Prepared for:

GLTC

FINAL

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MICROTRANSIT FEASIBILITY STUDY

GREATER LYNCHBURG TRANSIT COMPANY, LYNCHBURG, VA

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In Association with:

DRPT
Virginia Department of Rail and Public Transportation

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EXECUTIVE SUMMARY

Microtransit is a form of demand response transit that utilizes smaller vehicles than typical fixed-route buses and is technology-enabled to accept real-time trip requests and dynamically route vehicles to provide shared rides. In recent years, transit agencies have implemented microtransit services to improve the rider's experience through on-demand service and flexible routes, and right-size transit capacity in lower-density areas that are less suited to fixed-route transit.

The Greater Lynchburg Transit Company (GLTC) carried out this feasibility study to examine the viability of a microtransit service in Lynchburg, provide recommendations for a potential service zone and operating model, and identify the requirements for implementing a pilot. The goal of implementing a microtransit service is to evaluate its suitability as an alternative for underperforming fixed routes and to improve mobility with transit service for areas that are difficult to serve with fixed-route buses.

Three candidate service zones were identified, and **Figure 1** shows the recommended service zone and transfer opportunities to fixed routes.

> **The area most feasible for microtransit is a 7.2-square-mile zone encompassing existing weekday Route 7 and a portion of weekend Route 6/7X, two of the lower performing routes in the system that could be candidates for replacement with microtransit.**

FIGURE 1: RECOMMENDED MICROTRANSIT SERVICE ZONE
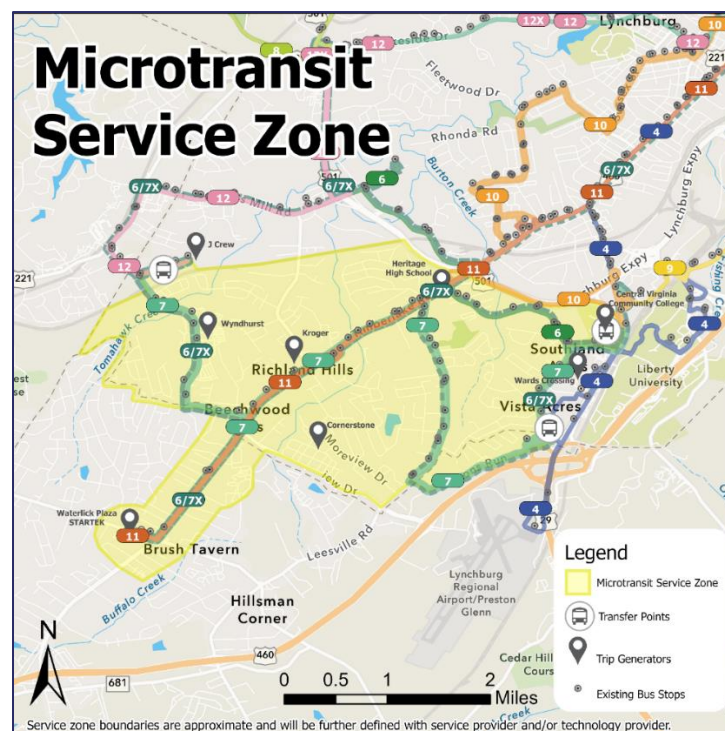
Source; Kimley-Horn, 2021.

Three potential service models for operating microtransit were identified: software as a service (SaaS), transportation as a service (TaaS), and partnering with a transportation network company (TNC). **Table 1** outlines key differences between these. They were compared using a variety of criteria, such as scalability and accessibility, as well as their respective strengths and weakness to determine which model is best suited for GLTC to consider implementing.

> **A software as a service model, in which GLTC contracts with a technology provider but operates the service itself, is recommended since it would provide the greatest control over service levels and has the potential for a lower upfront cost if GLTC operates the service with spare paratransit vehicles.**

TABLE 1: SUMMARY OF SERVICE MODELS

SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
GLTC provides and manages vehicles and drivers	Vehicles and drivers are obtained through a contractor	Vehicles and drivers are already in operation through existing services
GLTC is responsible for operations and maintenance of fleet	Contractor is responsible for operations and maintenance of fleet	Operations and maintenance are responsibility of TNC and its independent contractor drivers
Software is contracted to a third party	Software is contracted to a third party	Software is already in operation by the TNC

Source: Kimley-Horn, 2021.

Implementation considerations for a pilot were identified to assist GLTC in specifying requirements and defining the various components such as service days and hours, technology, booking and payment methods, and data collection and reporting.

