- **Michael Sutphin, Vice Mayor** - Term expires December 31, 2027
- **Susan Anderson** - Term expires December 31, 2025
- **Lauren Colliver** - Term expires December 31, 2025
- **Jerry R. Ford, Jr** - Term expires December 31, 2027
- **Susan Mattingly** - Term expires December 31, 2025
- **Liam Watson** – Term expires December 31, 2027

Town Council is the legislative body of the Blacksburg local government, adopting all ordinances and resolutions and establishing the general policies of the Town. The Council also sets the real estate tax rate and approves and adopts the annual operating budget. A town manager is responsible for the direction and supervision of all departments, including Blacksburg Transit.

A.3 | Organizational Structure

Figure 1: Blacksburg Transit Organizational Structure



A.4 | Services Provided and Areas Served

Service Information

BT is the public transportation provider for Blacksburg, Virginia Tech, Christiansburg and parts of Montgomery County. In Blacksburg, BT operates 20 fixed routes and a complementary paratransit service, BT Access. The fixed routes connect major residential areas to the Virginia Tech campus and commercial areas in a hub and spoke style with the Transit Center on campus as the hub. Daily pull out requires thirty-two vehicles, all of which are low-floor buses.

BT Access is a paratransit door-to-door service complementing fixed route bus service in Blacksburg. This service is available for persons with a temporary or permanent disability who meet the criteria established under the Americans with Disability Act. Passengers must be certified to use BT Access. Peak service requires five vehicles.

In Christiansburg, BT operates 2 deviated fixed routes, the Explorer Blue and Gold and a demand response service, Go Anywhere. The Explorer routes connect the residential areas to the downtown business district and the northern shopping district. Go Anywhere is a demand response service

that requires advanced reservation by phone and can be made up to 14 days in advance with a 2-hour cancellation policy, and are as a general rule, first-come, first-serve. There are no eligibility requirements. Peak service requires four vehicles.

One route, the Two Town Trolley provides a connector between Blacksburg and Christiansburg.

Funding and Partnerships

BT is fully funded through a combination of federal and state transit grants, with the local match provided through partnerships with Virginia Tech and the Town of Christiansburg. The federal funding for BT comes from FTA Section 5307 which is allocated based on population and population density. Additional federal funding is available through performance-based Small Transit Intensive Cities (STIC) funding. BT receives state operating assistance from DRPT who allocates funding using MERIT, a performance based formula. A projected amount is identified in the SYIP, but the exact allocation varies year to year due based on performance.

Virginia Tech and the Town of Christiansburg provide the local funding for the services they fund.

Regional Services

The Transit Center also serves as a hub for regional bus service providing connections to: Smart Way, Radford Transit, Our Bus, and Virginia Breeze. Several stops throughout the system are also shared by Radford Transit and Smart Way, providing additional connectivity throughout the New River Valley.

Bus Stops and Shelters

Many BT bus stops have benches with shelters covering, and many just have BT stop signage but no shelter infrastructure. Bus stop placement and thresholds for amenities were revised in Chapter 1.

A.5 | Fare Structure, Payments, and Purchasing

BT currently operates fare-free for all riders.

A.6 | Transit Asset Management – Existing Fleet and Facilities

The Virginia Department of Rail and Public Transportation (DRPT) sponsored a group TAM plan for Tier II agencies to ensure all transit agencies in Virginia remain in a State of Good Repair. DRPT classifies Blacksburg Transit (BT) as a Tier II agency which denotes rural and small urban transit agencies operating fewer than 100 vehicles across all fixed-route services. BT was included in the Group TAM Plan for Tier II agencies in December 2021, a document that remains effective until FY 2025. Blacksburg Transit inventory, useful life benchmarks, and replacement schedules adhere to the state-wide standards outlined in DRPT's biannual Virginia Group Tier II Transit Asset Management Plan.

As of 2024, BT's vehicle fleet consists of 94 vehicles in total, all of which are stored on site at BT's Administrative, Operations and Maintenance facility. Seventy-one of those vehicles are part of the revenue fleet, and the remaining 23 are non-revenue vehicles. The active revenue fleet is comprised of 48 low-floor buses, 14 of which are articulated buses, 16 cutaways, and two vans. The non-revenue fleet is comprised of 17 automobiles and six trucks. A contingency fleet was implemented

in 2022 to aid in the transition to battery-electric buses; this fleet is comprised of 9 low-floor buses that have all exceeded their useful life requirement. As of FY 2024, BT has 10 battery-electric buses, with plans to transition the fleet 100% to battery-electric.

In the 2022 Tier II TAM plan, one BOC, or cutaway, was beyond its useful life benchmark. In addition, 14 Heavy Duty Transit buses reach their ULB in FY 2024, and an additional 9 will in FY 2025.

Existing Facilities

Blacksburg Transit's main Operations and Maintenance Facility at 2800 Commerce Street contains administrative offices, daily operations areas including a dispatch center, an operator's lounge and training facilities, a 50-bay overnight parking vehicle garage, and diesel and gasoline fueling facilities on the property. Overnight electric bus charging to accommodate 10 battery-electric buses is located in the parking bays. The facility has a Transit Economic Requirements Model (TERM) Rating of 3 as of June 30, 2020. A TERM rating is a measure of a transit agency's facility assets according to a scale development by the National Transit Database (NTD). The rating is on a scale of 1-5 with 1 being poor and 5 being excellent. An asset is deemed to be in good repair if it has a rating of 3, 4, or 5.

Other Passenger Facilities

The new Transit Center opening in 2024 is the product of the planned efforts of the Town of Blacksburg in close coordination with Virginia Tech. The facility will serve as a central transportation hub for multiple modes of alternative transportation, including Blacksburg Transit, Smart Way bus, Virginia Breeze, Our Bus and bike share services. Future plans include the addition of two rapid chargers.

Electrification Transition Plan

BT's Fleet Electrification Plan was developed in 2021 in conjunction with BT's 2021 Low-No application. The detailed plan identifies BT's fleet replacement plan through FY 2032 when BT anticipates completing the transition to battery-electric. The plan covers all the elements required by FTA, including, but not limited to, the financial plan and how to support the charging infrastructure. A copy of the document can be found in Appendix D.

A.7 | Transit Security Program

A Facility Emergency Plan is in place which outlines staff procedures and responsibilities in the event of fire, bomb, accident, criminal behavior, or other suspicious or dangerous activity at the BT administrative and operations facility or on one of its vehicles. The plan includes evacuation and notification procedures and emergency contact information and protocols.

BT Facilities

Blacksburg Transit's main Administrative, Operations and Maintenance Facility at 2800 Commerce Street implemented key card access control on exterior doors of the administrative building. The Capital Improvement Plan includes security fencing around the entire property, which will be installed once the maintenance renovation and expansion is complete. Silent panic buttons are also installed in office spaces in main building entryways.

BT Vehicles

Incidents and activity on the road that threaten BT bus operators and riders are required to be radioed in to the dispatch center or a supervisor, who then can advise appropriate action. Depending on the vehicle's location, either Blacksburg Police, Virginia Tech Police, or Christiansburg Police will be called upon to assist.

All buses are equipped with an interior and exterior camera system in addition to a silent panic button. The panic button, when activated displays an emergency sign on the exterior of the bus, advising the public of an emergency and to contact 911.

BT works closely with the local police departments to ensure emergency responders are familiar with BT's facility and vehicles, including how to enter buses.

A.8 | Intelligent Transportation System (ITS) Program

ITS programs in public transportation encompass a broad range of communication-based information and electronics technologies that serve to improve safety, efficiency, and service, through use of real-time information.

Automatic Passenger County

Transit agencies use Automatic Passenger County (APC) systems to automatically record passenger boarding and alighting information by time and location. These systems typically consist of infrared sensors positioned at every door of a bus that communicate with a central APC unit located on the vehicle. The central APC unit is equipped with GPS technology that allows it to stamp the boarding and alighting information with the place and time of occurrence. The APC unit stores the data collected for every stop and every trip. The benefits of APC systems are a reduced cost to collect ridership information and increased quality of the information collected.

All of BT's buses have APC units. About 65% of the units are overhead and the other 35% are door units. The overhead style is installed on all new vehicles. The overhead units have a 95 percent accuracy rate compared to 65 percent accuracy rate for the door units. BT's cutaway buses do not have APC units, so there is not automatic passenger counting for the Christiansburg Routes.

Computer Aided Dispatch/Automatic Vehicle Location

Automatic Vehicle Location (AVL) is a computer-based vehicle tracking system that monitors the position of a transit vehicle and relays the information to a central system. Positioning information can be transmitted in near real-time using wireless communications infrastructure to provide a tracking capability for buses. GPS-backed tracking is a proven mechanism for accurately tracking vehicle location in the field. Computer aided dispatch (CAD) and AVL systems facilitate the management of transit operations, providing real time information on vehicle locations to assist transit dispatchers as well as inform travelers of bus status. Knowing the positions of all vehicles at any given time helps management respond to incidents more quickly as well as identify trends in schedule adherence that can be used to improve on-time performance.

BT has used AVL with GPS since 1994 to track its buses. BT has implemented a rider information system where the public can find departure information based on real-time AVL by stop or route by phone, text, website or the BT app.

Trip Planner

Like most transit agencies, BT publishes a General Transit Feed Specification (GTFS) that developers use to integrate transit stop, route, and schedule information to make trip planning easy and readily accessible to anyone with an internet connection. The GTFS has since been expanded to include real-time information, allowing BT to identify service changes such as stop closures or detours on platforms outside of BT's immediate control such as Google Maps.

BT App

The BT App combines the data from the GTFS with historical data to generate more accurate and reliable departure information to users. The functionality of the live map allows users to click on a bus to find route and stop level information, including the next departure times.

On-Board Security Cameras

BT has cameras deployed on all vehicles used in revenue service. Operators have the ability to push the "event" button to mark an incident that may need later review, or staff can query videos based on a number of criteria including date/time, location, bus number, etc. The system has a hard drive that saves the recordings for a minimum of 48 hours but the system generally stores two to three weeks of recordings since the vehicles do not run all the time.

A.9 | Data Collection and Ridership/Revenue Reporting Method

BT's has a robust data collection system, relying on a combination of MDT's, APC's, AVL and pay sheets to capture and verify ridership and revenue miles. Operators track ridership on the MDT's, and then verified by the APC's. A similar process is used for mileage; the mileage is pulled from the AVL, then verified by the operator pay sheet where they log the starting and ending mileage.

Ridership, Revenue Hours and Miles are reported monthly for Demand Response and Fixed Route to both DRPT and NTD. Slight differences exist between the two reports for Demand Response as paratransit is only reported to DRPT, while paratransit and demand Response are reported to NTD. A monthly safety/security report documenting minor and major incidents is also submitted to NTD.

Performance metrics, including financial information, are submitted to NTD annually. Once submitted, BT's Director then certifies the submission.

As a department of the Town of Blacksburg, BT must comply with various financial policies and procedures the Town has implemented. The BT Finance Manager has the day-to-day responsibility for managing funds and ensuring the accuracy of accounting records, internal controls, financial objectives and policies. Financial statements are prepared on an accrual basis in accordance with Generally Accepted Accounting Principles (GAAP). Financial statements are audited annually by an independent certified public accountant.

A.10 | Coordination with Other Transportation Service Providers

Blacksburg Transit coordinates with multiple transportation agencies, all of whom service existing BT bus stops throughout Blacksburg and Christiansburg, including: Radford Transit, Pulaski Area Transit, Smart Way Bus, Virginia Breeze and OurBus. The Transit Center operates as the major

regional hub for the majority of regional services. The Uptown Mall operates as a transfer center to the Two Town Trolley for BT's Explorer routes, Radford Transit (weekdays) and Pulaski Area Transit. Connections with these agencies increase connectivity throughout the New River Valley and beyond.

A.11 | Current Initiatives

BT participates in several different initiatives at the time of this plan's adoption. Since 2020, Blacksburg Transit has operated as on a fare-free basis, BT made this permanent in December 2022. Since 2022, Blacksburg Transit has launched the operation of ten battery electric buses (BEB) which replaced five conventional diesel and five hybrid-electric powered buses. BT is investing in additional depot chargers and an on-route charger to extend vehicle battery life and will continue to expand the BEB vehicle fleet.

Starting June 24, 2024, Blacksburg Transit shifted all routes to a new transit center located on the Virginia Tech campus adjacent to the Perry Street parking garage. The move away from the Drillfield shifts the hub of BT's system to the Academic core of campus while also improving on-time performance, reducing pedestrian conflicts, and facilitating route-to-route transfers. In August 2024, all regional service moved to the transit center, further optimizing transportation options.

The Virginia Passenger Rail Authority has launched The New River Valley (NRV) Passenger Rail Project which will extend Virginia's state-supported Amtrak service to Christiansburg. Final Design is not complete at the current time of plan adoption between 2024-2025.

Blacksburg TRANSIT

Appendix B

Additional Chapter 2 Data Analysis

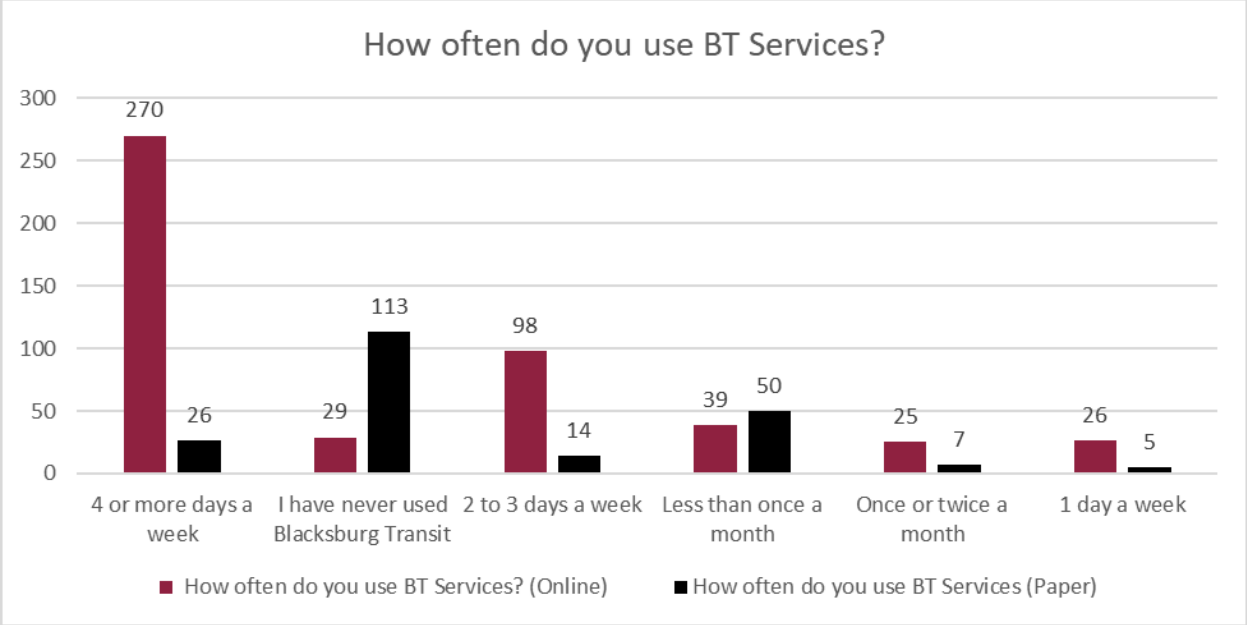
Appendix B contains additional information from the main Transit Strategic Plan Chapter 2 including public survey results and other travel pattern data which contributed to the development of opportunities for improvement.

2.1.4 Public Survey Results

Frequency of use of BT Service

The survey asked respondents a variety of questions to understand how individuals use or interact with transit. Most respondents reported using transit 4 or more days per week. However, the majority of paper survey responses reported having never used transit.

Figure 1: Public Transit Usage Survey Response



Source: Blacksburg Transit

Reasons for Riding

The top reason for using transit among both groups of respondents is to save money. Online respondents reported difficulty/expense to park and better for the environment among the top 3 reasons for using BT. People who responded to the paper survey reported less stress and difficulty/expense to park as primary reasons. Not having a car was also a top reason for paper responses.

Daily Needs

- **Region** – Daily needs are centered on the north side of Blacksburg and throughout Christiansburg. In the comments associated with placed icons, many respondents cited grocery shopping as their key need that they use the bus to take. Going to the laundromat, to childcare, and to appointments were also mentioned in many comments.
- **Christiansburg** – In Christiansburg the daily needs icons are centered on the Uptown Mall, Walmart, Target, and Kroger.

- **Blacksburg** – Daily needs in Blacksburg center on the University Mall Shopping Center, Downtown Main Street, South Main Street and Kroger, and Food Lion.
- **Virginia Tech** – Aside from campus most daily needs are just off campus along Main Street.

Desired Destinations

- **Region** – Desired destinations are grouped in Blacksburg and Christiansburg as well as in Radford. Themes from the comments associated with the desired destination icons include a direct route from VT to Target, better connections from local apartment complexes to campus, buses from Blacksburg to Radford and more routes to local parks and recreation areas, such as Pandapas Pond.
- **Christiansburg** – The majority of desired destinations in Christiansburg center around the mall and the Target shopping center. The area surrounding the intersection of 460 and highway 81 has multiple desired destinations as well.
- **Blacksburg** – Virginia Tech campus, Lane Stadium, and the shopping areas around Main Street are the key desired destinations in Blacksburg.
- **Virginia Tech** – desired destinations on campus are grouped along west campus drive, and around the Drillfield.

2.2.1 Transit Demand and Underserved Area Evaluation

Land Use and Development Patterns

Figure 2 through Figure 5 below show the future land use from the Town of Blacksburg Comprehensive Plan, Town of Christiansburg's Comprehensive Plan, Montgomery County Comprehensive Plan, and future development on Virginia Tech's campus.

Figure 2: Town of Blacksburg Future Land Use Map

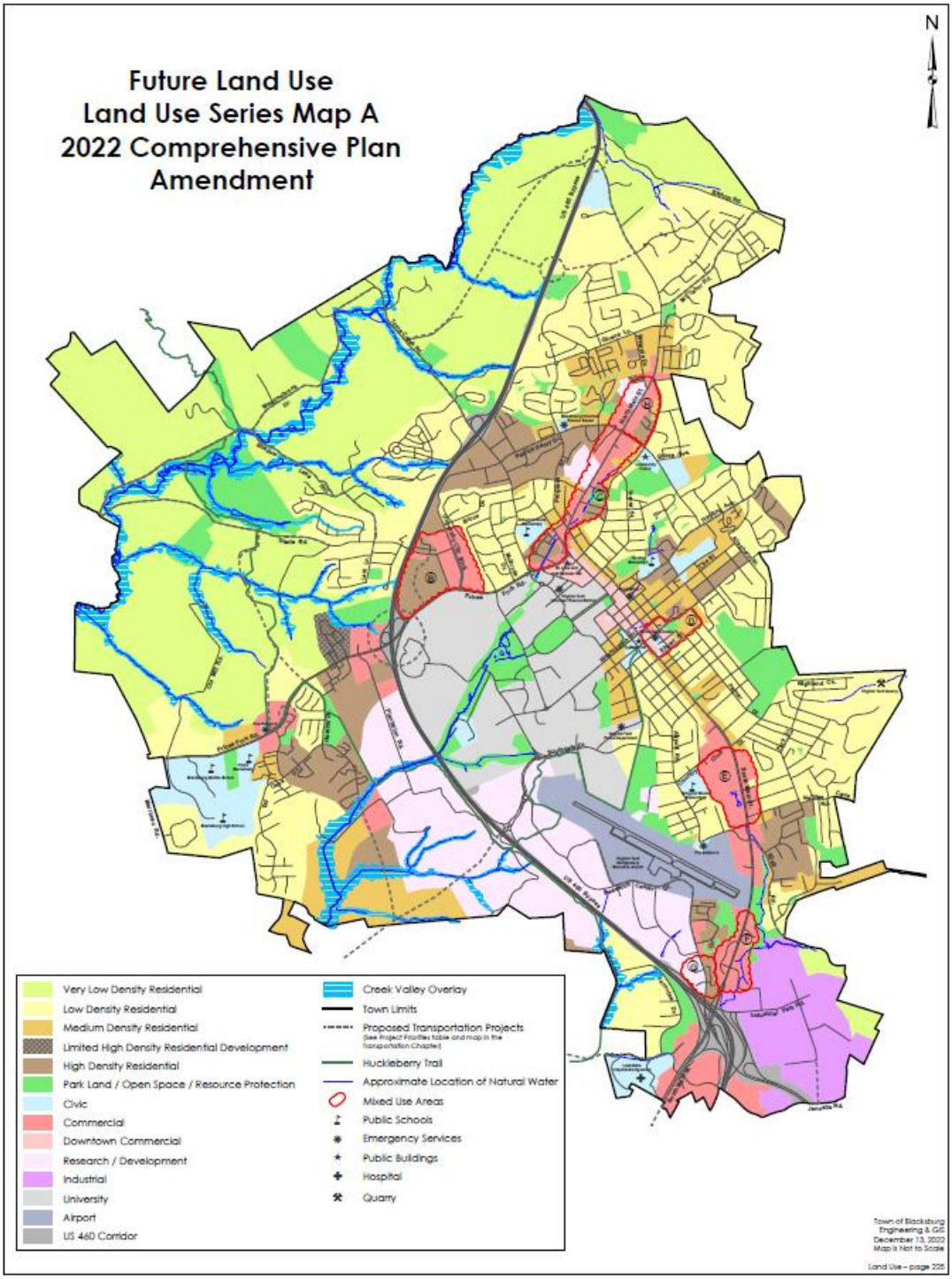


Figure 3: Town of Christiansburg Future Land Use

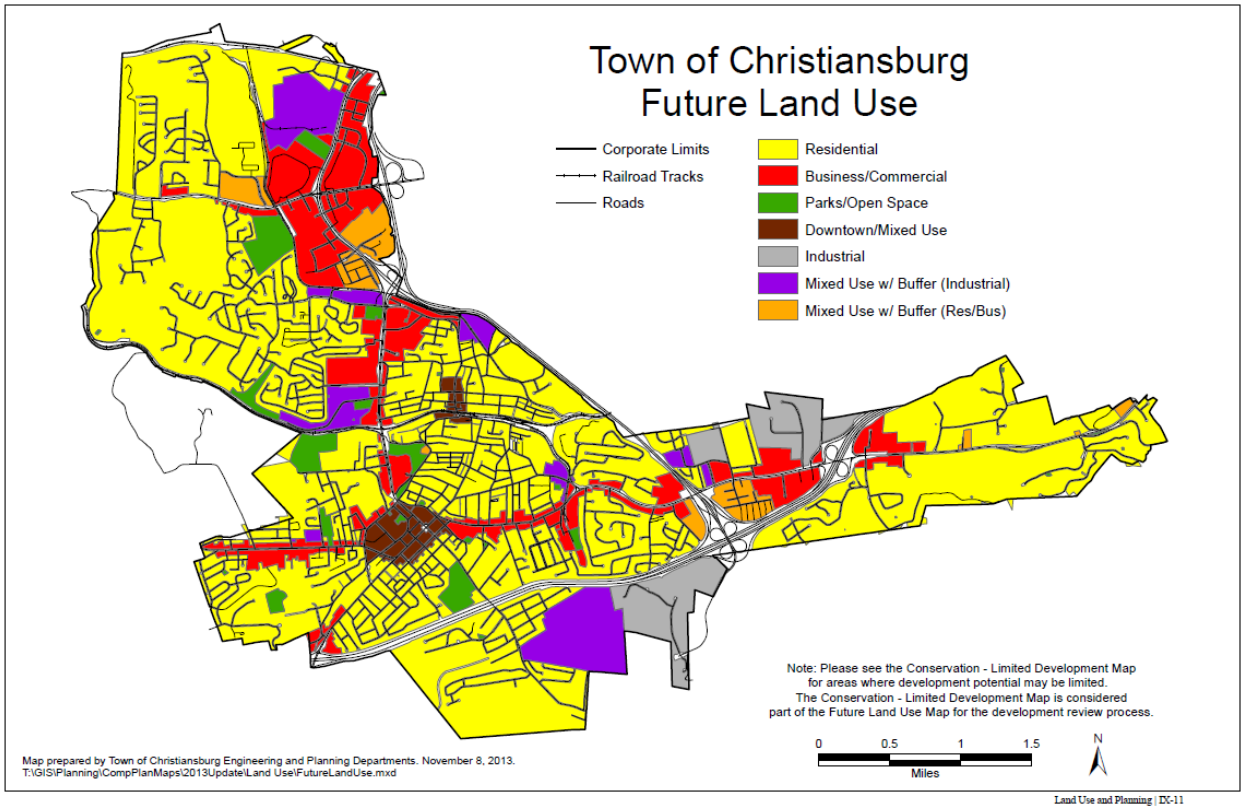


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Figure 4: Montgomery County Future Land Use