Going forward, should GLTC decide to implement the service, funding would need to be secured for a pilot program prior to acquiring the technology platform and beginning marketing and education campaigns. Upfront costs for the pilot could range from approximately $40,000 to $100,000. An 18-month pilot would require total ongoing costs ranging from $600,000 to $1,250,000 during this period. The low end of the range reflects ongoing operations with one vehicle in service seven days a week and the high end with two vehicles. However, this could be partially offset by nearly $550,000 if Route 7 is replaced during the pilot.

A microtransit pilot would provide GLTC with an opportunity to test the "proof of concept" of a new service type that could provide a flexible alternative to underperforming fixed routes. GLTC will be able to utilize lessons learned from this experience to explore other innovative ways to create a more responsive and effective transit system for the future.

INTRODUCTION

The Greater Lynchburg Transit Company (GLTC), in partnership with the Virginia Department of Rail and Public Transportation (DRPT), carried out this feasibility study to understand how on-demand transit (also known as microtransit) may function in GLTC's current and future transit service model. This study identified opportunities for microtransit and evaluated potential service areas and models for future implementation. This report documents:

- GLTC's goal(s) for microtransit service
- Analysis of demand potential and propensity for microtransit service with consideration of existing transit services
- Potential service models for microtransit that best fit in GLTC's current operational paradigm
- A recommended service zone and model for a microtransit pilot based on the analysis in the study
- Pilot implementation considerations

BACKGROUND

GLTC operates 14 bus routes within the City of Lynchburg and a portion of Madison Heights, Monday through Friday from 5:00 a.m. to 10:15 p.m., 9 routes on Saturday from 6:00 a.m. to 10:15 p.m., and 9 routes on Sunday from 7:30 a.m. to 7:15 p.m. The main transfer station for the GLTC system is located at 800 Kemper Street with buses arriving every half hour at quarter past the hour and quarter till the hour. All but two routes (routes 6 and 7) begin and end at the transfer station to allow passengers to make transfers as needed to continue their ride to their destination.

In recent years, microtransit has emerged as a potential alternative to fixed-route transit in particular areas. Transit agencies have implemented microtransit services to improve the rider's experience through on-demand service and flexible routes, and right-size transit capacity in lower-density areas that are less suited to fixed-route transit.

> **For the purposes of this study, microtransit has been defined as a privately or publicly operated, technology-enabled transit service that typically uses multipassenger/pooled shuttles or vans to provide on-demand or fixed-schedule services with either dynamic or fixed routing[1].**

A few key characteristics of microtransit are shown in **Figure 2**.

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[1] SAE International. (2018). Retrieved from Taxonomy and Definitions for Terms Related to Shared Mobility and Enabling Technologies J3163_201809: https://www.sae.org/standards/content/j3163_201809/

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FIGURE 2: COMMON CHARACTERSTICS OF MICROTRANSIT

On-Demand	Technology-Enabled	Flexible	Zone	Shared Ride Vehicles
Service responds and is dispatched to riders in real-time	Technology supports real-time ride requests, dynamic and optimized routing, and payment	Accommodates riders whose schedules may not fit into fixed route service timings	Trips start and end in a predefined area with opportunities to connect to existing fixed routes	Operated with smaller vehicles than fixed-route service to reach areas full size buses cannot

Source: Kimley-Horn, 2021.

Essentially, microtransit uses technology to route transit vehicles based on real-time passenger demand. Vehicles range from sedans to minivans to small cutaway buses. Most public agencies that operate microtransit use small vehicles with dynamic routing and scheduling for curb-to-curb transit. Customers use a dedicated smartphone application (app) to plan, request, pay, and track the vehicle within an area, or alternatively call the transit provider to arrange a trip. Dynamic routing software matches riders traveling in similar directions and assigns the trips to a shared vehicle. Leading up to and during the trip, riders receive real-time information on estimated pick-up and drop-off time. A device (smartphone or tablet) in the vehicle provides the driver with turn-by-turn directions and monitors vehicle location to share this information with the rider and transit provider.

Transit providers are primarily using microtransit to replace fixed-route bus services in low-demand, low-density areas, serving as a first mile-last mile connection to transit hubs and key community destinations. Microtransit can offer the following benefits to transit providers and riders:

- A cost-effective alternative to fixed-route bus service on low performing routes
- Can be used to increase service coverage, particularly into areas that are difficult to serve with full-size buses or at times when demand for service is lower
- Can be used to supplement fixed-route bus service by acting as a first/last mile solution
- Offers an on-demand rider experience, potentially reducing waiting and travel times compared to fixed-route bus alternatives

GOALS FOR MICROTRANSIT SERVICE

At the start of the feasibility study, the study team consisting of GLTC staff (General Manager, Assistant General Manager, Director of Transportation), DRPT project manager, a Central Virginia Planning District Commission (CVPDC) representative, and the consultant, Kimley-Horn, discussed GLTC's goals for microtransit service to guide the study and service development.

GLTC's primary goals for microtransit service are to:

1. **Replace underperforming fixed-route service**
2. **Improve transit service for hard-to-reach areas**

Secondary goals included implementing a cost-effective service and providing connection opportunities to the fixed-route bus service.

SERVICE ZONE EVALUATION

Microtransit services typically operate within a dedicated service area or zone, requiring all trips to start and end within a predefined geography during service hours. This section describes the process, analysis, and results of identifying candidate microtransit service zones in the Lynchburg area as well as includes:

- Methodology and analysis used to identify candidate service zones
- Summary of three candidate service zones

METHODOLOGY AND ANALYSIS

This section documents the methodology used to identify candidate microtransit service zones in Lynchburg. Kimley-Horn analyzed existing data readily available from the U.S. Census Bureau, CVPDC, and GLTC to identify three candidate service zones suitable for microtransit considerations. This was done through a geographic information system (GIS) analysis of transit potential (i.e., population and employment densities supportive of on-demand transit) and transit propensity (i.e., concentration of persons more apt to use transit). Propensity includes factors such as zero-car households, low-income households, persons with disabilities, seniors, and student populations. Areas with lower levels of potential (i.e., low density) and higher levels of propensity with lower or no levels of fixed-route service may be candidate microtransit service zones.

TRANSIT POTENTIAL

The purpose of calculating transit potential was to identify the census block groups within the study area that are able to support transit service. This was done by calculating people and jobs per acre for each block group in Lynchburg and the three surrounding counties: Amherst, Bedford, and Campbell. The primary focus of the feasibility study was on service within the existing GLTC service area as well as outlying areas should service expansion be considered after the study. The identified qualitative and quantitative thresholds are shown in Table **2**.

TABLE 2. TRANSIT POTENTIAL THRESHOLDS

CATEGORY	TRANSIT POTENTIAL THRESHOLDS (PEOPLE AND JOBS PER ACRE)
Low	1-5
Low – Moderate	6-10
Moderate	11-15
Moderate – High	16-30
High	>30

Source: Kimley-Horn, 2021.

The transit potential study area is shown in **Figure 3**. The population data used in the analysis was from the American Community Survey (ACS) 2019 5-year survey while job data was from the Longitudinal Employer-Household Dynamics (LEHD) 2018 dataset. **In general, areas with low or low-moderate transit potential may be better suited for microtransit whereas areas with higher potential are better suited for fixed-route service.** The block groups identified with the highest levels of transit potential are in the downtown area of Lynchburg. Other areas with above moderate transit potential include Liberty University and University of Lynchburg.