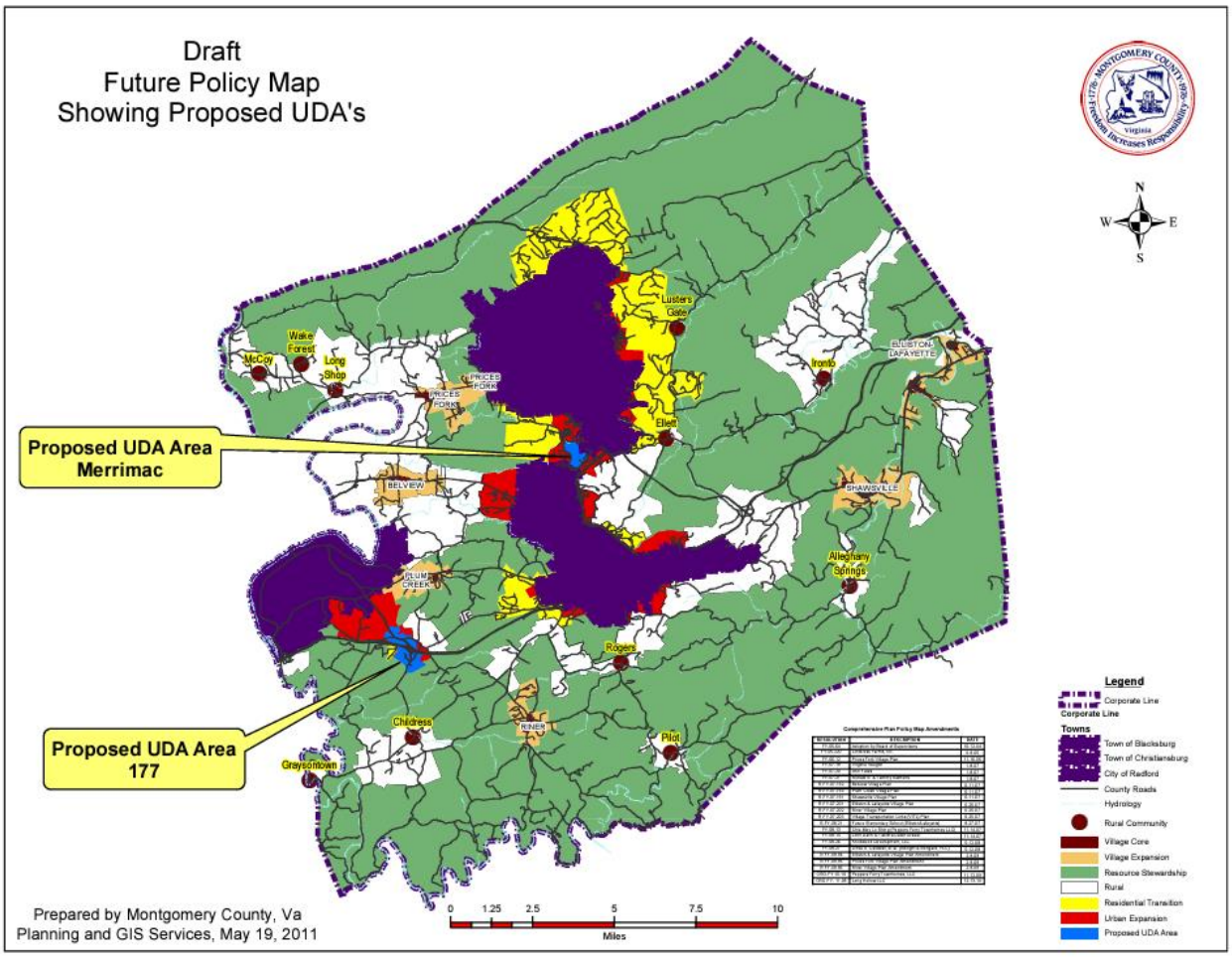
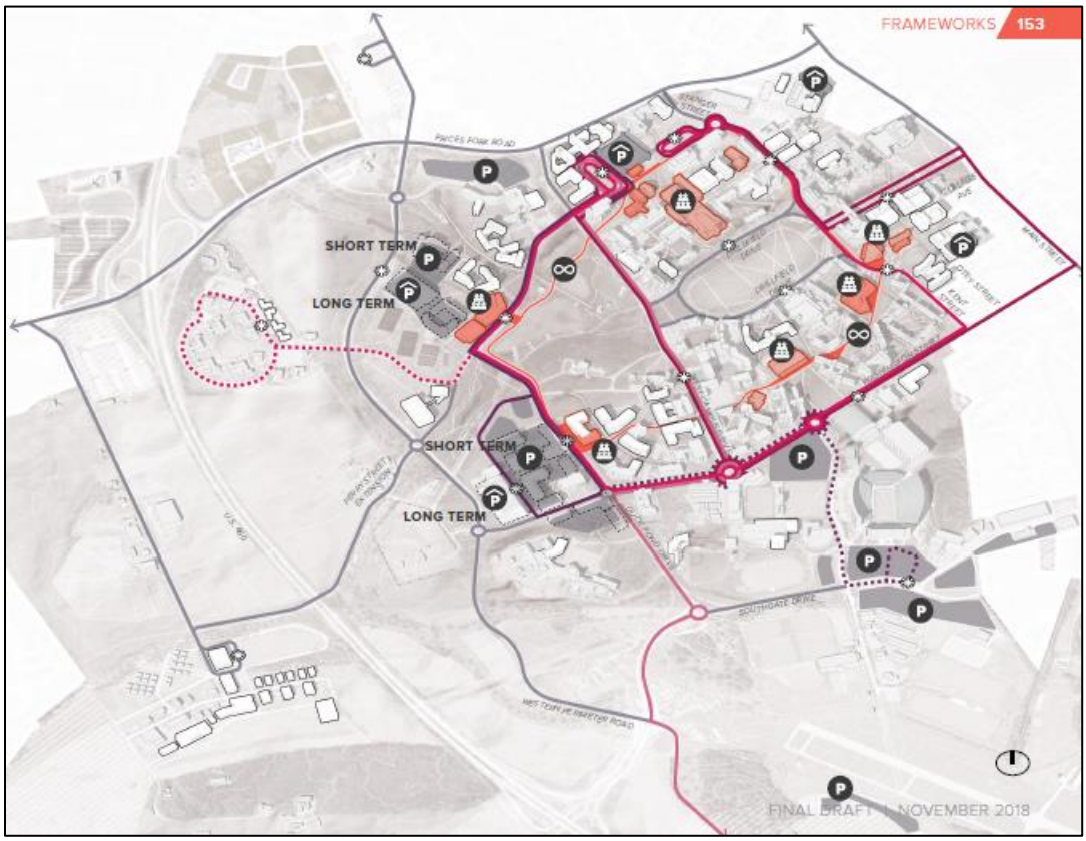


Figure 5: Virginia Tech Future Transit and Parking Framework



Demographics and Socioeconomic Factors

The demographic and socioeconomic section provides additional detail where specific populations that may be underserved by transit reside within the BT service area. Included below is a summary of major differences and overlaps of different demographic markets, how well they are served by transit, and future potential needs. Figures for each demographic group are included.

Older Adult (65+) Population:

- High concentrations along Prices Fork Road (some areas not served by transit).
- Areas north of Patrick Henry Drive and off Harding Avenue are covered by multiple Blacksburg Transit routes.
- In Christiansburg, several areas including near LewisGale Hospital, Belmont Farms, and behind Uptown Mall have high senior populations but lack adequate transit coverage.

Population 18 Years or Younger:

- In Blacksburg, Prices Fork Road and Shenandoah/Main-Patrick Henry areas have high concentrations and are partially served by transit routes.
- In Christiansburg, areas like Belmont Farms and neighborhoods behind Uptown Mall are not fully covered by transit despite having high young populations.

College Students:

- Most areas with high concentrations of college students, especially near Virginia Tech, are well-served by Blacksburg Transit.
- High concentrations of college students live to the west and north of campus with medium concentrations along South Main Street which are both served by frequent, direct service.

Population with a Disability:

- Several areas with high concentrations of individuals with disabilities are covered by transit routes in Blacksburg.
- In Christiansburg, areas near LewisGale-Montgomery Hospital and Belmont Farms have high populations of individuals with disabilities but are not currently served by frequent transit.

Minority Population:

- High concentrations along Prices Fork Road, the Shenandoah/Main-Patrick Henry area, and Virginia Tech are well-served.
- In Christiansburg, areas behind Uptown Mall and near LewisGale-Montgomery Hospital have high minority populations but lack transit coverage.

Limited English Proficient (LEP) Population:

- In Blacksburg, high concentrations of LEP individuals are found in areas near Virginia Tech areas that are well-served by Blacksburg Transit. Some areas are not covered by Blacksburg Transit such as further West on Prices Fork Road.
- In Christiansburg, there are high concentrations of LEP individuals in areas already covered by the Explorer routes. Again, some areas are not covered by BT, such as further west along Peppers Ferry Road.

Low-Income Households:

- In Blacksburg, low-income households are concentrated along Prices Fork Road and Shenandoah/Main-Patrick Henry and are generally well-served by transit.
- In Christiansburg, several areas near U.S. Route 460 and behind Uptown Mall have high concentrations of low-income households but lack frequent transit coverage.

Zero-Vehicle Households:

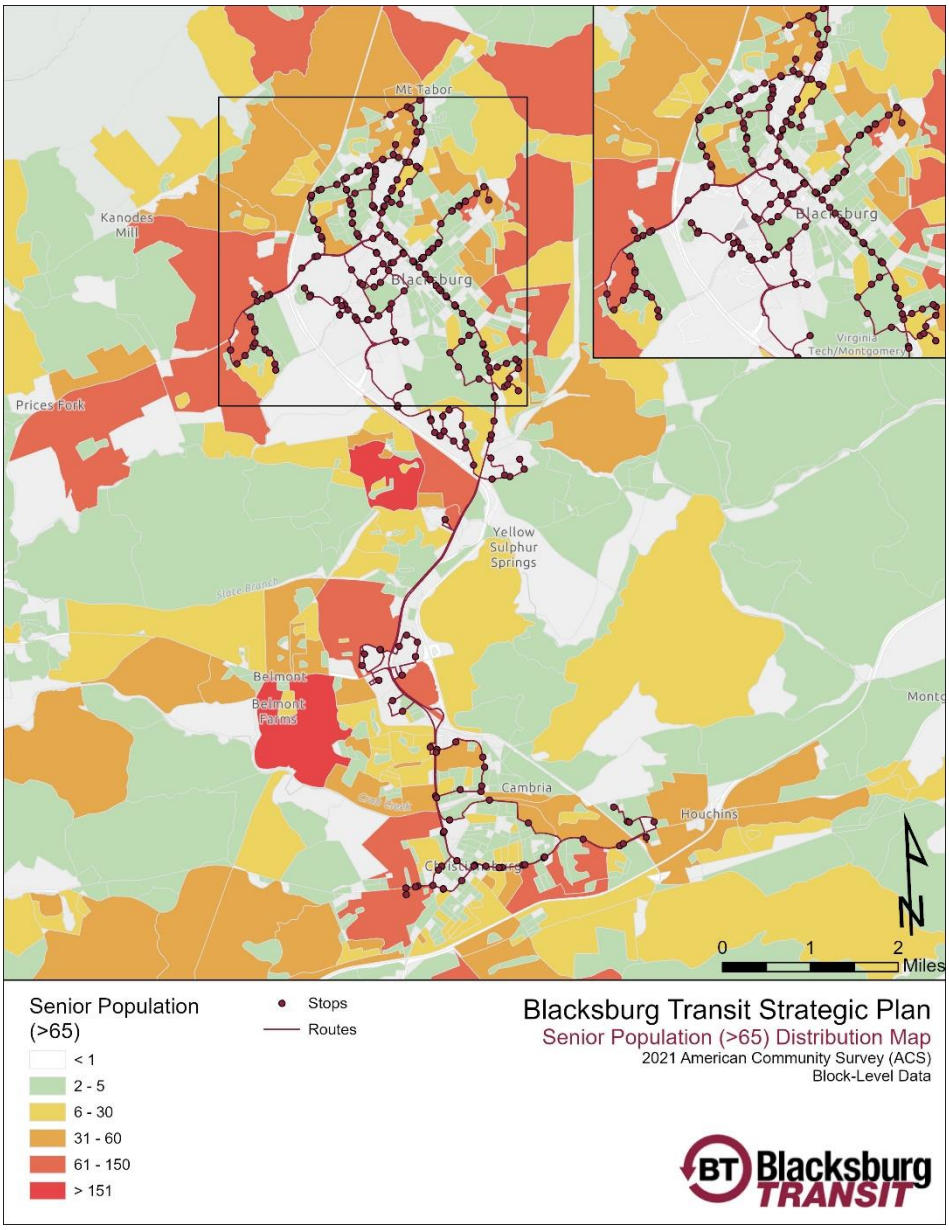
- Blacksburg Areas such as Prices Fork Road and Shenandoah/Main-Patrick Henry are well-served by multiple transit routes, helping meet the needs of zero-vehicle households.
- Christiansburg Areas, especially near Uptown Christiansburg and U.S. Route 460, experience notable gaps in transit coverage. Expanding service to residential zones behind these major locations would significantly improve accessibility for zero-vehicle households.

Overlap: There is significant overlap in the areas with high concentrations of vulnerable populations, particularly in Prices Fork Road (Blacksburg) and residential areas adjacent to Uptown Mall (Christiansburg). This indicates that transit expansion in these areas would benefit multiple groups.

Unique Needs: Each group has distinct needs—college students are already well-served, but LEP populations, low-income households, and older adults, especially in areas like Belmont Farms and New Village Dr NW, face more significant gaps in coverage.

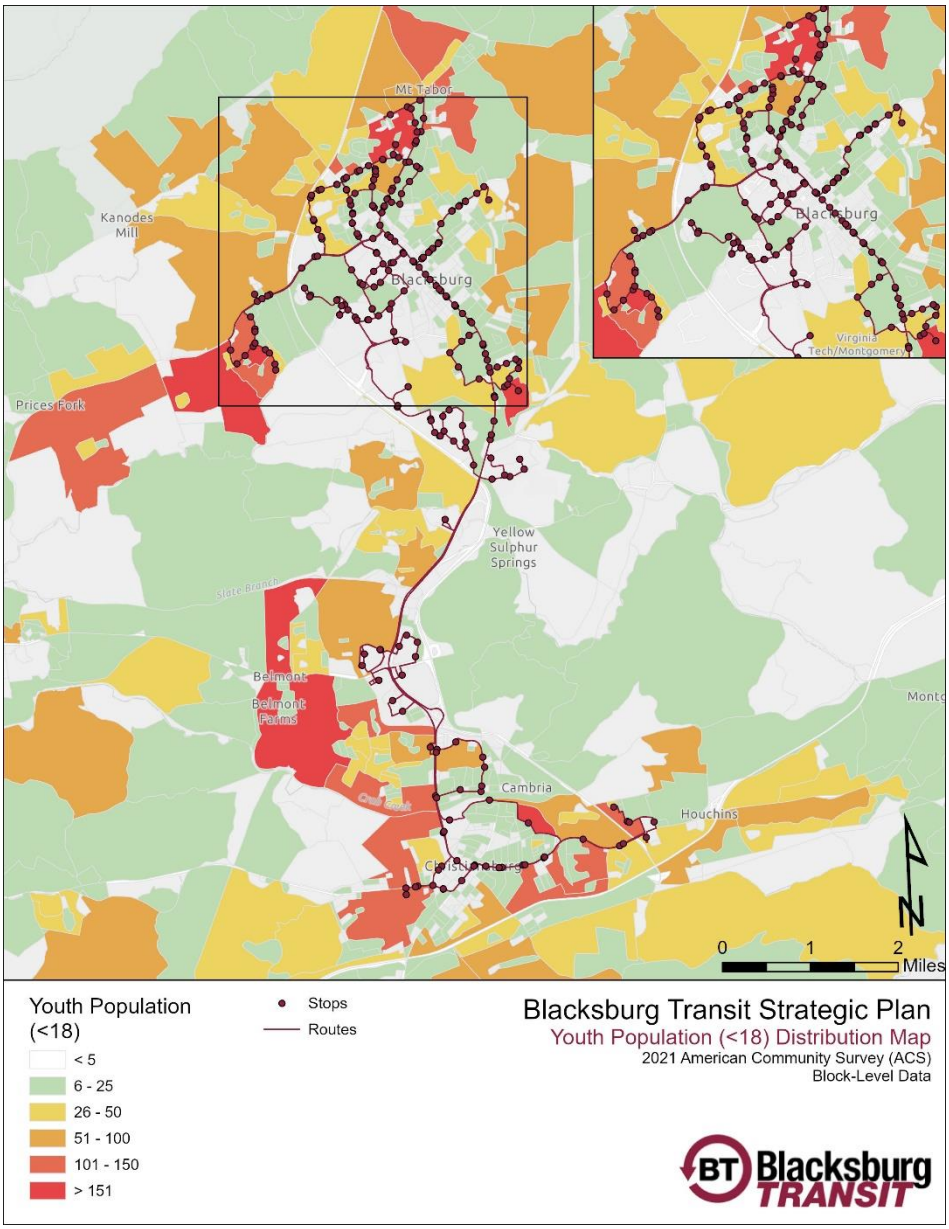
Focus Areas for Improvement: Enhancing transit service in areas like in Blacksburg along Roanoke Street and in Montgomery County and Christiansburg U.S. Route 460 near LewisGale Hospital, Belmont Farms, and residential areas behind Uptown Mall would address the needs of many underserved groups, including older adults, low-income households, people with disabilities, and minority populations.

Figure 6: 65 or Older Population



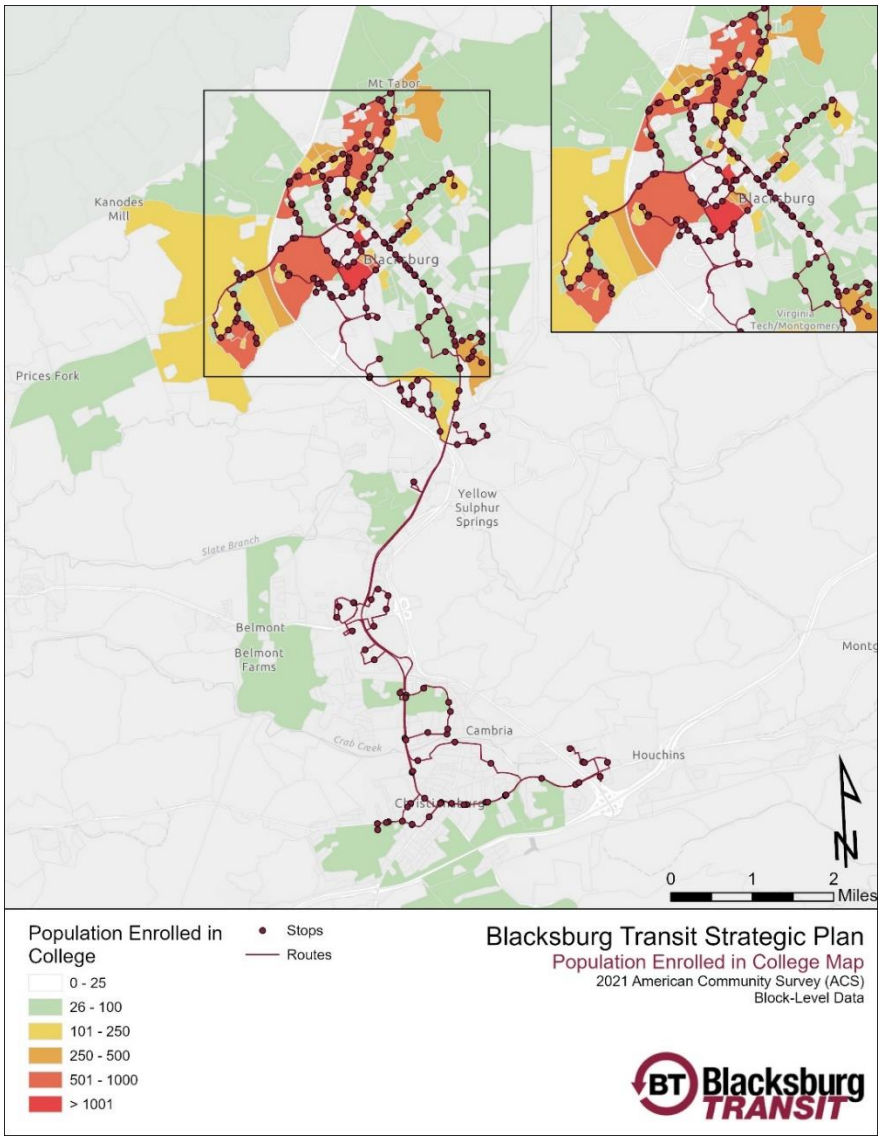
Source: American Community Survey 2021

Figure 7: Youth (18 and under) Population



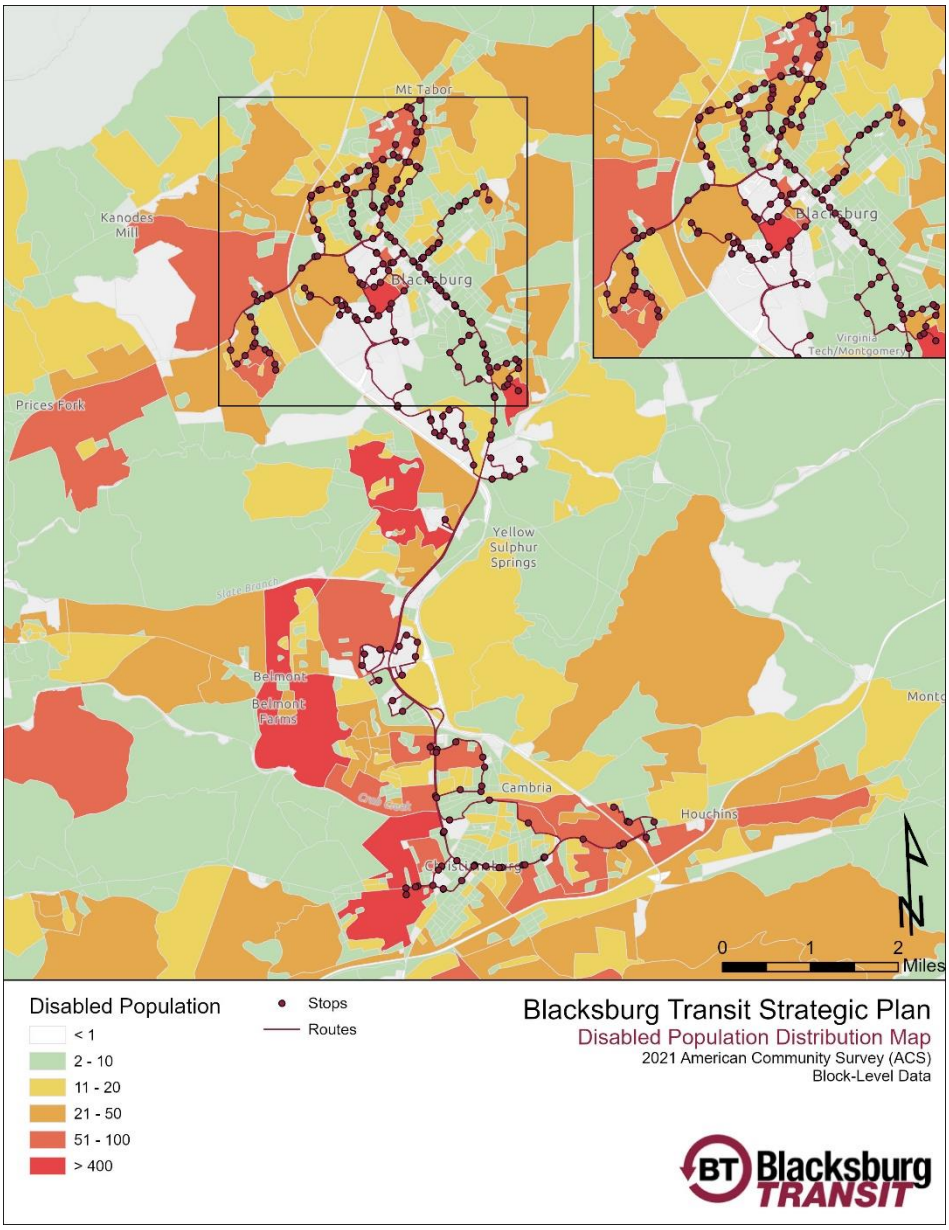
Source: ACS 2021

Figure 8: Population Enrolled in College



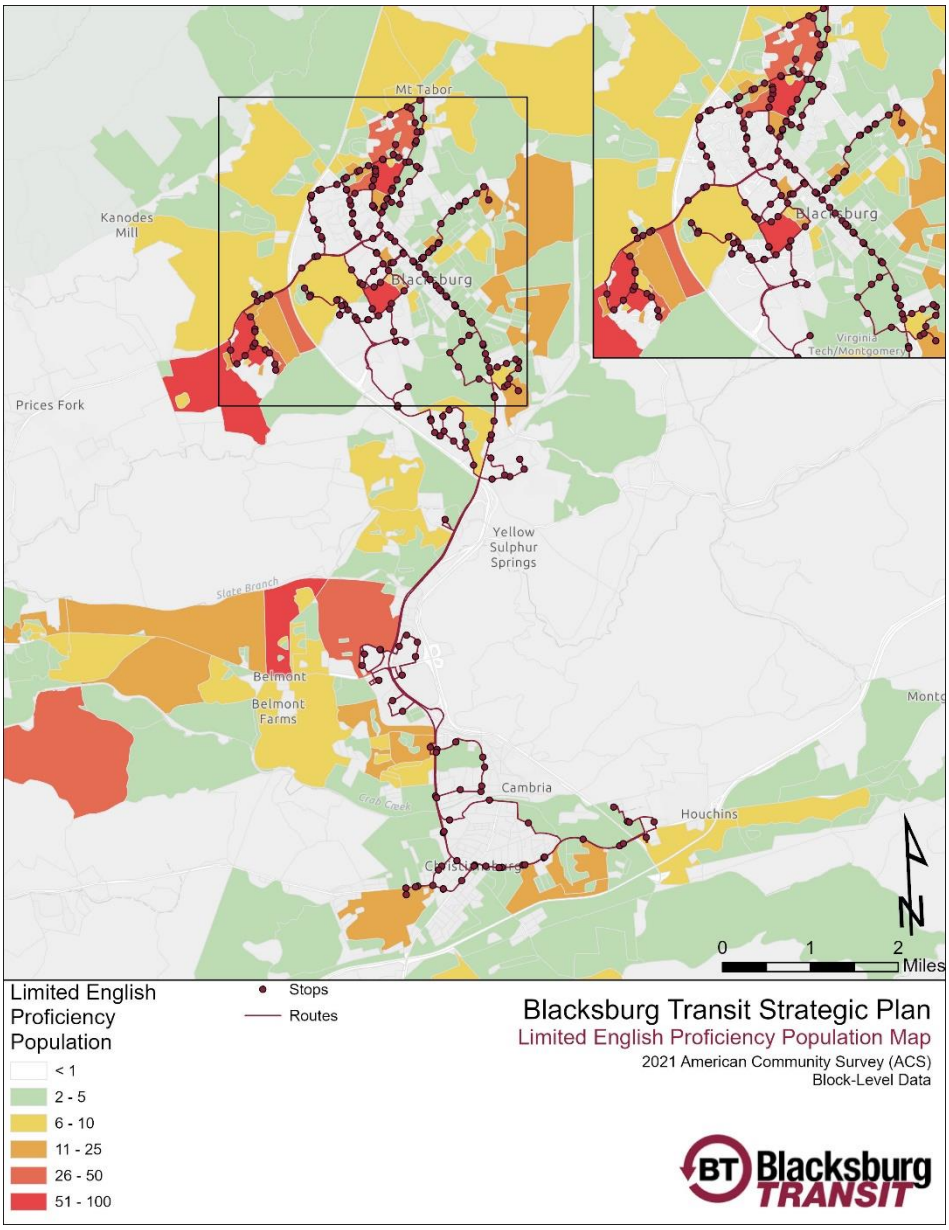
Source: ACS 2021

Figure 9: Disabled Population



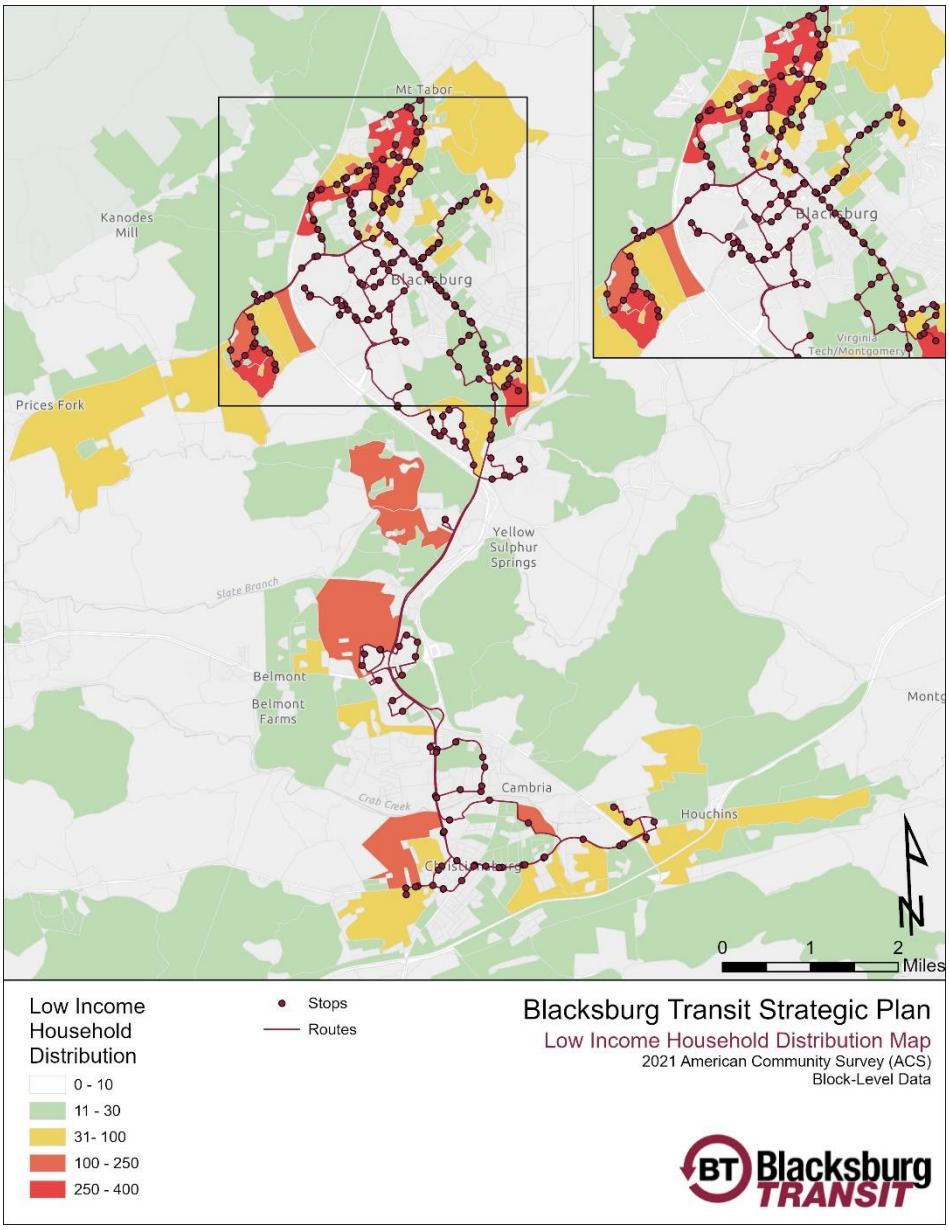
Source: ACS 2021

Figure 10: LEP Population



Source: ACS 2021

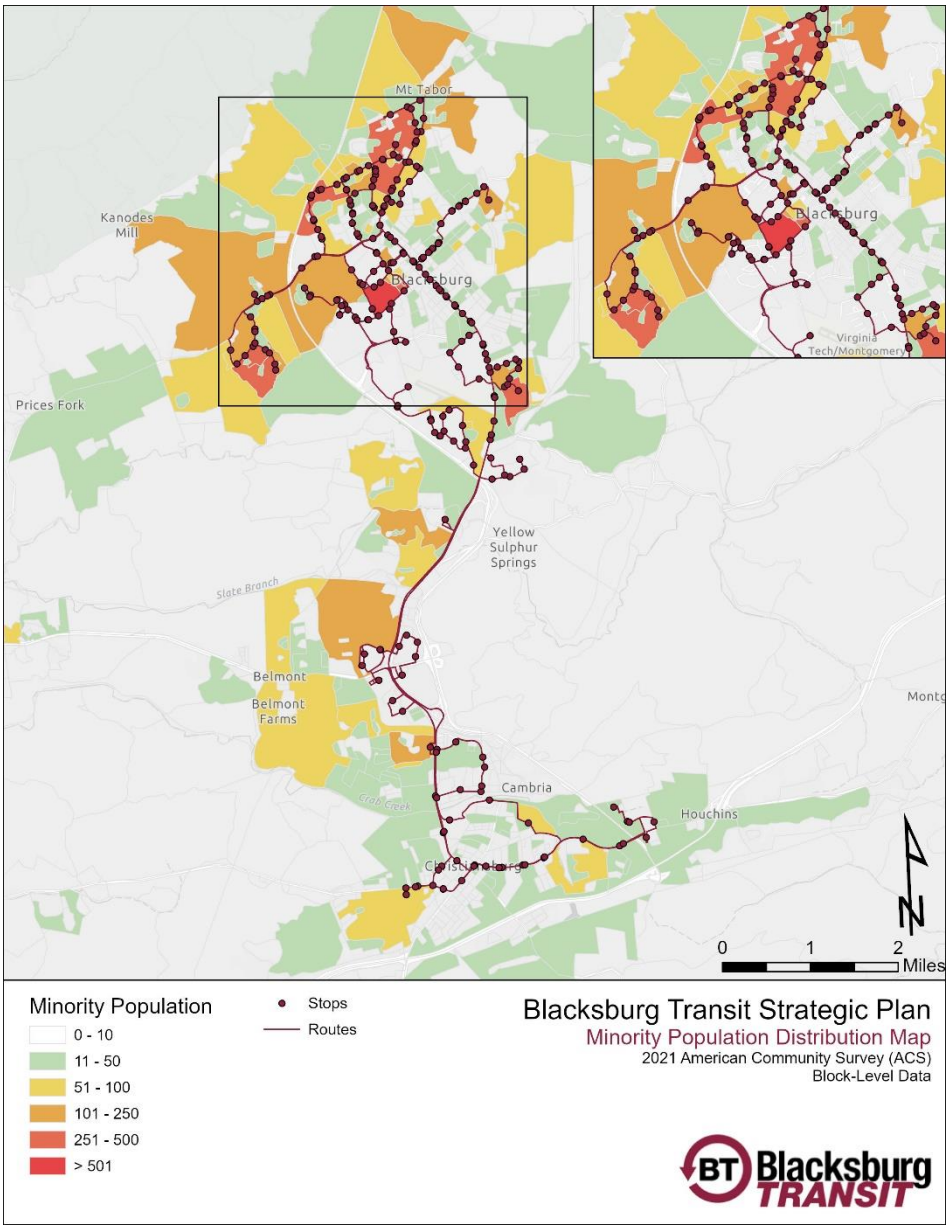
Figure 11: Low Income Household Distribution [1]



Source: ACS 2021

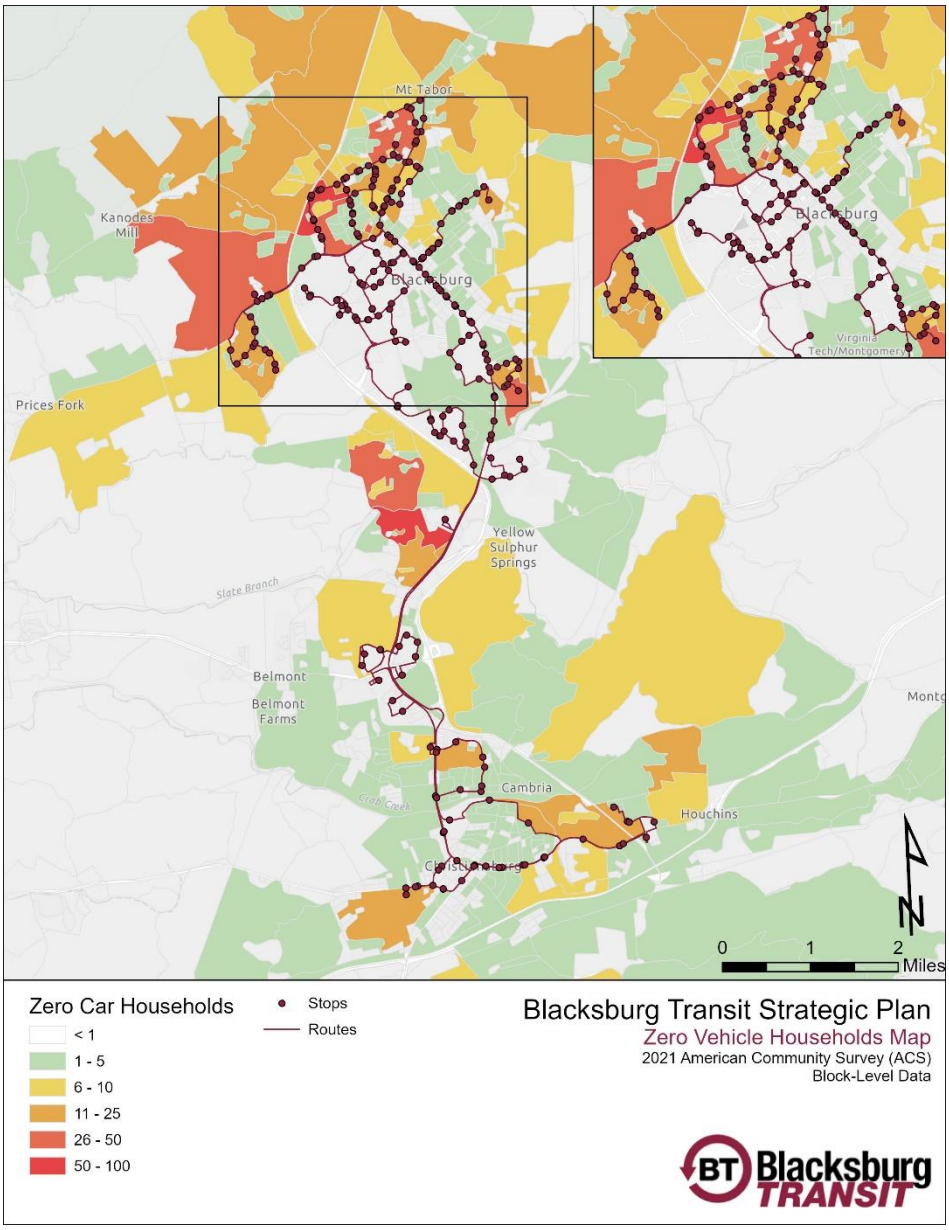
[1] *Low-income Household Distribution may also be affected by the student body population as off-campus housing increases the overall number of residents reporting zero to partial household income.*

Figure 12: Minority Population



Source: ACS 2021

Figure 13: Zero-Vehicle Households



Source: ACS 2021

2.2.2 Additional Travel Market Data

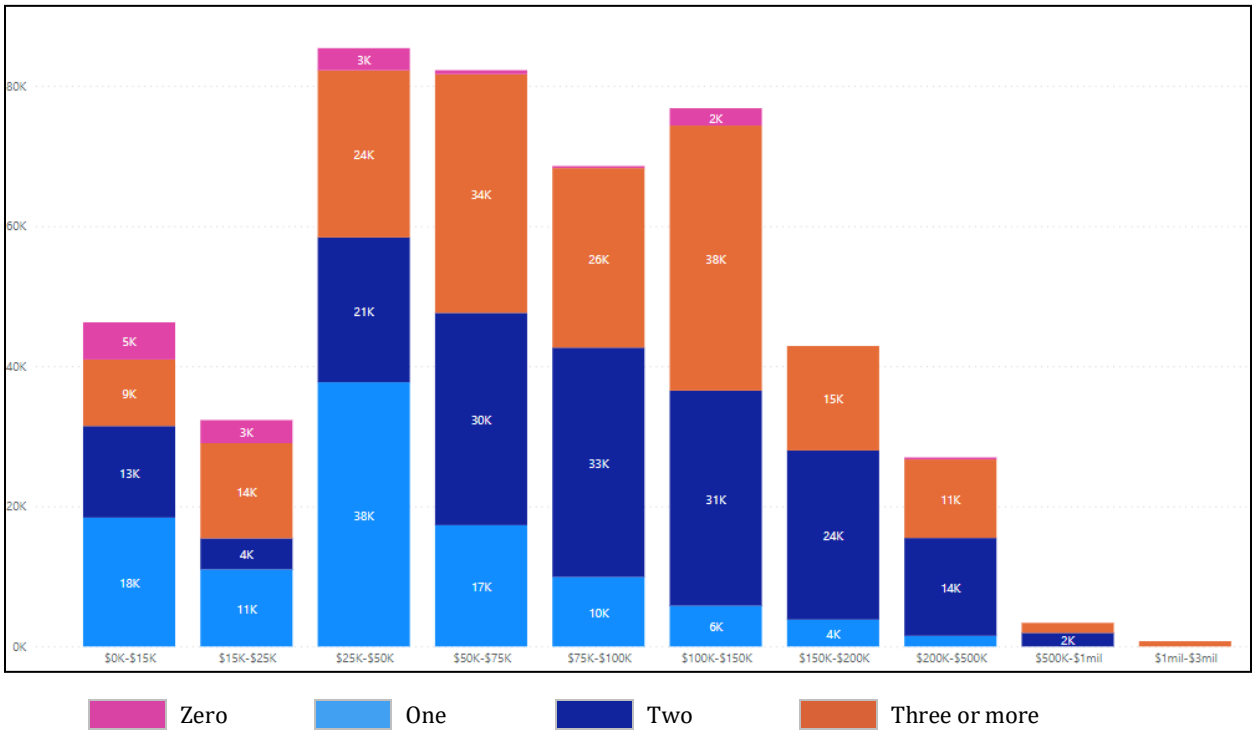
Chapter 2 gives examples of when, why, or how people in the BT service area travel and the opportunities for transit service to capture some of these market opportunities. Below are additional figures pulled from Replica (Location-Based Data) that capture the travel market and behavior that inform opportunities for improvement for the BT system.

Household Income by Vehicle Availability

Figure 14 shows the household income by vehicle availability. The figure confirms the anecdotal perception that people riding transit typically have no car or one car available to the household.

- The highest number of all trips per income bracket includes those with household incomes from $25,000 to $75,000 with over 160,000 combined weekday trips.
- People making less than $15,000 live in the most zero vehicle households than compared to other income ranges with nearly 52% of households having no or one vehicle available.
- Around 10,000 households that make less than $25,000 do not have access to a vehicle.
- People making over $25,000 have at least two or three vehicles available to their households. The average median household income in Blacksburg and Christiansburg are $43,000 and $63,000 respectively.
- While the distribution of people in each income bracket is not uniform, there is still a large overlap between people who make less than $25,000 and the availability of vehicles.

Figure 14: Number of Trips by Household Income and Vehicle Availability



Source: Replica 2022

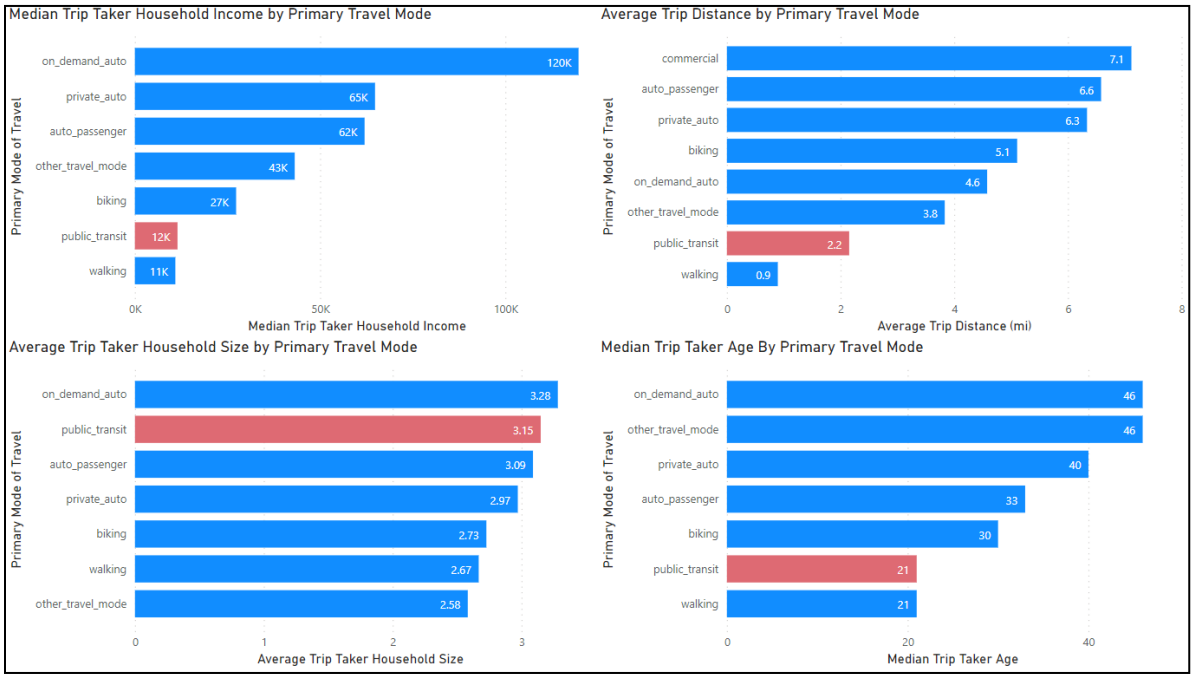
Travel Demographics by Travel Mode

Figure 15 shows several demographic statistics by mode of travel in Montgomery County. This analysis provides insight into the demographics of a "typical transit rider" and allows comparison to the average demographics of people who take other modes of transportation. This data could be used to adjust Blacksburg Transit to better serve the "typical rider's" needs or adjust service to be a better option than other modes of transportation. The following key observations from the travel demographics by mode include:

- The median age of people riding public transportation is 21 years old. This is likely due to the proximity of Virginia Tech's campus in Blacksburg.
- The median trip taker's household income for people riding public transportation is around $24,000 for Montgomery County, which is less than Blacksburg (~$43,000) and Christiansburg (~$63,000).
- The average trip taker's household size for people riding public transportation is around 3 persons per household. Overall, this ranks third against other modes of transportation. Vehicles and on-demand service rank higher when considering the trip taker's average household size.

Households with no access to a vehicle have to find other means to get to and from destinations like home, work, school, and shopping. Typically, public transportation can provide low-cost access for households that do not own a car or only have one vehicle. In Blacksburg and Christiansburg, nearly 23,000 trips are either no vehicle or one vehicle households. As stated previously, low-income, zero-vehicle trips, and youth trips are already served by several routes.

Figure 15: Travel Demographics by Mode



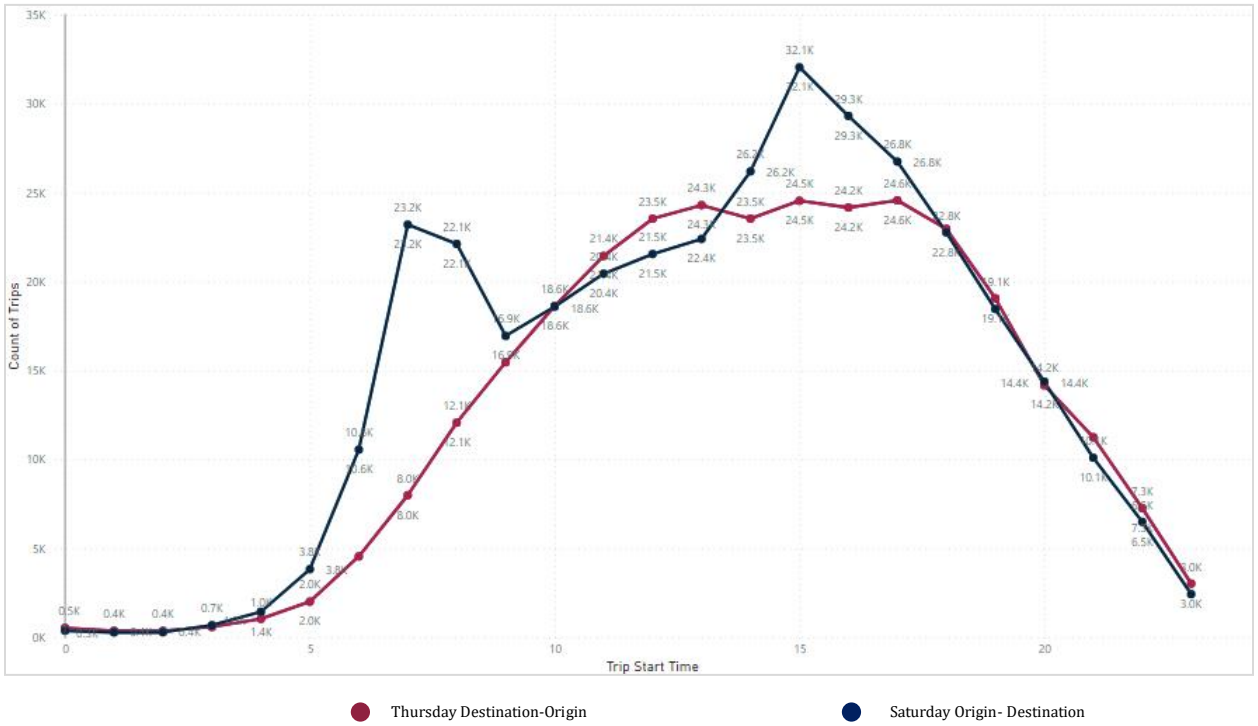
Source: Replica 2022

2.2.3 Travel Patterns

Trip Start Time

Figure 16 shows the overall trip demand for a typical weekday and weekend trip in Montgomery County.

Figure 16: Trip Start Time by Time Period

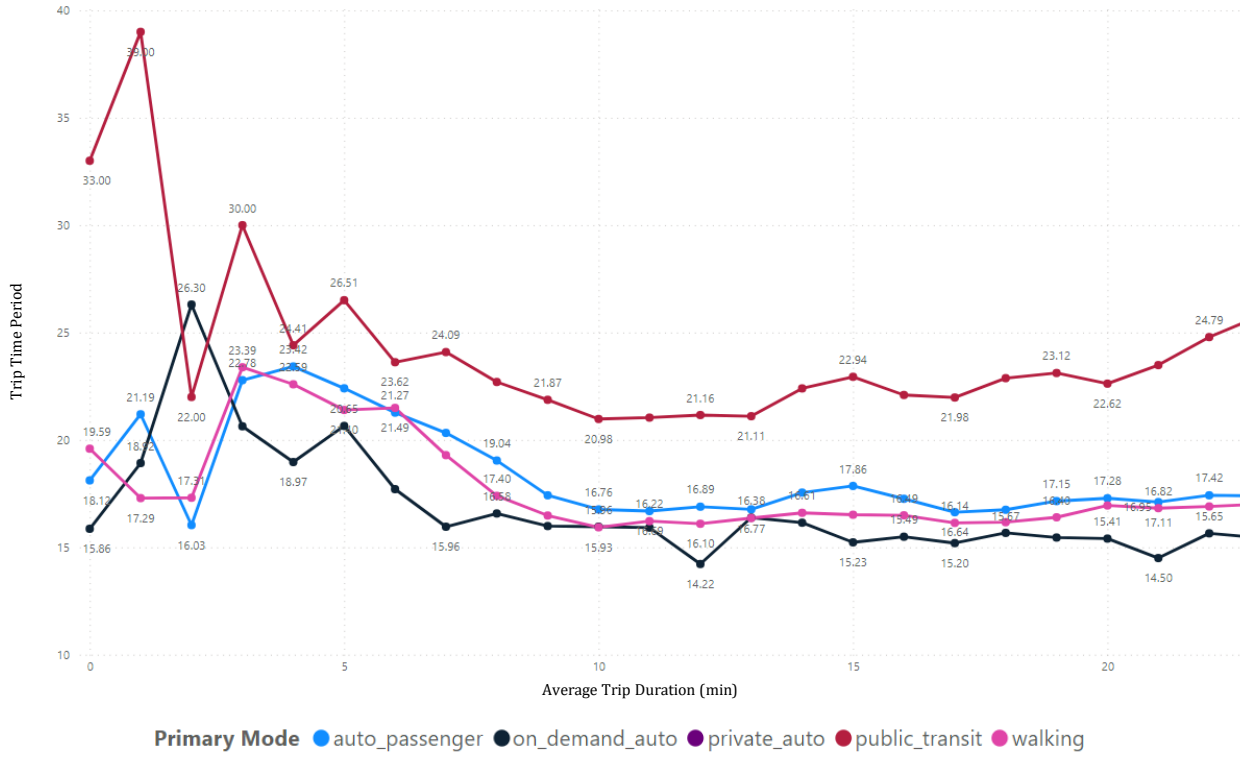


Source: Replica 2022

Average Trip Duration

Figure 17 shows the average duration of trips starting and ending in Montgomery County throughout a typical weekday by mode.

Figure 17: Average Trip Duration (minutes) by Mode and Trip Start Hour



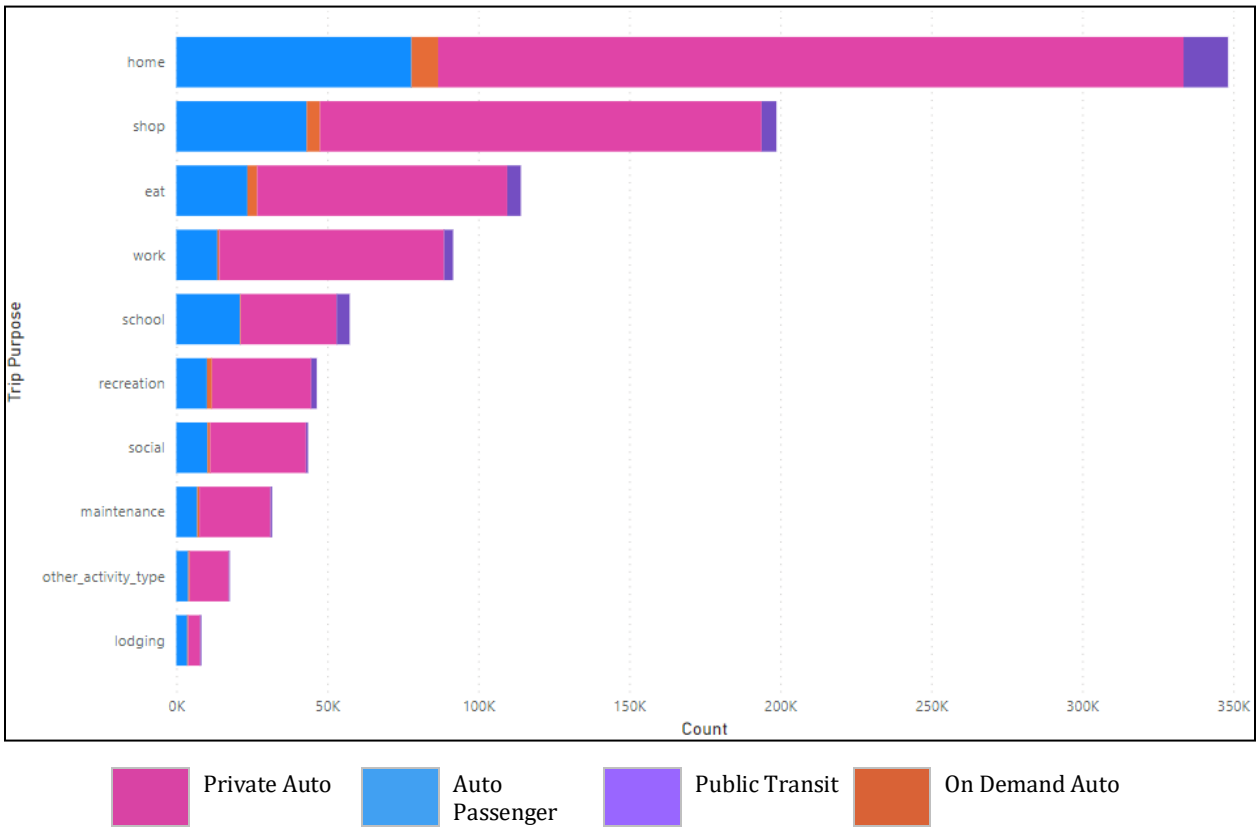
Source: Replica 2022

2.2.4 Travel Purpose

Figure 18 shows the trip purpose by travel mode on a typical weekday and weekend are displayed.

- Trips from home account for more than 7,000 public transportation trips in the Blacksburg Transit service area.
- Private auto trips account for the largest mode of transportation for all trip purposes. This may be due to the figure capturing trips that finish in Giles County, Pulaski County, and the City of Radford in addition to trips ending in Montgomery County.
- The trip purposes with the highest transit mode share include school (5.7%), home (3.6%), eating (3.23%) and work (2.8%).
- While the public transit share represents just a small amount of overall trips taken, when filtered to travel behavior of populations with zero vehicles or low-income, the amount of transit trips increases to over 17% of travel while the overall share of transit trips for zero vehicle household in some categories including work and school exceed 30% - 40% illustrating the need for those transit-dependent.

Figure 18: Trip Purpose by Travel Mode Split

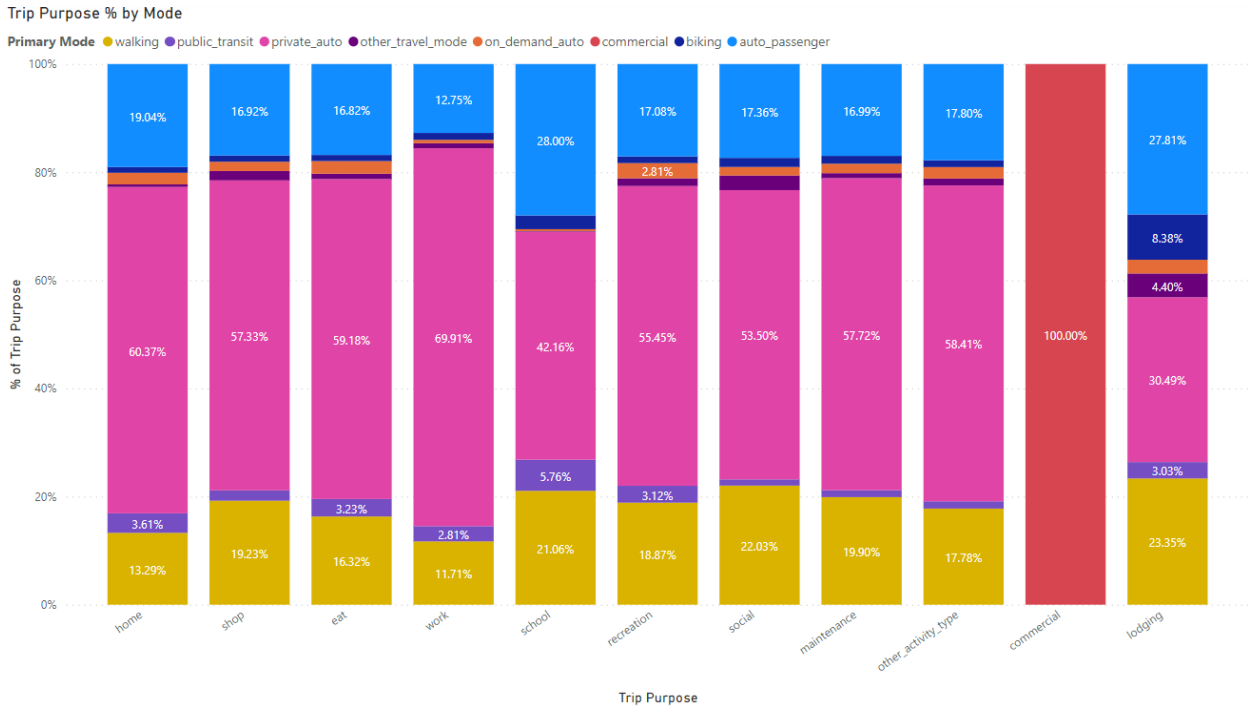


Source: Replica 2022

Figure 19 shows the trip purpose percentage by travel mode for all trips taken. The following observations can be seen:

- Private auto trips account for nearly 50% of all trips to home, work, shopping, eating, school, recreation, social, and other activity trips.
- Public transportation trips account for almost 4% of all trips to home, work, shopping, eating, school, recreation, social, and other activity trips.

Figure 19: Trip Purpose Percentage by Travel Mode Split (All Trips)



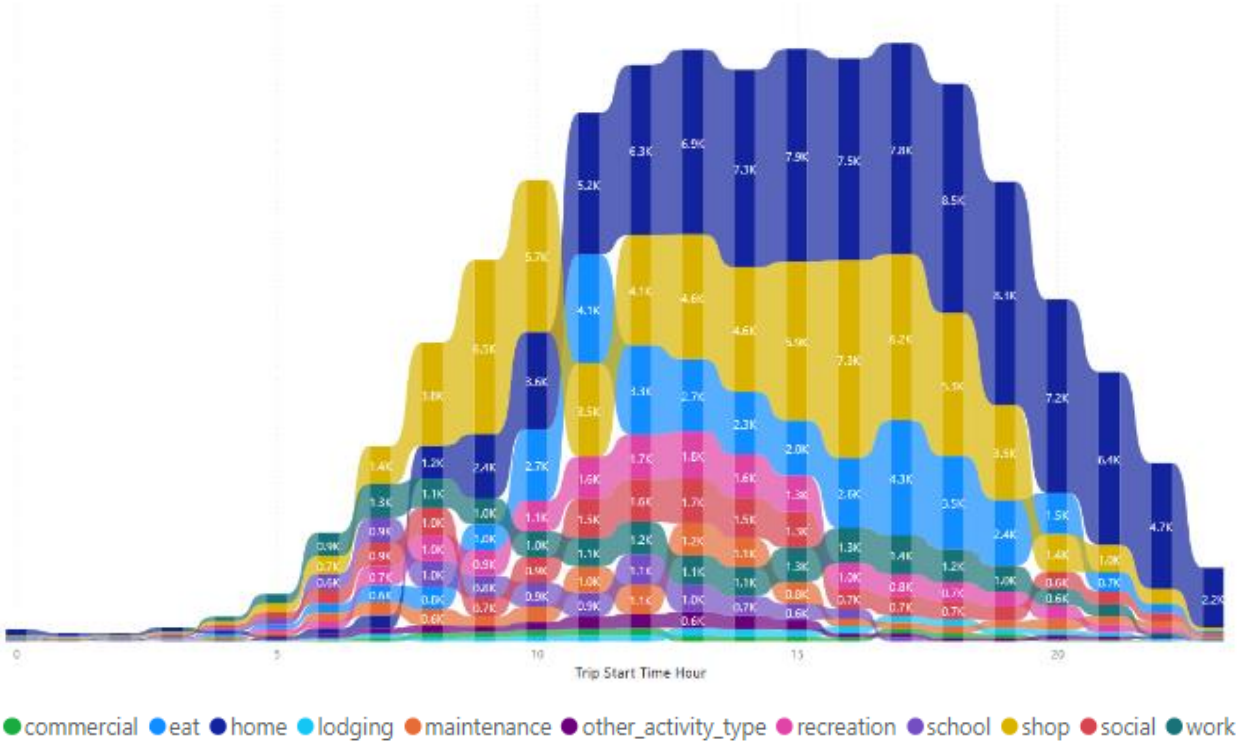
Source: Replica 2022

Figure 20 shows trip purpose by time of day for trips starting and ending in Montgomery County on a typical weekend. While there are less distinct peaks, the demand for different trip purposes increases throughout the day. The key observations from trip purpose by time of day on a typical weekend include:

- There are more than 278,000 trips taken during the typical weekend.
- There are more shopping trips in the morning, especially between 7:00 am and 10:00 am.
- The trips for eating or food is relatively similar to the typical weekday figure.

There are more recreation and social trips, which start earlier and end later, than typical weekday trips. The recreation and social trips peak between 11:00 am and 3:00 pm.

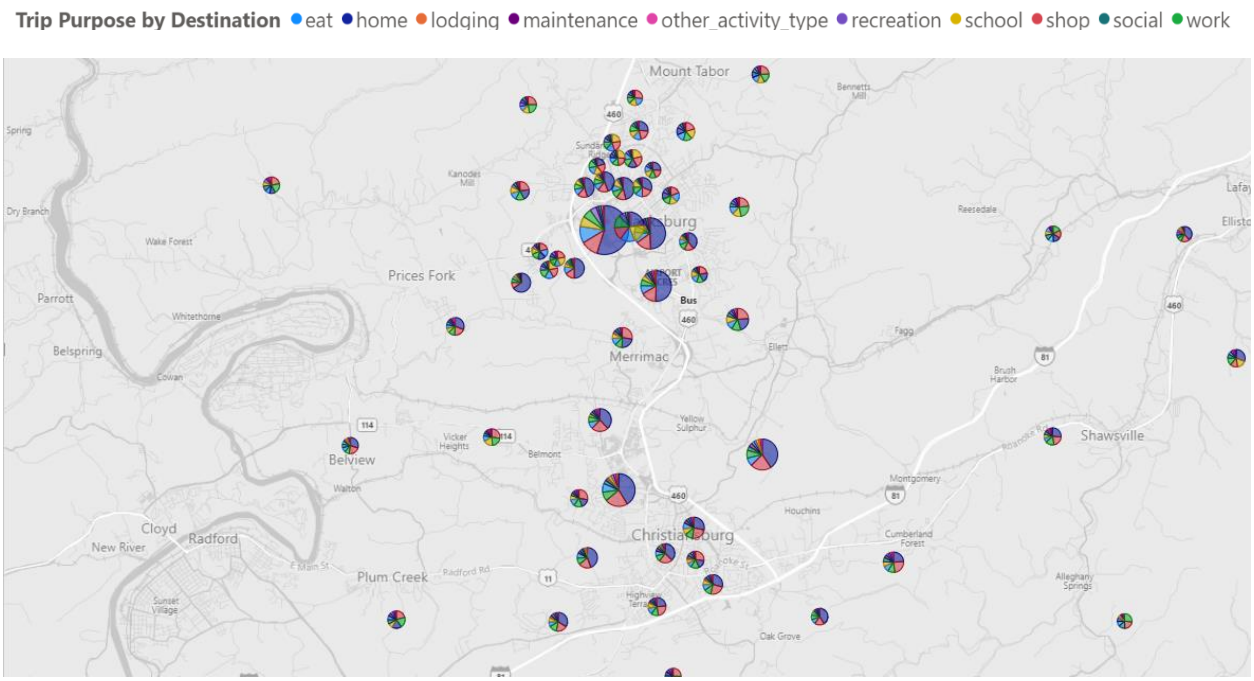
Figure 20: Trip Purpose Origin by Start Hour (Weekends)



Source: Replica 2022

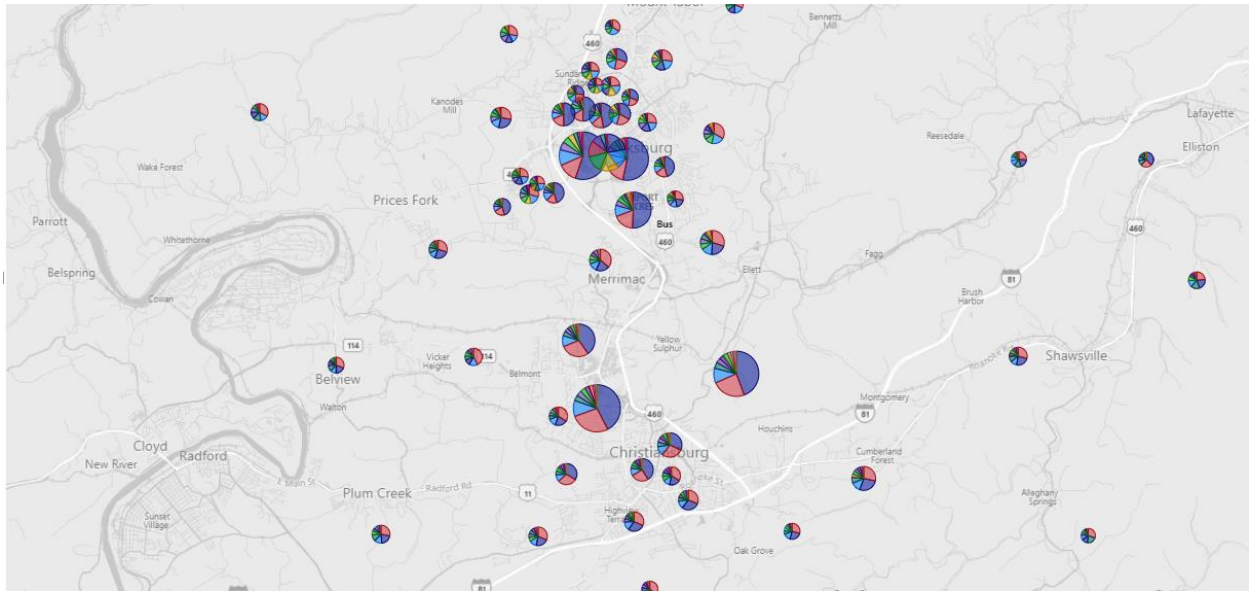
Figure 21 through Figure 24 shows the trip purpose by destination block group for weekday and weekend trips starting and ending in Montgomery County. For example, in Figure 21, Virginia Tech as a destination is represented by a pie chart with the diameter of the pie indicating how popular a destination it is on weekday, and unique slices of the pie in different colors corresponding to the different trip purposes that comprise its overall demand.

Figure 21: Trip Purpose by Destination Census Block Group (Weekday)



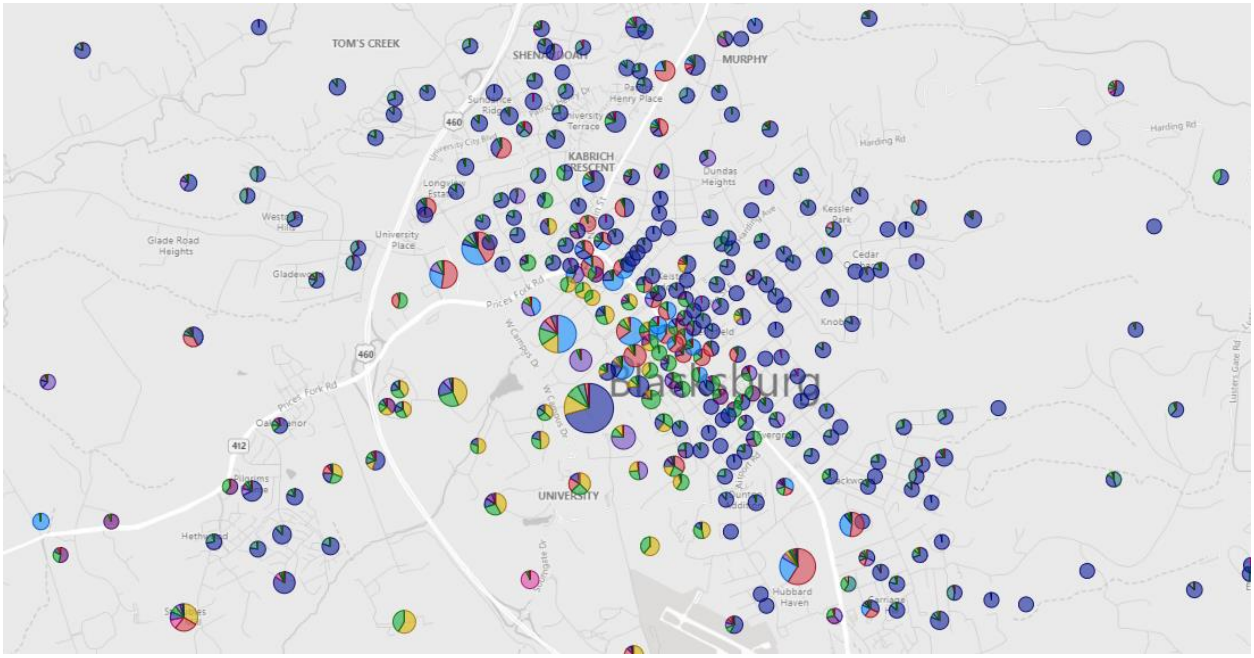
Source: Replica 2022

Figure 22: Trip Purpose by Destination Census Block Group (Weekend)



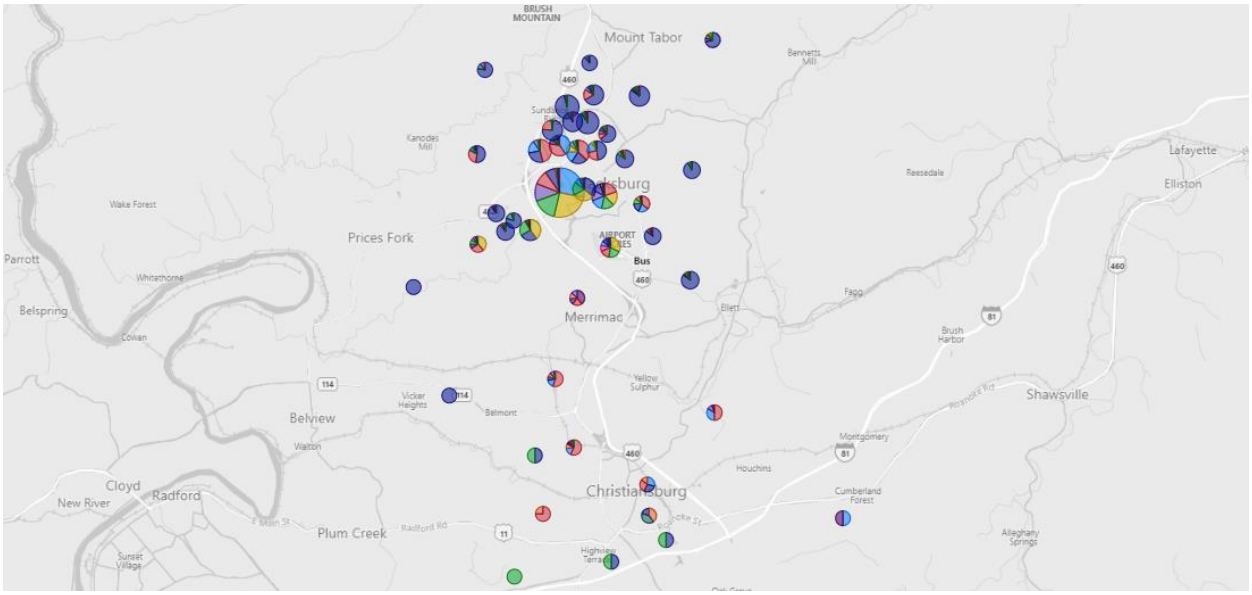
Source: Replica 2022

Figure 23: Blacksburg Trip Purpose by Destination Census Block Groups (Weekday)



Source: Replica 2022

Figure 24: Transit Trip Purpose by Destination Census Block Group (Weekend)



Source: Replica 2022

2.2.5 Transit Potential

Areas with both higher residential and/or employment density often correlate with higher transit ridership. A transit potential evaluation combines the population and employment densities of each Transportation Analysis Zone (TAZ) to indicate the viability of a fixed route transit service in the area. The transit potential model assumes that regions where residents plus jobs total more than five per acre are transit supportive.

Table 1: Transit Potential Thresholds

Category	People and Jobs per Acre
Negligible	<1
Low	1-5
Low-Moderate	6-15
Moderate	16-30
Moderate-High	31-60
High	>60

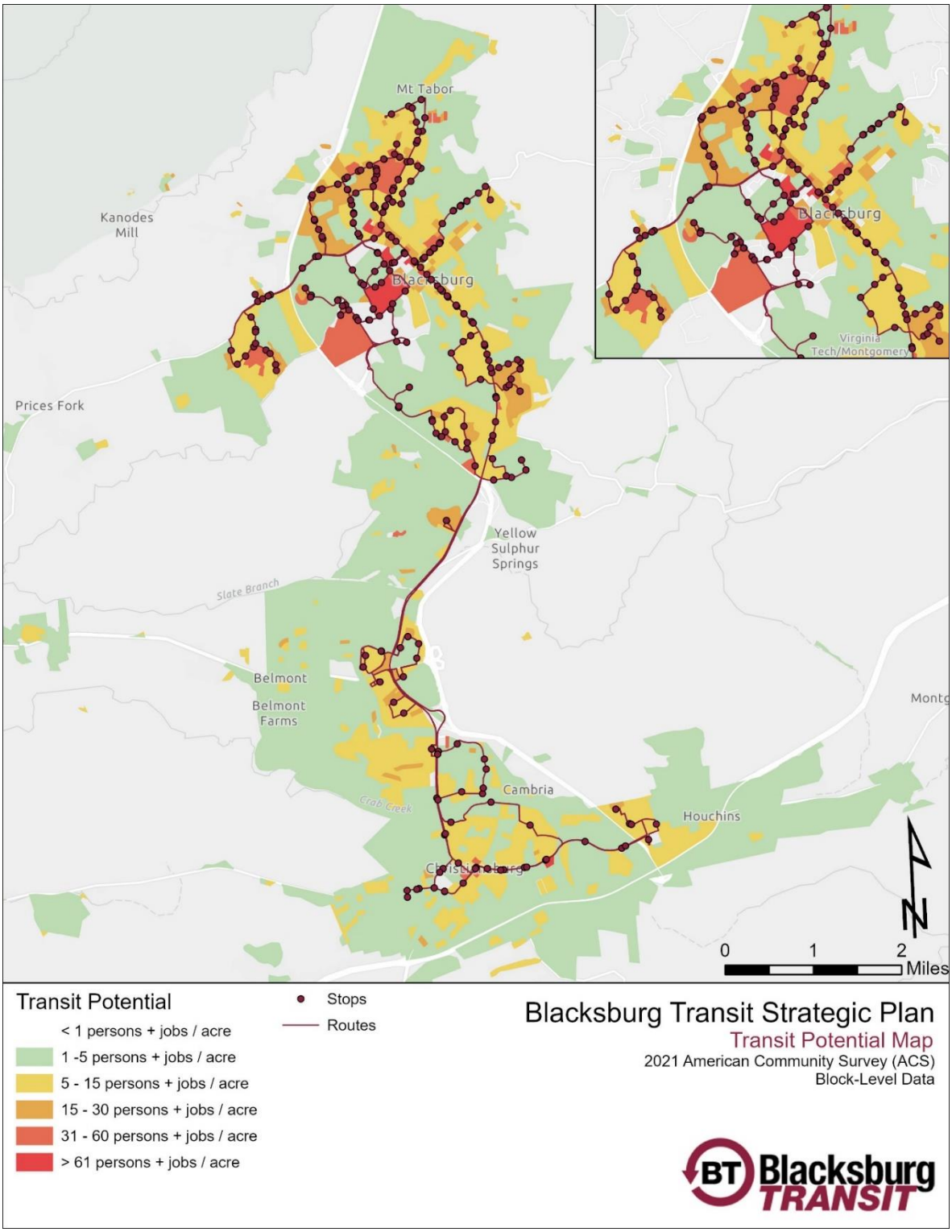
Figure 25 shows the transit potential calculated for the Blacksburg Transit service area. Population and job combinations areas of high transit potential that may be further evaluated for service in Blacksburg could include:

- Virginia Tech campus – 97 persons + jobs / acre
- University Mall Shopping Center area – 25 persons + jobs / acre
- Shenandoah/Main Street-Patrick Henry area – 30 persons + jobs / acre
- Roanoke Street – 32 persons + jobs / acre

High transit potential in Christiansburg include:

- Roanoke Street, area around Montgomery County Government Center – 309 persons + jobs / acre
- East Main Street/Roanoke Street area – 55 persons + jobs / acre
- Uptown Christiansburg Mall area – 16 persons + jobs / acre
- Northgate Village Mall area – 36 persons + jobs / acre

Figure 25: Transit Potential



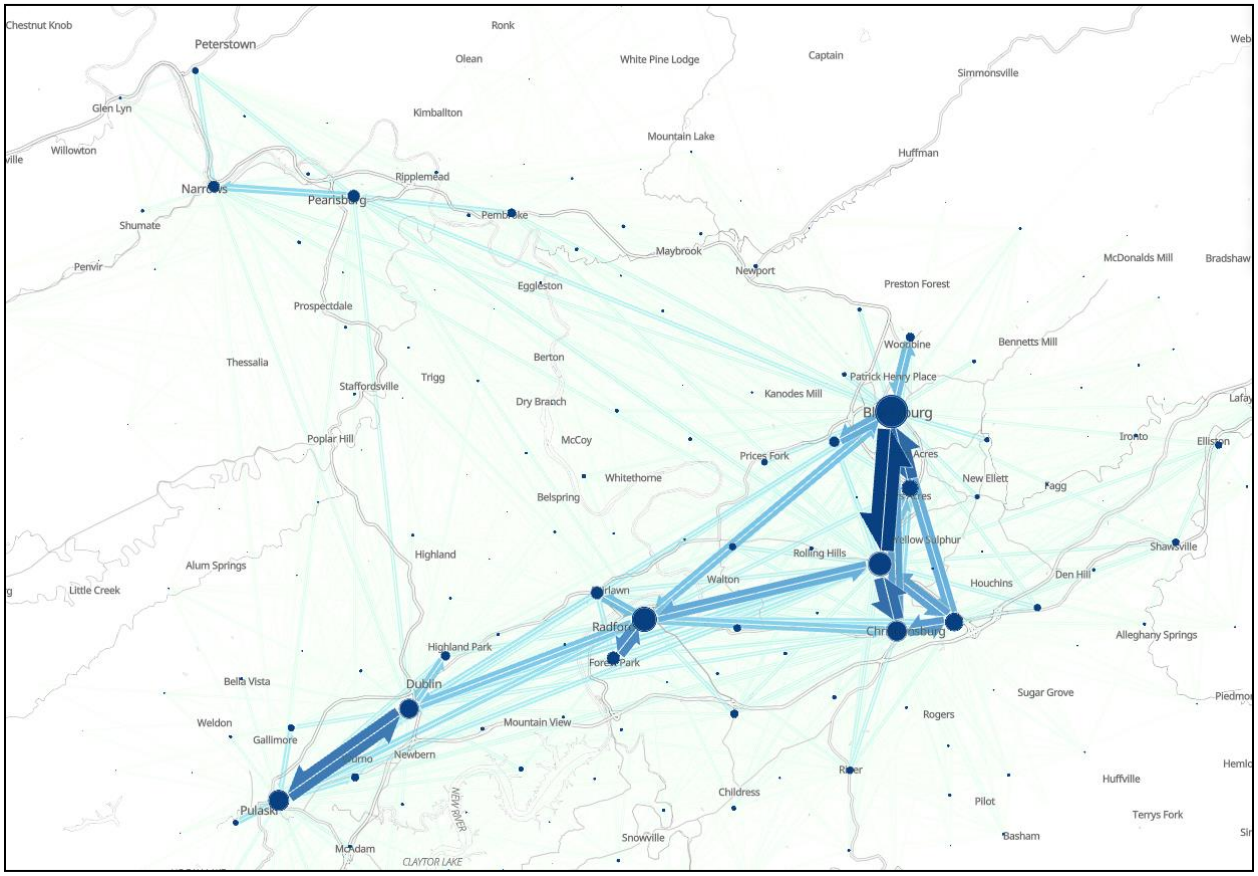
Source: ACS 2021

2.2.6 Origin Destination Analysis

All Trips

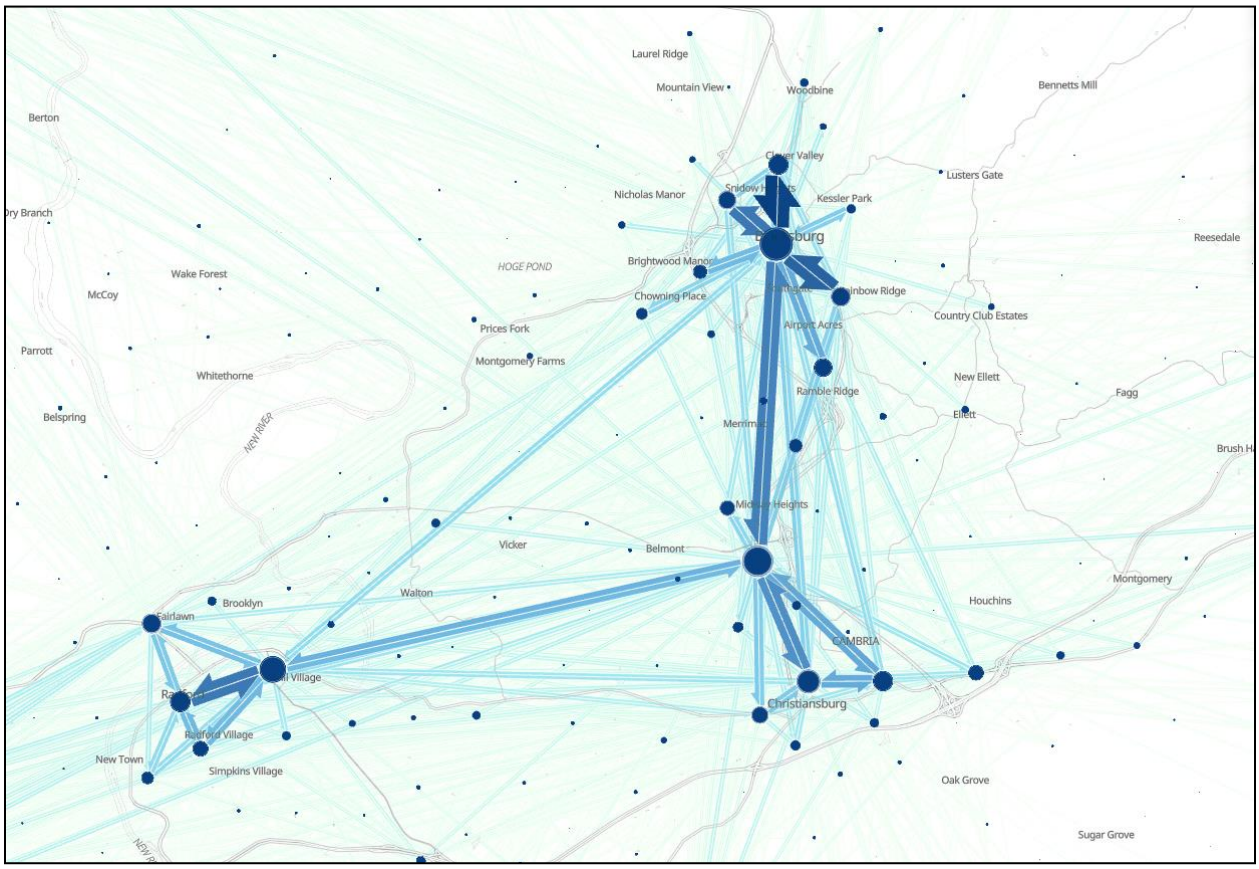
Figure 26 and Figure 27 show the major origin-destination flows for all trips starting and ending in Montgomery County during a typical weekday. The darker shade of blue and the larger the arrow indicate a higher frequency of trips. The dots correspond with trip arrival and departure locations (the larger the dot, the more trips). Figures 28 through 36 show additional breakdowns of the origin-destination flows.

Figure 26: All Trip Patterns O-D Flows (Regional)



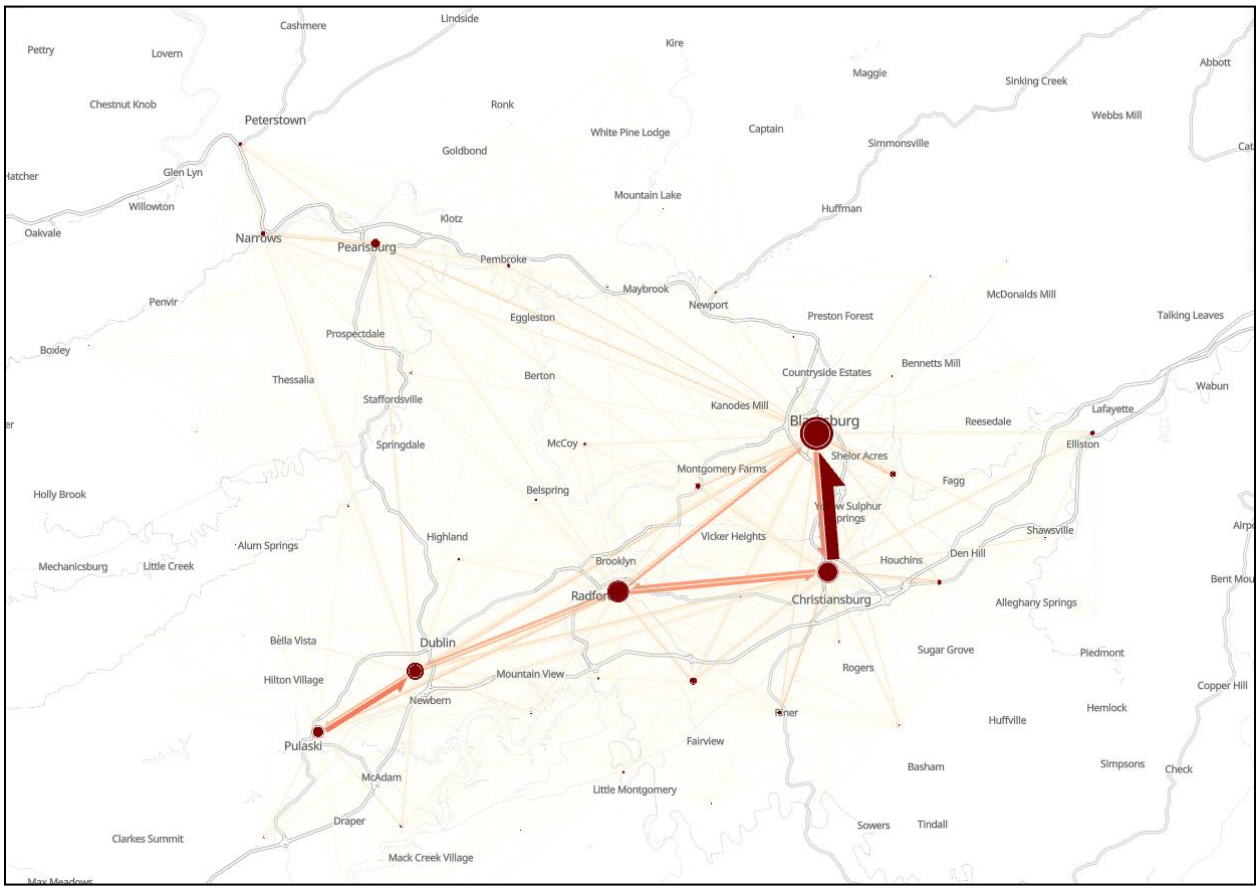
Source: Replica 2022

Figure 27: All Trip Patterns O-D Flows (Montgomery County)



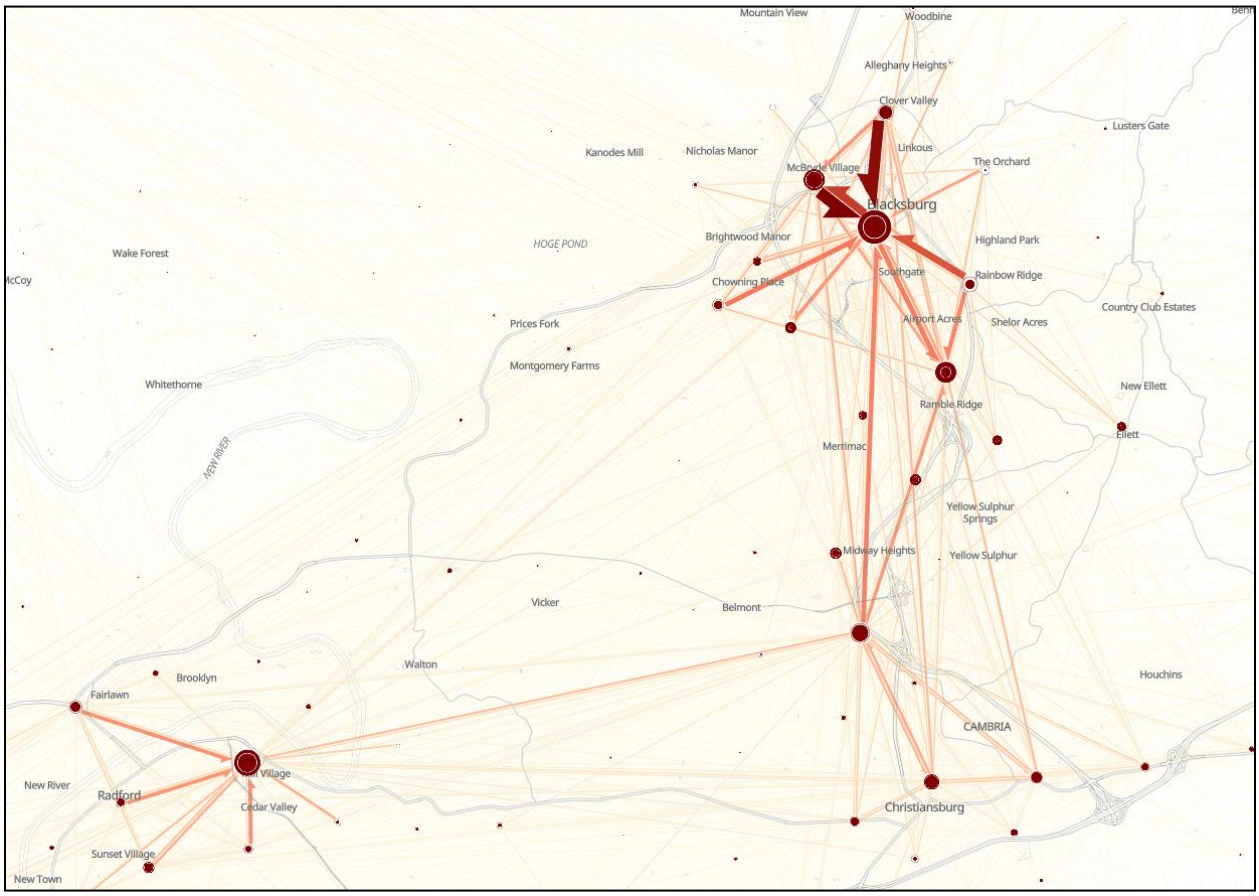
Source: Replica 2022

Figure 28: Work Trip O-D Flows (Regional)



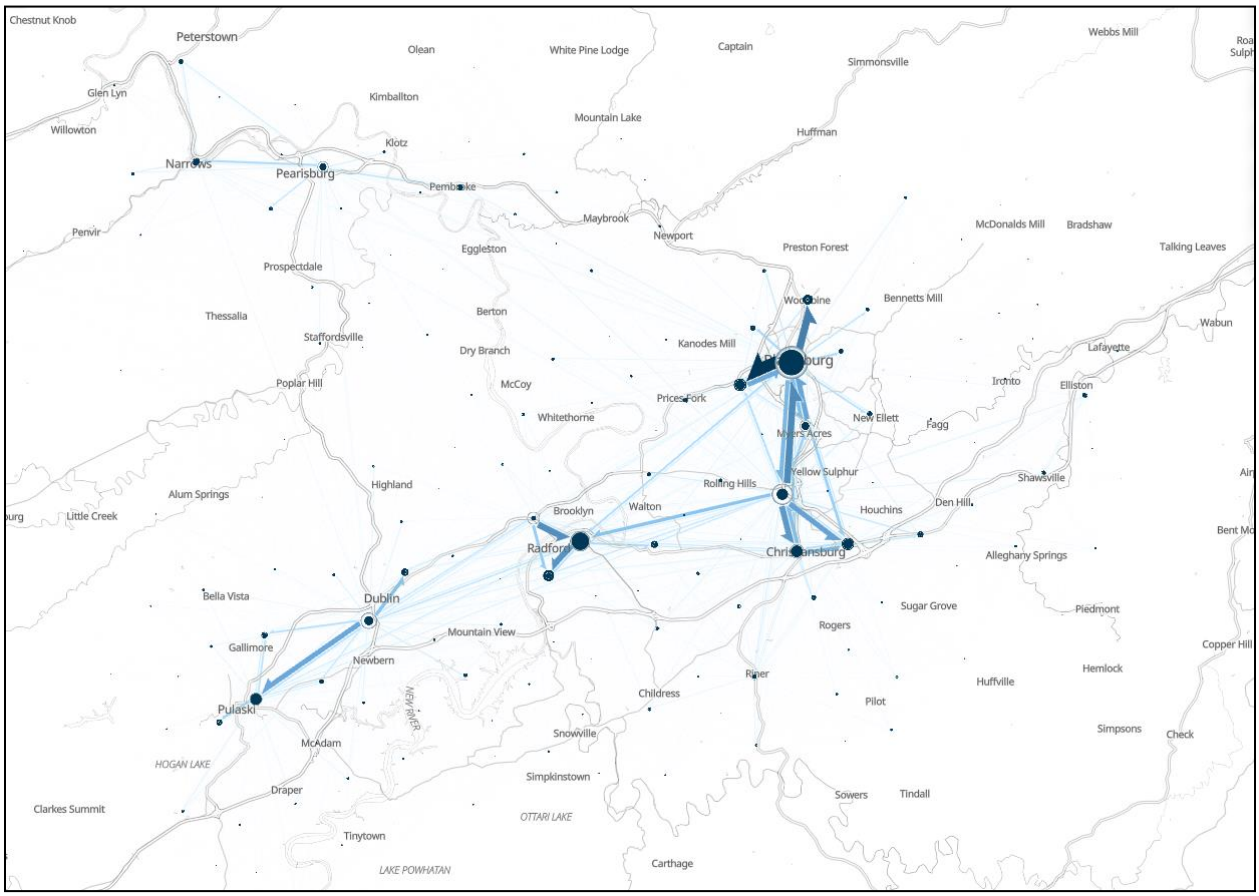
Source: Replica 2022

Figure 29: Work Trip O-D Flows (Montgomery County)



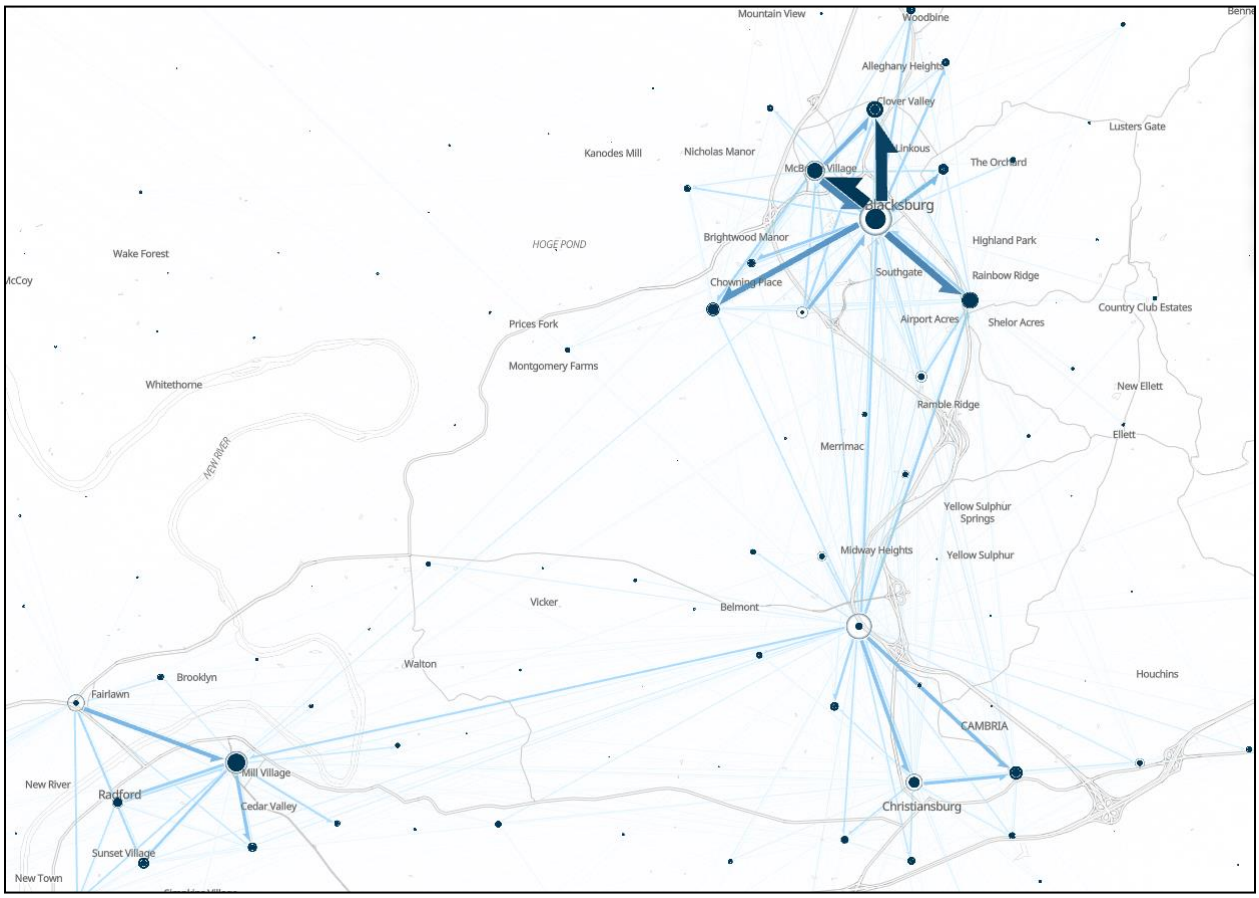
Source: Replica 2022

Figure 30: Home Trip O-D Flows (Regional)



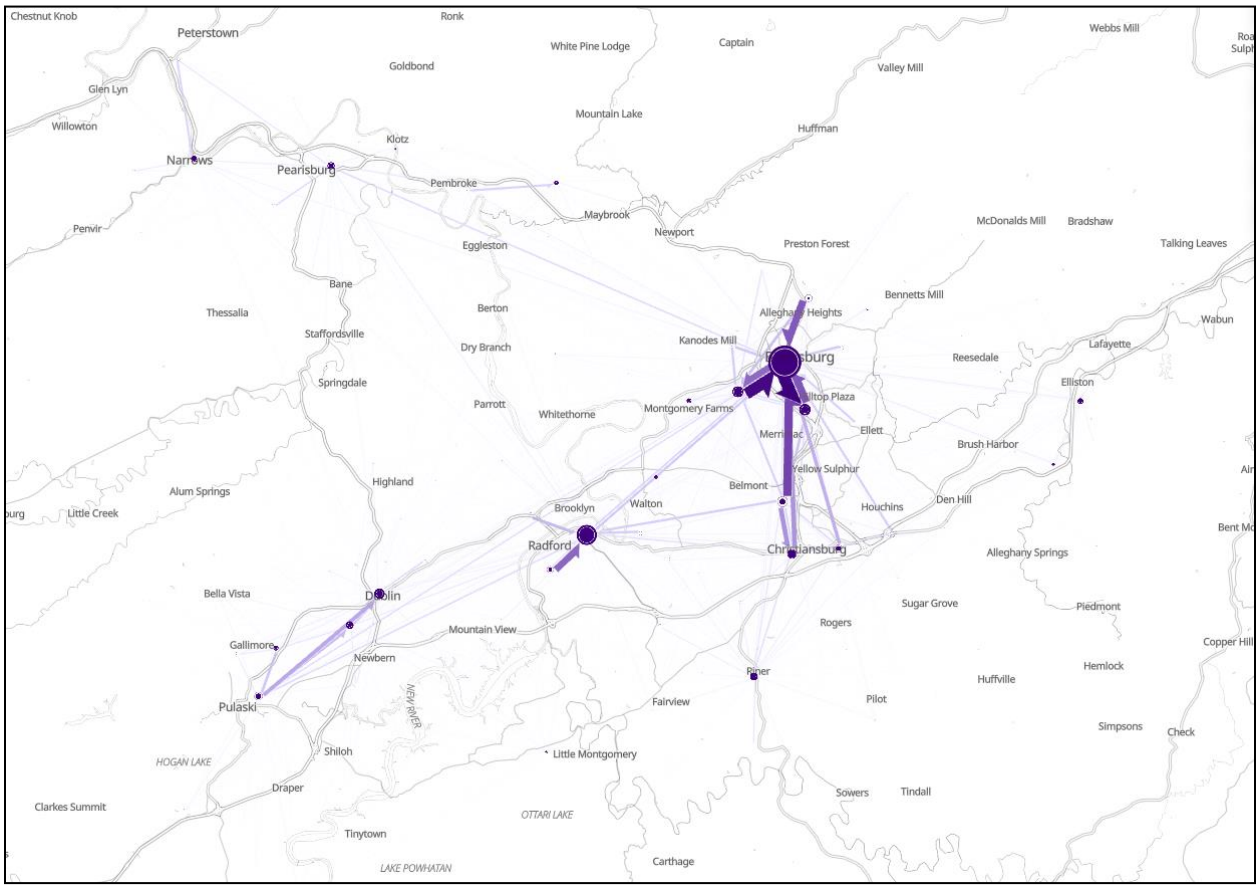
Source: Replica 2022

Figure 31: Home Trip O-D Flows (Montgomery County)



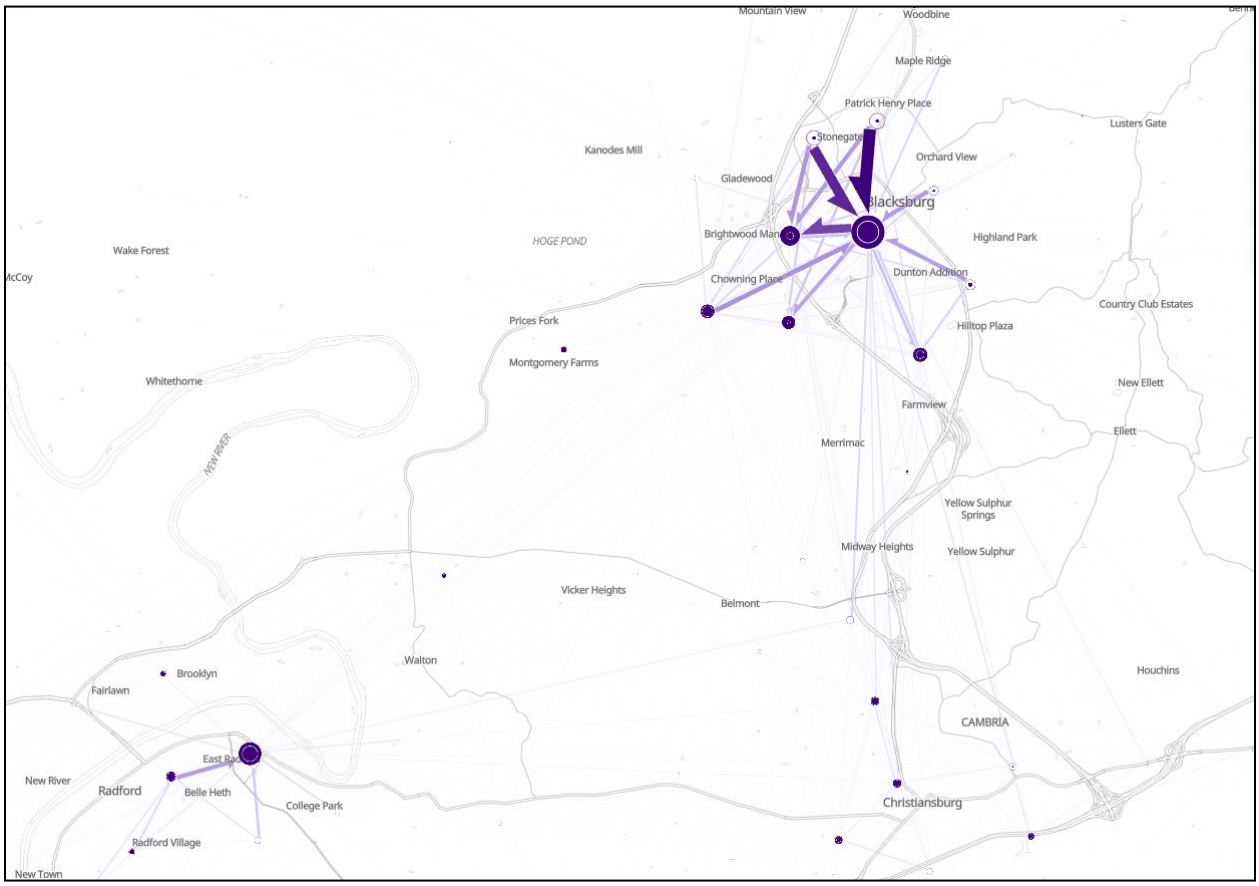
Source: Replica 2022

Figure 32: School Trips O-D Flows (Regional)



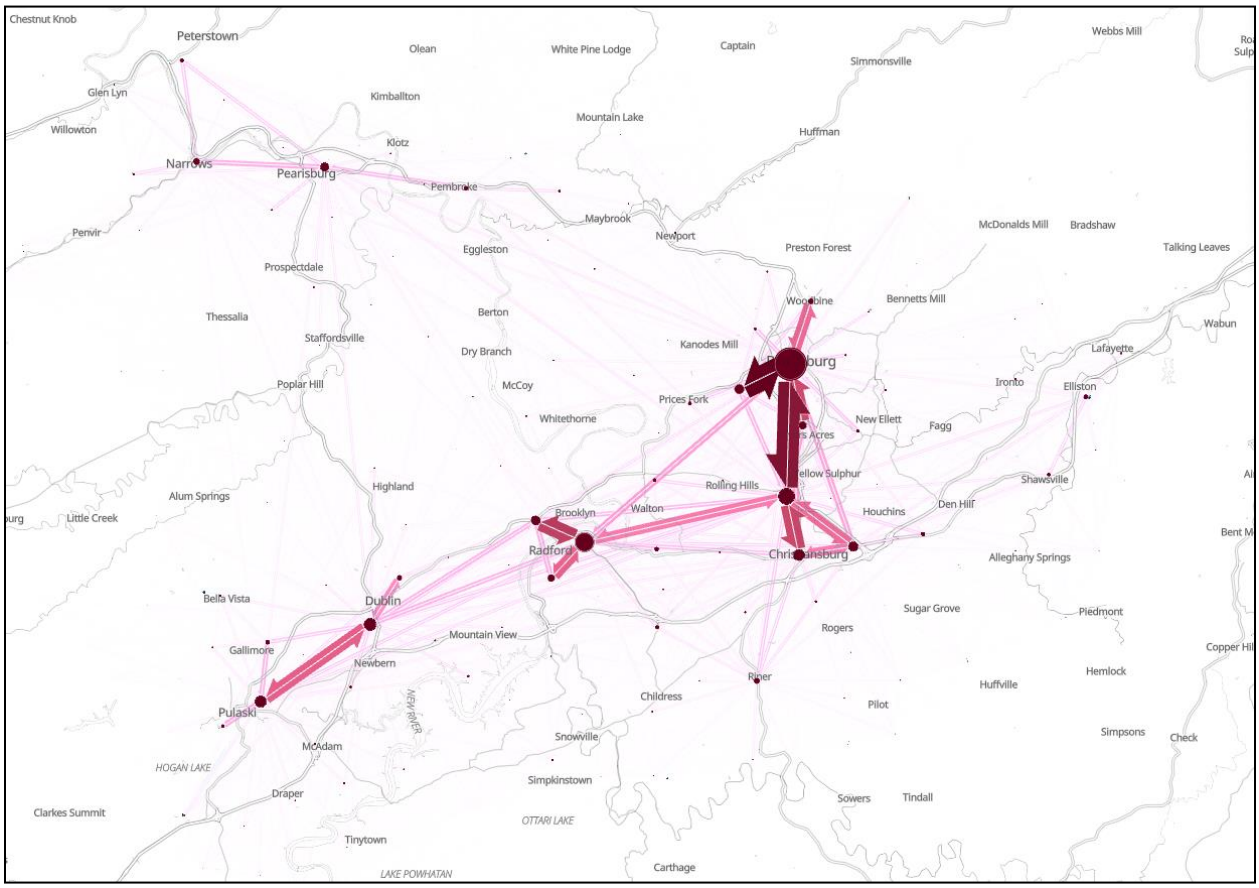
Source: Replica 2022

Figure 33: School Trips O-D Flows (Montgomery County)



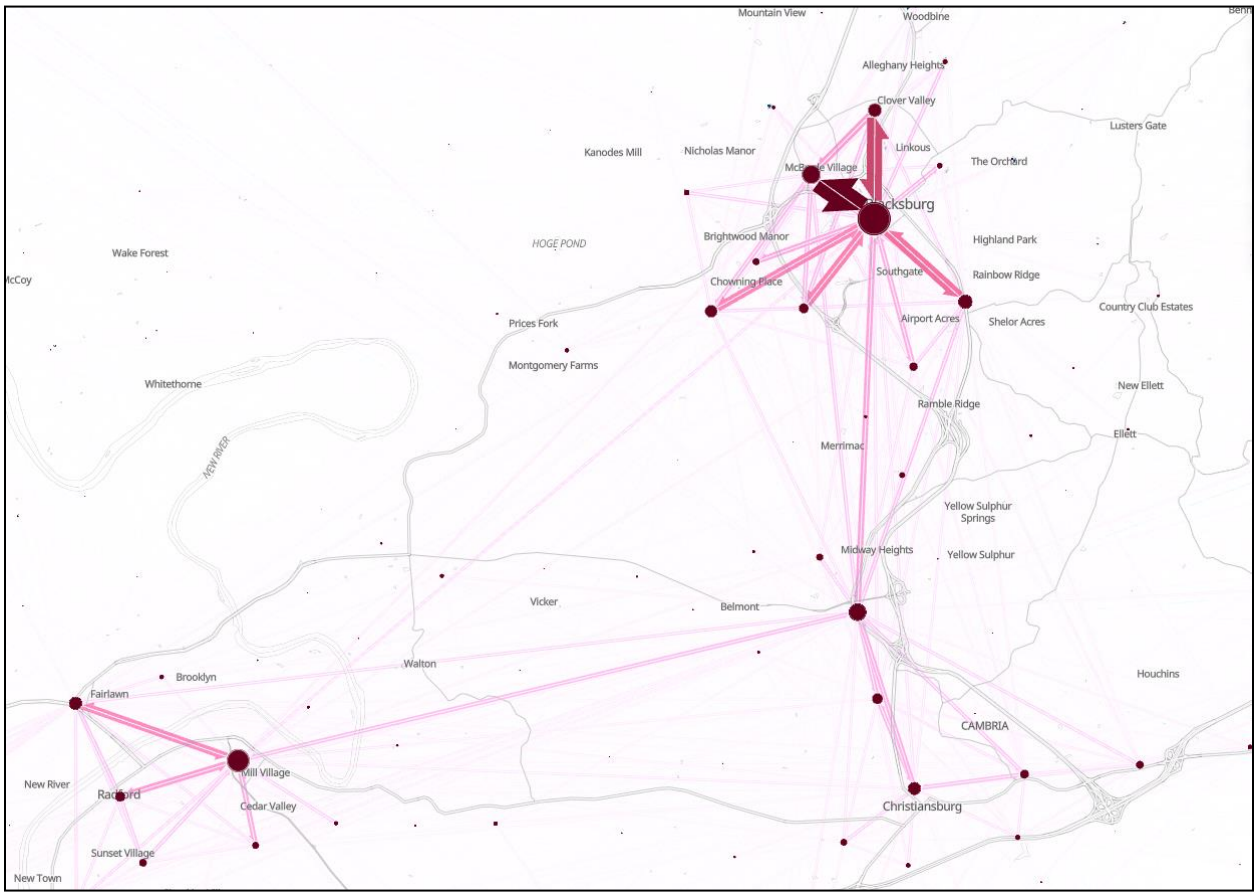
Source: Replica 2022

Figure 34: Income Under $15,000 (Regional)



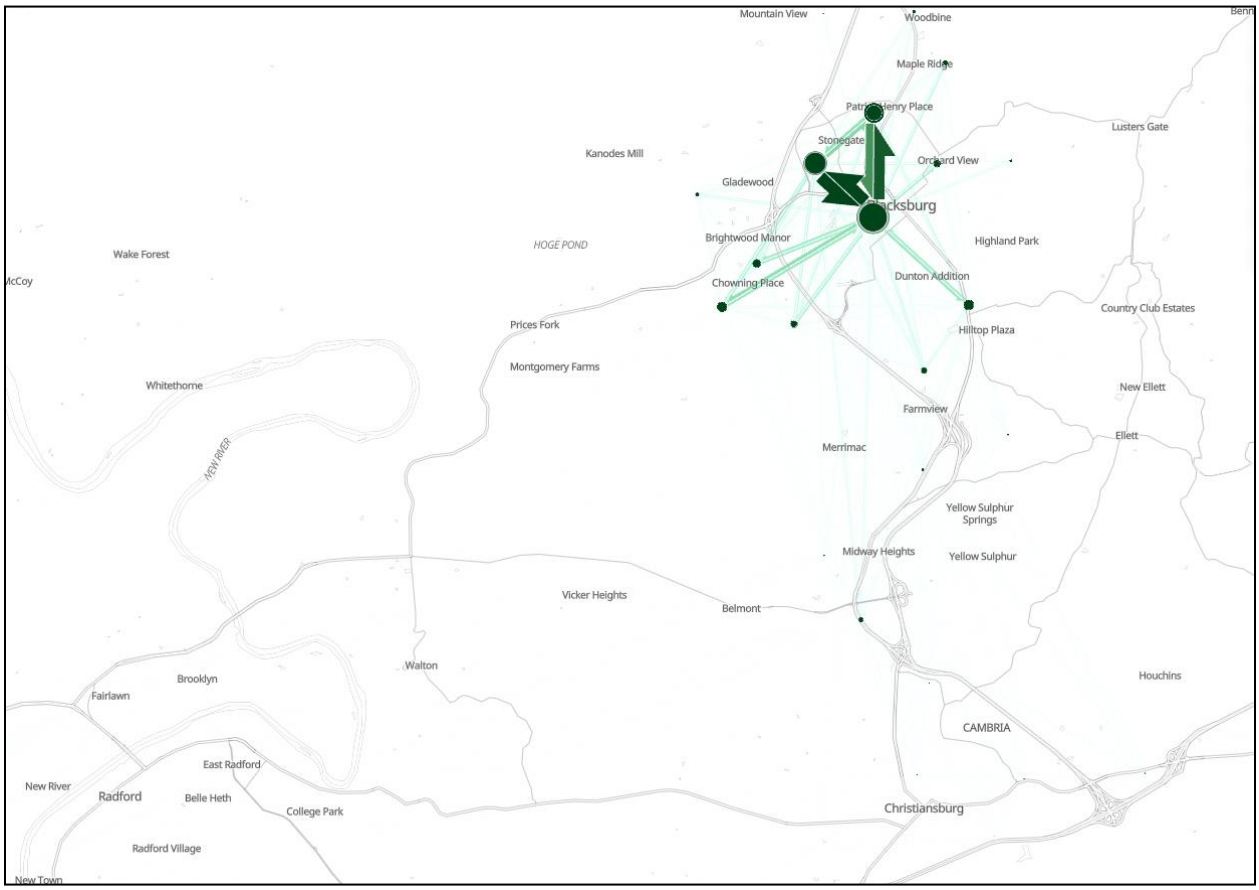
Source: Replica 2022

Figure 35: Income Under $15,000 (Montgomery County)



Source: Replica 2022

Figure 36: Public Transportation Trips (Montgomery County)



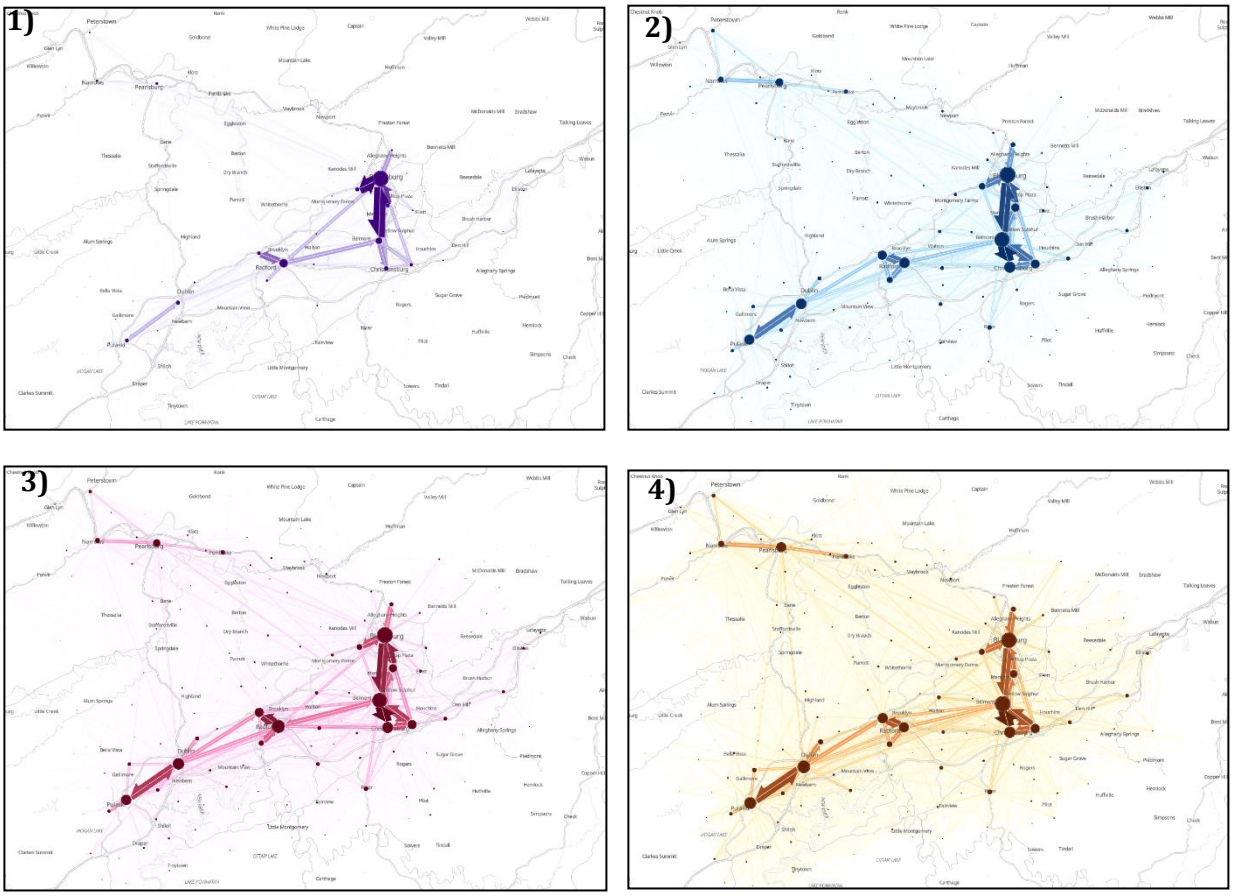
Source: Replica 2022

Figure 37 show the distribution of travel origins and destination patterns by age group cohort in the Montgomery County area on a typical weekday.

- The trips for people ages 18 – 34 are primarily around Virginia Tech's campus with nearly 83,000 trips. This age cohort group has the most concentrated number of trips that primarily stay in the Town of Blacksburg. The number of trips between Blacksburg and Christiansburg is approximately 8,900 trips.
- For people between the ages of 35 – 49, the primary trips occur within Blacksburg, within Christiansburg, and between the two towns. The number of internal trips around Virginia Tech's campus is nearly 7,300 trips. The number of incoming and outgoing trips in northern Christiansburg is nearly 9,500 both ways.
- The travel patterns of 50 – 64-year-olds is fairly similar to ages 35 – 49. The number of internal trips around Virginia Tech's campus is nearly 8,700 trips. The number of incoming and outgoing trips in northern Christiansburg is nearly 10,200 both ways.
- There are less trips between Blacksburg and Christiansburg made by people over 65-years-old. This age cohort has 3,800 trips in northern Christiansburg with nearly 7,400 incoming and departing trips in both directions. Within the Town of Christiansburg, this age cohort

has nearly 6,000 trips. There are only 2,000 trips made between Christiansburg and Blacksburg for this age cohort.

Figure 37: O-D Flows Ages 1) Ages 18 – 34, 2) Ages 35 – 49, 3) Ages 50 – 64, 4) Over 65



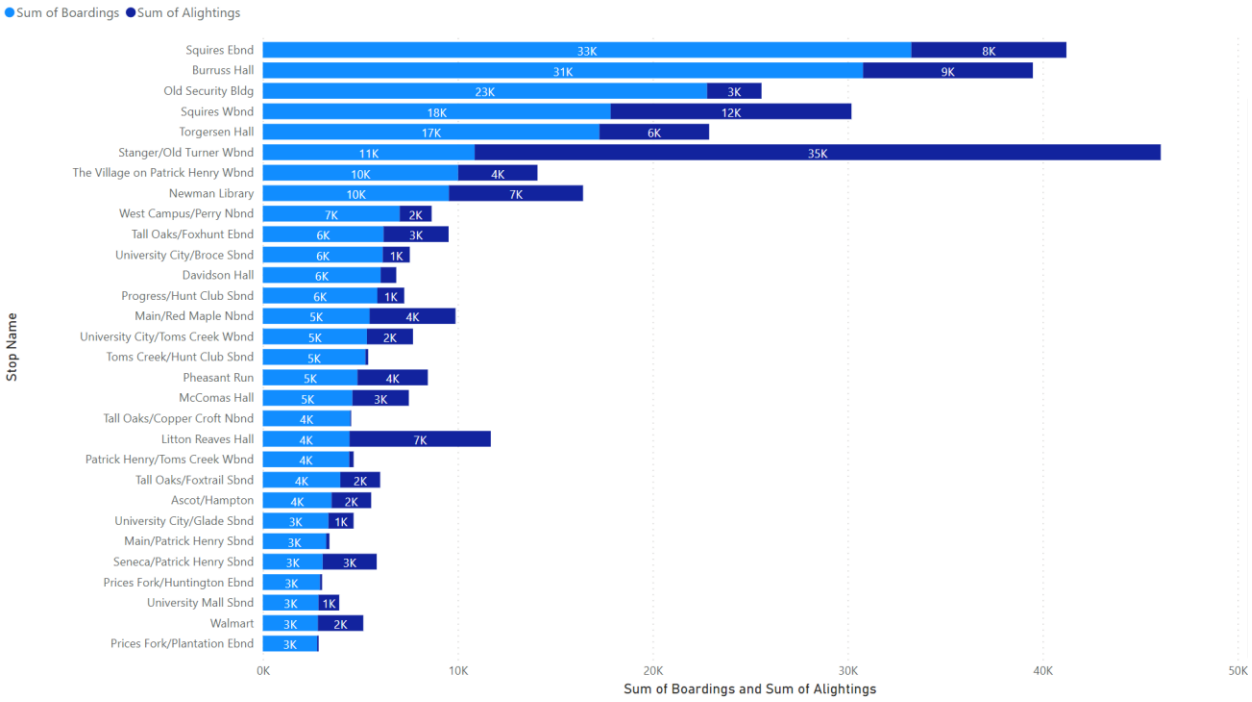
Source: Replica 2022

2.3.1 Performance Evaluation

Bus Stop Evaluation

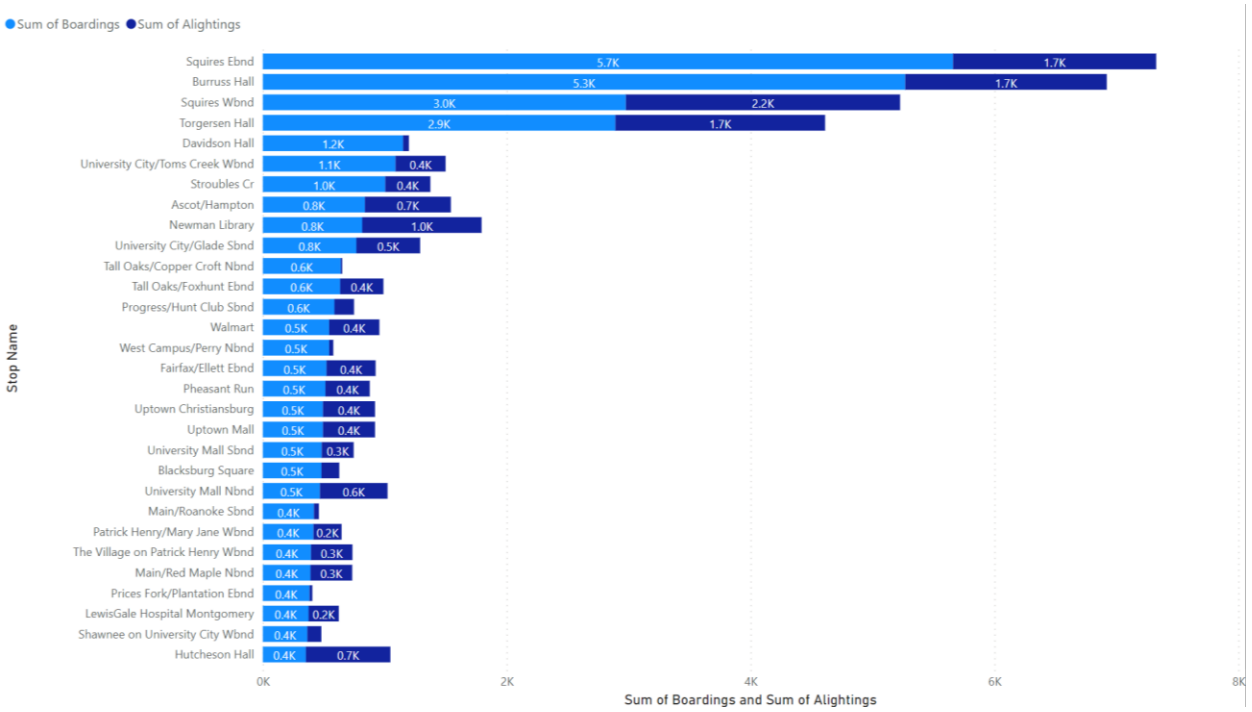
Figure 38 and Figure 39 show the highest total boardings and alightings per stop arrival ranked by ridership for APC data from October and July of 2022. Figure 40 and Figure 41 show ridership per stop arrival normalizes for the amount of service that each stop receives.

Figure 38: Total Boardings and Alightings per Stop (October 2022)



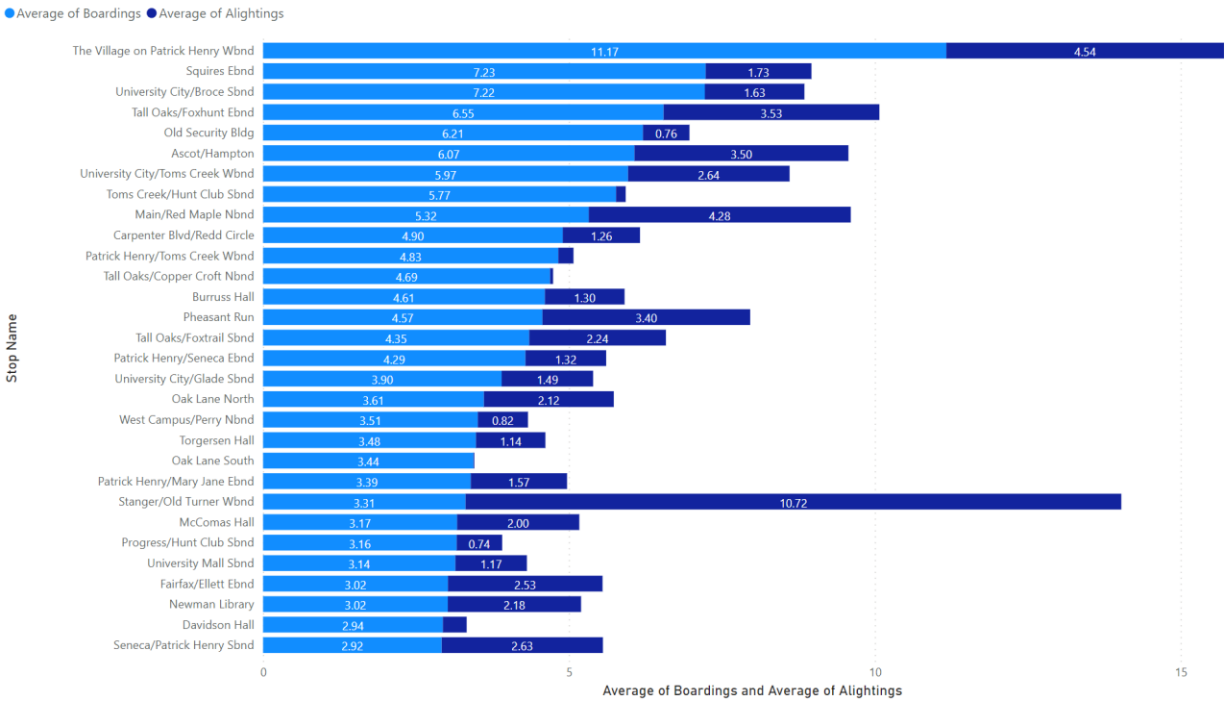
Source: Blacksburg Transit APC System

Figure 39: Total Boardings and Alightings per Stop (July 2022)



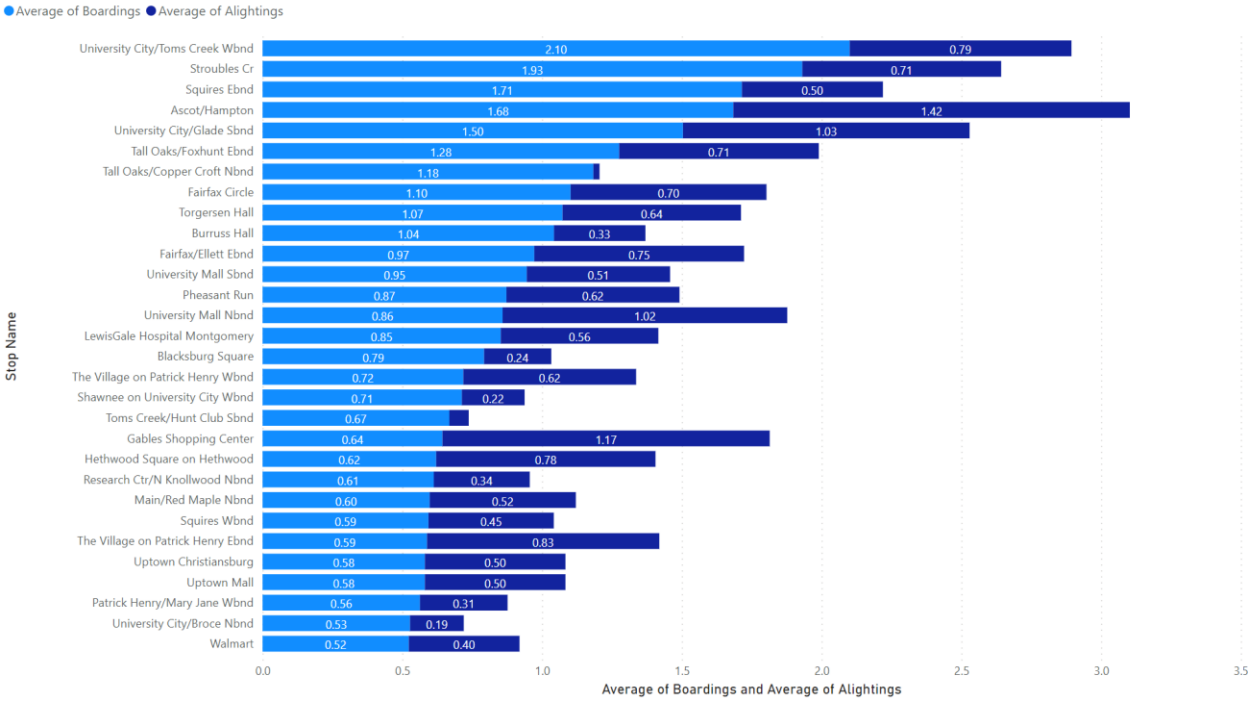
Source: Blacksburg Transit APC System

Figure 40: Average Boardings and Alightings per Trip Arrival (October 2022)



Source: Blacksburg Transit APC System

Figure 41: Average Boardings and Alightings per Trip Arrival (July 2022)



Source: Blacksburg Transit APC System

Blacksburg TRANSIT

Appendix C

Operating and Capital Revenues

C.1 | Operating Revenues, FY 2022 to FY 2024 and Unconstrained Routes

As required by DRPT TSP guidelines a summary of all actual revenues is included for additional background information to Chapter 5. This data provides a comparison to the estimated revenues and funds projected in Chapter 5 and the 10-year planning horizon with actual funding data for Blacksburg Transit. Table 1 provides a three-year retrospective of Blacksburg Transit's operating revenues from FY 2022 – FY 2024.

Table 1: FY 2022 – FY 2024 Funding Revenues ($1000s)

Revenue Source	FY 2022	FY 2023	FY 2024
Federal/State Grants	$13,970	$18,573	$13,610
Virginia Tech Contract	$5,320	$5,101	$8,617
Christiansburg Reimbursement	$383	$503	$765
Fares and passes	$0	$0	$0
Interest	$16	$59	$35
Other	$154	$98	$115
Total Revenues	**$19,843**	**$24,335**	**$23,142**
C.I.P Capital (reported separately)	**$13,468**	**$9,747**	**$11,017**

Source: Town of Blacksburg, Virginia: Adopted Operating Budget Fiscal Year 2024/2025

C.2 | Unconstrained Transit Service

Projects that do not fit within the constrained funding or 10-year planning horizon of the Transit Strategic Plan are identified below. Should future additional funding become available, the following services would be considered by Blacksburg Transit. Expansion beyond the town limits of Christiansburg will require a partnership agreement between BT and Montgomery County.

- **Two Town Trolley** – extend route to I-81 Park & Ride, replacing Gold Explorer.
- **Peppers Ferry/Belview Zone** – Demand response service west of mall stretching to Belview community in Montgomery County.
- **Merrimac Zone** – Demand response service covering area west of 460 and hospital with drop off points at the LewisGale Hospital Montgomery, Uptown Mall, and Walmart.
- **Christiansburg Zone** – Replace Explorer services with demand response zone with external drop off points at Target, Walmart, Uptown Mall, and LewisGale Hospital Montgomery.
- **University City Boulevard Toms Creek** – Supplemental service to connect University City with Main Street along Patrick Henry

Appendix D

BT Fleet Electrification Plan

2022

BT Fleet Electrification Plan

Revised May 2022

* Updated Vehicle Replacement Schedule – Sept 2024

CONTENTS

INTRODUCTION

Blacksburg Transit (BT), a department of the Town of Blacksburg, operates fixed route and demand response service for the Town of Blacksburg, Town of Christiansburg, small portions of Montgomery County, and Virginia Tech. The revenue fleet consists of heavy-duty buses ranging in length from 35-foot to 60-foot, as well as body-on-chassis vehicles and vans.

There are 18 fixed routes (16 in Blacksburg and two in Christiansburg). BT operates bus service all year long but there are different service levels, as follows:

- Full service (FS) during the fall and spring semesters when Virginia Tech is in session; all routes operate, buses are most frequent and service runs until midnight, or later.
- Reduced service (RS) during Virginia Tech's winter, spring, summer and fall breaks; most routes operate; buses are less frequent and service ends earlier than Full Service. Reduced Service is about 31 percent of Full Service hours.

BT's capital funding is provided by federal and state grants through the Virginia Department of Rail and Public Transportation (DRPT) with matching local funds provided by Virginia Tech (for Blacksburg service) and the Town of Christiansburg (for Christiansburg service). BT also seeks competitive grants through FTA and the Commonwealth of Virginia to supplement funds made available through DRPT from traditional sources. Operating funding is provided from the same sources, but with different percentages.

Vehicles in the fixed-route fleet are heavy-duty transit buses, with 12-year or 500,000 mile useful service life, in a mix of 35-foot, 40-foot, and 60-foot lengths. These buses are powered by either diesel, hybrid-electric, or battery-electric propulsion systems. Currently, all vehicles were manufactured by New Flyer Industries. Composition of the heavy-duty bus fleet is shown below.

Table 1: Active Bus Fleet

Capacity			Number				
Vehicle Size	Seating	Seating + Standing	Diesel	Hybrid-Electric	Battery-Electric	Total	Federal Interest
35-foot	30	70	12	0	3	15	15
40-foot	39	80	18	7	0	25	25
60-foot	55	107	9	2	2	13	11
TOTAL			**39**	**9**	**5**	**53**	**51**

COMMITMENT

In coordination with local, state, and federal partners, BT has committed to transitioning the fleet from diesel and hybrid-electric to 100 percent battery-electric. Electrification of the fleet

allows BT to support the goals of the Town of Blacksburg and our partners related to the reduction of greenhouse gases and reliance on carbon-based fuel. Additionally, the conversion to an all-battery-electric fleet is anticipated to provide both financial and operating benefits over the lifetime of the vehicle.

HISTORY

BT first began the evaluation of alternative fuel vehicles in 2008 in preparation for the FY 2010 grant cycle. This analysis and related grant application led to the purchase of nine New Flyer hybrid-electric buses that entered service in July 2010. When BT replaced additional buses in 2014, funding was not available to cover the price difference between traditional diesel and hybrid-electric buses so diesel buses were purchased.

Due to a delayed introduction of EPA 2010 compliant engines, the 2010 hybrid-electric buses have EPA 2007 compliant engines. Technological advancements of diesel engines resulted in the 2010 hybrid-electric buses and the 2014 diesel buses achieving the same fuel efficiency. Based on this data, BT continued to investigate and evaluate alternative power sources. BT has investigated other zero emissions technologies, but battery-electric buses are the preferred alternative to diesel-based propulsion for our region and operations.

In 2018, as part of the VW settlement, the Virginia Department of Environmental Quality (DEQ) announced grant opportunities in conjunction with the Virginia Department of Rail and Public Transportation (DRPT) to fund battery-electric transit buses and related infrastructure. BT applied for, and received funding for five buses and related charging infrastructure. As part of BT's commitment to electrification, the electric infrastructure was upgraded to accommodate a total of ten, 200 Amp vehicle chargers supporting up to 30 transit vehicles at BT's facility.

In FY 2022, BT has 21 buses eligible for replacement; 17 of the 21 replacements were approved through two successful grant opportunities in FY 2021. Twelve battery-electric buses, five depot chargers and one on-route charger were awarded through the VW settlement by DEQ and another five battery-electric buses were awarded under a Low-No grant opportunity.

The remaining four eligible vehicles are being submitted for replacement under an FY 22 Low-No grant application. This application also includes two more vehicles that will be eligible for replacement in the next 12 months; successful award of all six vehicles will make BT's fleet 57% battery-electric.

FLEET ELECTRIFICATION SCHEDULE

BT's Electrification plan has three core objectives: replace heavy-duty buses with battery-electric buses as they reach the end of their 12-year useful life, maintain an acceptable spare ratio, and maintain or increase the number of 60-foot articulated buses in the active fleet.

These buses allow BT to increase the passenger-carrying capacity of the fleet while keeping staffing levels the same. The chart below shows the fleet replacement plan through 2032 when, if adequate funding is available, BT will be able to achieve a 100% battery-electric fleet.

Table 2: Fleet Replacement and Expansion Schedule

Transition Schedule									
Date & Action	**Total Diesel or Hybrid Buses by Size**			**Total Electric Buses by Size**			**Total Fleet**	**% Electric**	**Contingency Fleet**
	35'	**40'**	**60'**	**35'**	**40'**	**60'**			
1/1/2023 - Active Fleet	12	25	11	3	0	2	**53**	**9%**	0
5/15/2023 - Implementation of Contingency Fleet	12	21	11	3	0	2	**49**	**10%**	4
Low-No - replace 5 x 40' with 3 x 40' and 2 x 60'	12	16	10	3	3	4	**48**	**21%**	8
VW / DEQ - replace 12 x 40' with 2 x 35' and 10 x 40'	12	4	10	5	13	4	**48**	**46%**	8
FY 23 - replace 2 x 60' with 2 x 60’	12	4	9	5	13	6	**49**	**49%**	8
FY 24 - replace 4 x 40' with 2 x 40' and 2 x 60'	8	4	9	5	15	8	**49**	**57%**	8
FY 25 - replace 4 x 35' and 2 x 60' with 4 x 35’ and 2 x 60’	4	4	7	9	15	10	**49**	**69%**	8
FY 26 – replace 4 x 35’ with 4 x 60’	0	4	7	9	15	14	**49**	**78%**	8
FY 27 - replace 4 x 40' and 1 x 60' with 1 x 35' and 4 x 60'	0	0	6	10	15	18	**49**	**88%**	8
FY 28 - no replacements	0	0	6	10	15	18	**49**	**88%**	0
FY 29 - no replacements	0	0	6	10	15	18	**49**	**88%**	0
FY 30 - replace 4 x 60' with 4 x 60’	0	0	2	10	15	22	**49**	**96%**	0
FY 31 - no replacements	0	0	2	10	15	22	**49**	**96%**	0
FY 32 - replace 2 x 60' with 2 x 60’	0	0	0	10	15	24	**49**	**100%**	0

This schedule assumes that adequate grant funding will be received to order the buses in the year in which the bus is eligible for replacement. If grants are not approved, replacement buses may be delayed. In general, BT takes delivery of buses about 18 months from the grant approval date.

CONTINGENCY FLEET

Until the pandemic in FY 2020 BT had experienced several years of ridership growth which created a need to expand both the service and fleet. Two growth strategies were originally identified: increase the number of articulated buses by expanding the fleet, and replace two 40-foot buses with one articulated bus. Ultimately, BT's fleet grew to 53 vehicles and exceeded the spare ratio in terms of peak vehicle usage and spare vehicles.

As a result of the 2017 Triennial, BT was tasked with meeting the 20 percent spare-ratio requirement by FY 2023. With the anticipated growth at Virginia Tech directly impacting BT's ridership, BT believed the ridership needs and spare-ratio requirement could be met by progressively increasing service.

The aftermath of the pandemic has left BT significantly short-staffed in all areas of the agency, causing service to be decreased rather than expanded. BT's staffing problems, while moving in the right direction, will not be resolved in the short-term, and therefore not possible to expand service to meet the spare-ratio requirement by FY2023. Instead, BT will move four buses into a contingency fleet that have met or exceeded the useful life requirement. Due to the agency – wide staffing shortages, the contingency fleet will be the only option to meet the spare-ratio requirement by FY 2023. The contingency fleet will allow BT the ability to resume the plan for increasing service as staffing levels improve. It is anticipated that BT will return to pre-pandemic service levels by FY 2025.

CHARGING INFRASTRUCTURE

Critical to the success of the deployment of battery-electric buses is understanding and managing the charging infrastructure and process. BT will need to prioritize charging in off-peak periods to avoid excessive demand charges. Demand charges are calculated using the peak demand in a 30-day cycle and applying to the next three, 30-day billing cycles. Essentially, the peak demand calculations are intended to ensure there is enough capacity in the electrical grid to meet future demand.

To ease management and budgeting in the future, BT would like to see specific tariffs implemented for battery-electric bus charging by both public transit and public school systems. Ideally, regional, statewide and national associations will work together to have these polices and legislation enacted, aiding the adoption of BEBs nationally.

In preparation, BT has installed all charging infrastructure on a separate meter to easily identify the amount of energy consumed for charging battery-electric buses.

UTILITY SERVICES

The Town of Blacksburg is served by two separate electric utilities, Virginia Tech Electric Service (VTES) and Appalachian Power, a division of American Electric Power (AEP). VTES provides electricity for the Virginia Tech campus and approximately 6,000 customers in the Town of Blacksburg, the remainder of Blacksburg, including the BT facility are served by Appalachian Power. BT has involved both utility companies in development of the fleet electrification plan. BT is developing electrical capacity calculations for both depot charging at the BT facility and on-route charging at key points in the BT service area.

DEPOT CHARGING

The FY20 grants allowed BT to fund the battery-electric bus charging infrastructure for the first five buses in the fleet, including two depot chargers and six dispensers. As part of the same project, BT was able to install duct bank, switchgear, and related infrastructure to accommodate 10 depot chargers and up to 30 dispensers at our facility. These upgrades will support the charging needs for up to 30 transit vehicles. One depot charger can support two or three dispensers, depending on the size of the vehicles. When charging 60-foot buses, only two dispensers can be supported, versus three dispensers for smaller 35- or 40-foot buses.

ON-ROUTE CHARGING

To ensure that buses are able to stay on route for the entire span of service, BT will need to deploy on-route chargers. BT is constructing a Multi-Modal Transit Facility (MMTF) which has incorporating on-route chargers into the design. In addition to serving as a central transfer facility on Virginia Tech's campus, it will also house two on-route chargers. BT applied for, and was awarded funding in FY 21 to install the first on-route charger at this location. As part of the MMTF construction, the duct bank and related electrical infrastructure will also be installed for the second on-route charger. BT plans to add a second on-route charger to the CIP in FY 28. Based on current modelling, the two on-route chargers will be adequate to meet BT operations needs for the next five years. The chart below shows planned investments in charging infrastructure.

Table 3: Charger Schedule

Battery-electric bus chargers FY21-FY29						
Year	**# Depot Chargers Replacement**	**# Depot Chargers - Expansion**	**Total Depot Chargers on Site**	**# On-Route Chargers Replacement**	**# On-Route Chargers - Expansion**	**Total On-Route Chargers**
Starting Levels	**n/a**	**n/a**	**2**	**n/a**	**n/a**	**0**
FY 2021 – Low-No		6	8		0	0
FY 2021 – VW		2	10		1	1
FY 2022			10			1
FY 2023			10			1
FY 2024			10			1
FY 2025			10			1
FY 2026			10			1
FY 2027			10			1
FY 2028			10		1	2
FY 2029			10			2

OPERATIONAL CONSIDERATIONS

This section summarizes the major changes to BT operations that will be required to accommodate battery-electric buses as fleet electrification moves forward.

ROUTE SCHEDULING

Depot-charged buses have limited in-service range before needing to be recharged. Currently, 43% of BT's full service routes are too long for depot-charged buses to handle on a single charge based on the existing range of buses. The range is expected to increase in the future as battery life improves. BT is working to deploy a yard management system that will allow for automated bus scheduling to manage bus assignments in the future, including the complexity introduced by the addition of battery-electric buses.

OPPORTUNITY CHARGING

As BT builds on-route charging capacity, there will be less impact on bus assignments, but operational changes will be required. To accommodate the necessary bus charging time, BT will need to build layover time into the existing route schedules and introduce route interlining to maintain effective service. It is assumed that any bus operating for 12 or more hours will need to opportunity charge at least once during the span of service.

PASSENGER LOADS

Battery-electric buses have different gross vehicle weight limitations due to the weight of the batteries. BT will need to reevaluate the maximum passenger loads on buses annually and make service changes as needed.

OPERATOR TRAINING

BT has operated hybrid-electric buses since 2010, but these were only 17% of the bus fleet. Training, monitoring, and coaching operators on proper battery-electric bus driving techniques is extremely important as the percentage of battery-electric buses increases over time. One of the biggest factors is braking and effectively utilizing regenerative braking. Over the last year, BT has discovered that regenerative braking "feels" different in a battery-electric vehicle vs a hybrid-electric. Specific training and feedback systems are needed to fully realize the benefits of regenerative braking in our system.

MAINTENANCE CONSIDERATIONS

The bus maintenance program will need to evolve over the next ten years as BT moves to an all-battery-electric fleet. Ultimately, it may require re-training of existing employees to develop new skills and the recruitment of new employees with different skillsets than those of traditional diesel mechanics. Most systems on battery-electric buses will be the same or similar as systems on current internal combustion engine buses; only 25–40 percent of current maintenance activities will change. In addition, BT already maintains hybrid-electric buses, which incorporate very similar drivetrain components as battery-electric buses, including electric drive motors, inverters/power electronics, and battery packs. Drive train diagnostics and maintenance activities for battery-electric buses will be similar to those for BT's current hybrid-electric buses. BT maintenance staff will need to plan for the following items in the next 3-4 years.

- High-Voltage Safety Training
- PM Scheduling and Tracking
- Additional diagnostic tools and programs
- Battery capacity loss over life of service

FINANCIAL CONSIDERATIONS

OPERATING BUDGET

Over the 12-year lifecycle of a transit bus, BT has calculated that battery-electric buses will have a 40% lower total lifecycle cost. The estimates in the table below are based on the lifecycle cost of one of the battery-electric buses that was added to the fleet in FY21.

Table 4: Lifecycle Costs

	Diesel 35'	35' Diesel CPM	35' Battery-Electric	35' BEB CPM	60' Hybrid-Electric	60' Hybrid CPM	60' Battery-Electric	60' Battery-Electric CPM
Fuel/Electricity	$282,702		$78,803		$302,531		$99,278	
Maintenance	$412,788		$323,644		$387,504		$289,931	
Total	**$695,490**	**$2.20**	**$397,447**	**$1.25**	**$690,034**	**$2.91**	**$389,209**	**$1.64**

Note: The lifecycle costs of a 60' battery-electric bus appear lower than those of a 35' battery-electric bus, however the 60's typically travel fewer miles. On average, a 35' bus travels 25 percent more miles than a 60' bus. The lifecycle costs per mile (CPM) have been added to clarify this data.

The majority of these savings are due to the reasonable cost of electricity in our region; currently BT averages 7.7 cents per kWh. Compared to diesel, electricity rates show less volatility, historically. As BT adds additional buses and on-route charging, these costs will be expected to rise over time as a result of inflation.

CAPITAL BUDGET

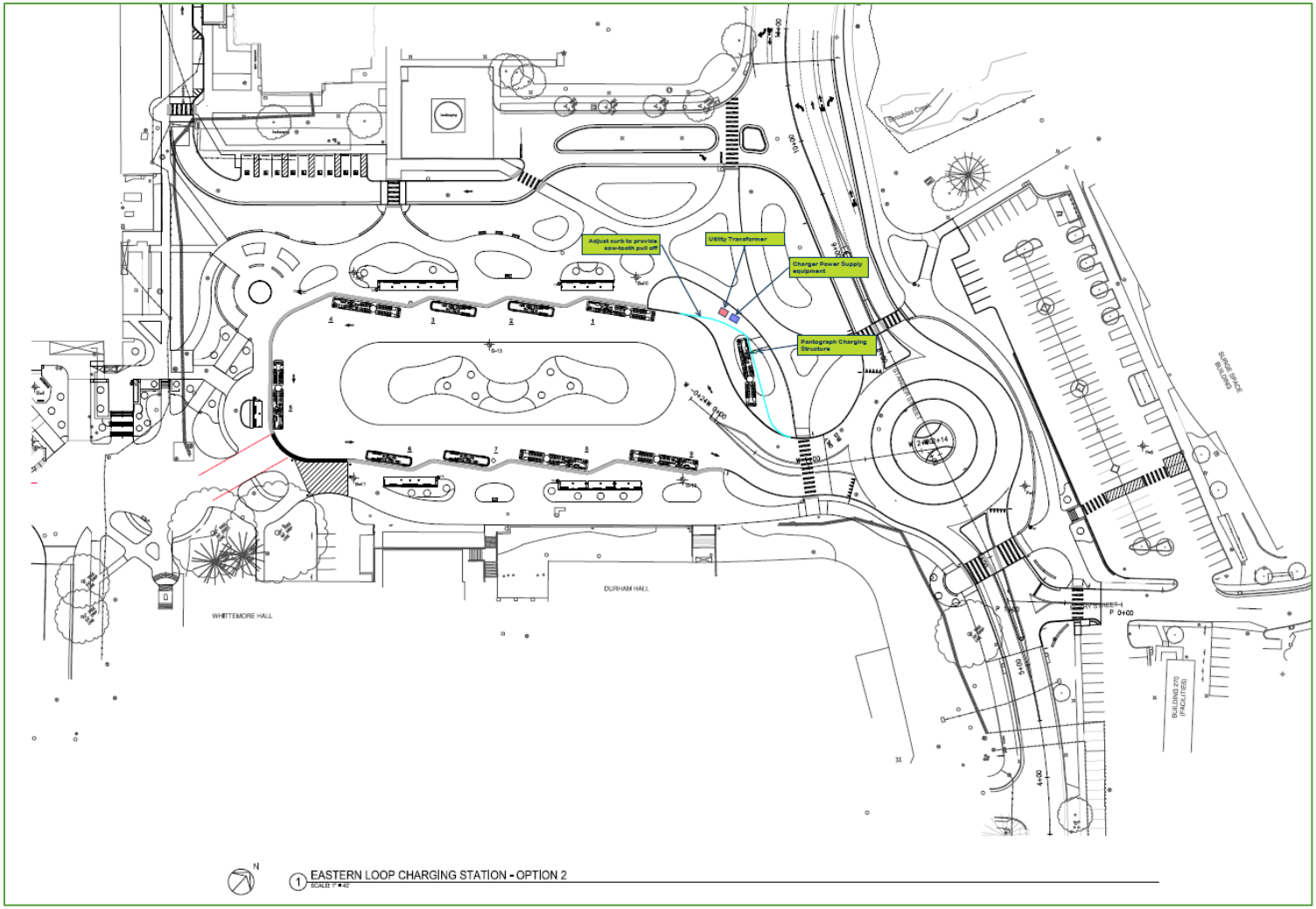
In BT's FY 2022 estimates, the cost of a 40-foot battery-electric bus is 36% higher than an equivalent diesel bus and the cost of a 60-foot battery-electric bus is 73% higher. Below is a table showing the total cost of achieving the replacement/expansion schedule.

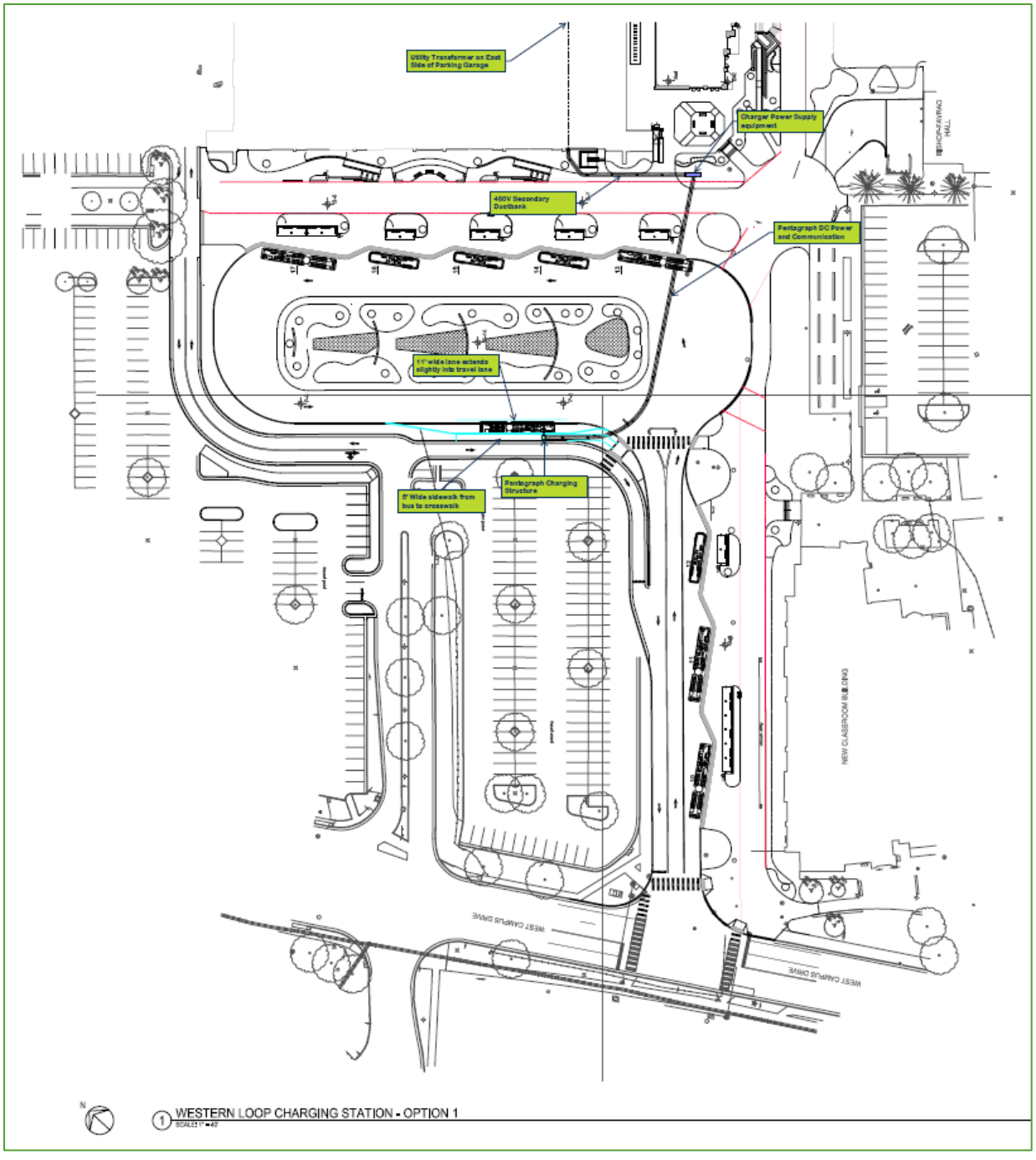
Table 5: Capital Cost Schedule (FY 22 Dollars, in Millions)

Fiscal Year	Battery-Electric Buses	Depot Chargers	On-Route Chargers	Total
FY 2022				$0
FY 2023	$7.9		$1.0	$8.9
FY 2024				$0
FY 2025	$8.3			$8.3
FY 2026				$0
FY 2027	$12.2			$12.2
FY 2028				$0
FY 2029				$0
FY 2030	$9.1	$0.5		$9.5
FY 2031		$0.6	$1.3	$1.9
FY 2032	$4.9	$0.6	$1.4	$6.9
Total	**$42.4**	**$1.7**	**$3.7**	**$47.8**

Appendix 1: Potential On-route Charging Locations

BT is constructing a Multi-Modal Transit Facility (MMTF) on Virginia Tech's campus to serve as a central transfer facility. This location will also house two on-route chargers, one in each loop.





1 WESTERN LOOP CHARGING STATION - OPTION 1
SCALE: 1" = 40'