FIGURE 3: TRANSIT POTENTIAL
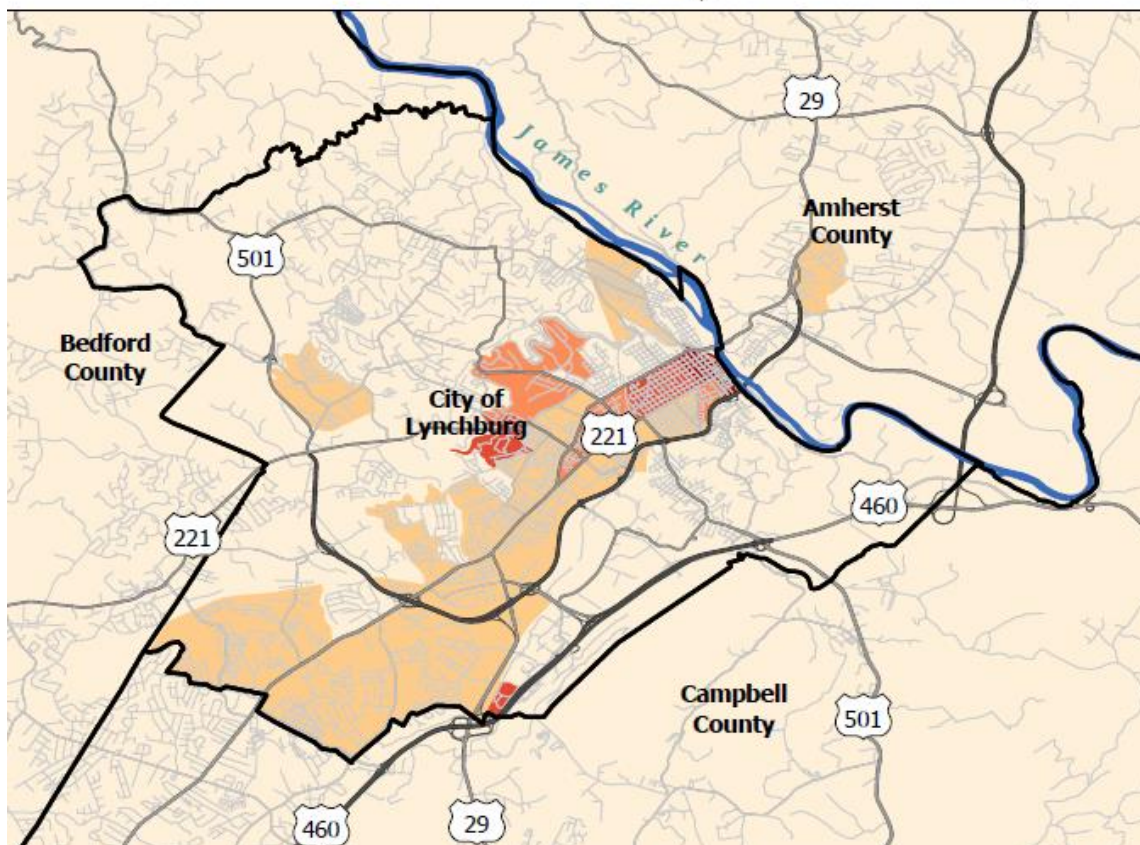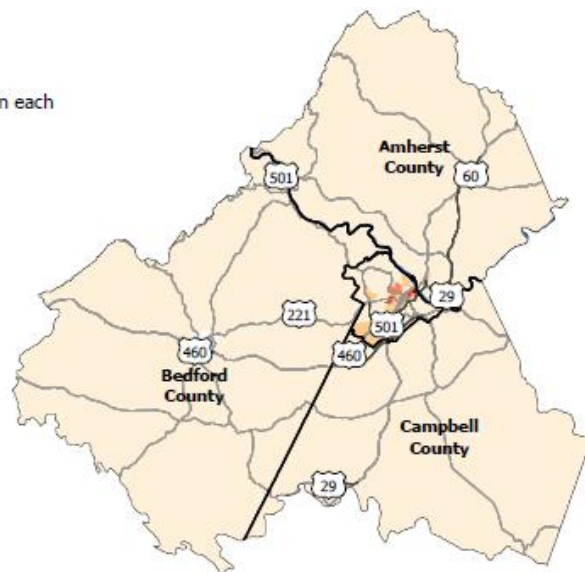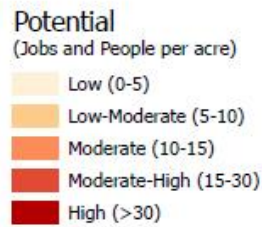
Source: Kimley-Horn, 2021.

TRANSIT PROPENSITY

The transit propensity model combined multiple data sources into an index that identified where populations with the highest propensity for transit use exist. Every census block group in the study area was indexed relative to the other block groups for a given category (e.g., senior population, low-income population, persons with disabilities). The population characteristics data came from the ACS 2019 5-year survey. Indices from each category were added together, weighted according to Table **3**, and normalized relative to all block groups to calculate a composite propensity index. Normalization resulted in an index between 0 and 100 for all block groups using the normalization equation:

$$z_i = \frac{x_i - \min(x)}{\max(x) - \min(x)} * 100 \text{ where:}$$

- z_i is the ith normalized value within the dataset
- x_i is the ith value within the dataset
- $\min(x)$ is the minimum value in the dataset
- $\max(x)$ is the maximum value in the dataset

The composite propensity index for each block group was then assigned a qualitative level using Table **4** (see **Figure 4** for maps of transit propensity in study area). **In general, areas with moderate to high propensity may be better suited for transit service including microtransit.** The areas with highest levels of propensity have been identified as the neighborhoods bounded by Timberlake Road, Greenview Drive, and Leesville Road in the southwest area of Lynchburg (Cornerstone, Lakeland, Windsor Hills). Areas with moderate-high propensity have been identified as:

- Adjacent to Enterprise Drive and Timberlake Road (Wyndhurst, Kenwood Hills)
- Adjacent to Graves Mill Road, Lynchburg Expressway, and Lakeside Drive (New Towne, Turtle Creek, Keystone Forest)
- Surrounding Linkhorne Drive and Old Forest Road (Linkhorne, Panorama Hills)

TABLE 3. PROPENSITY CATEGORIES AND WEIGHTS

CATEGORY	WEIGHT
Population	30
Low-Income Population	25
Zero-Car Households	25
Persons with Disabilities	10
Student Population	5
Senior Population	5

Source: Kimley-Horn, 2021.

TABLE 4. NORMALIZED PROPENSITY CATEGORIES AND INDEX

CATEGORY	PROPENSITY INDEX
Low	0-20
Low – Moderate	21-40
Moderate	41-60
Moderate – High	61-80
High	81-100

Source: Kimley-Horn, 2021.

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FIGURE 4: TRANSIT PROPENSITY

Transit Propensity

Transit propensity is an index calculated with socio-economic characteristics such as income, automobile availability, age, and disability status, which are indicative of a higher propensity to use transit

Propensity
- Low
- Low-Moderate
- Moderate
- Moderate-High
- High
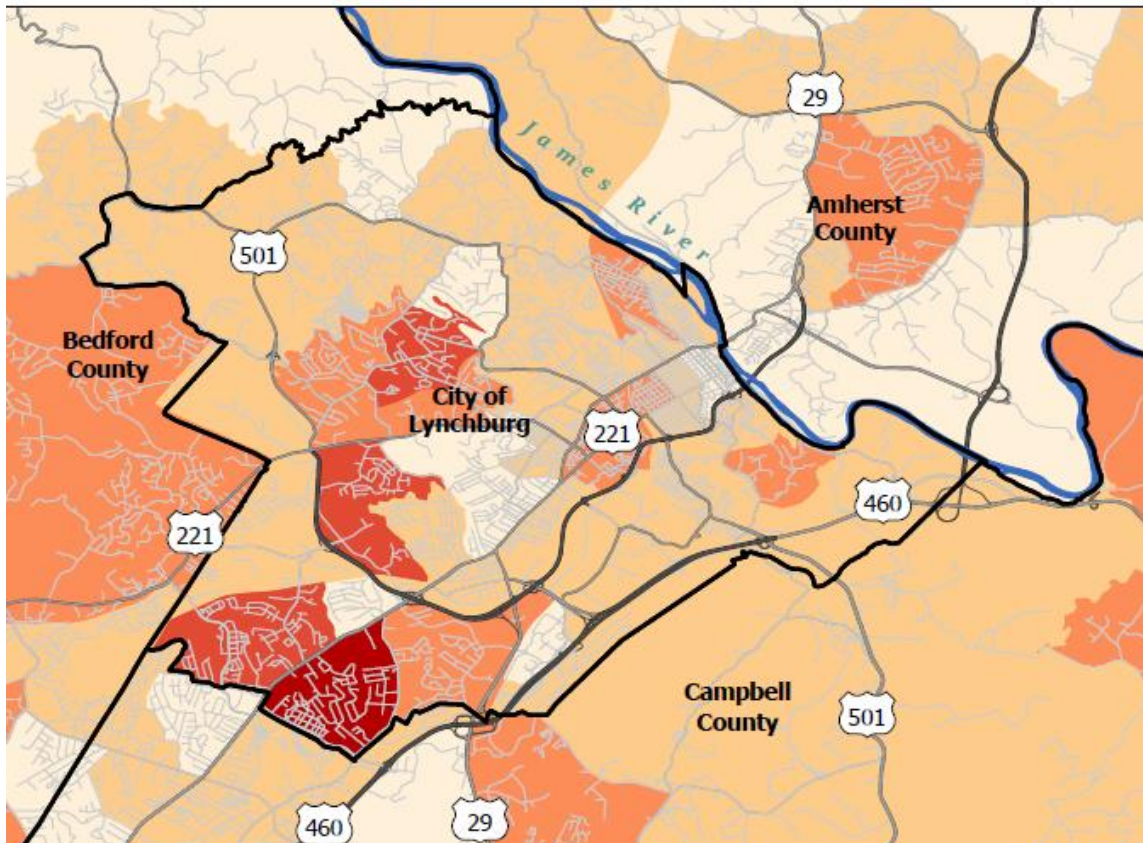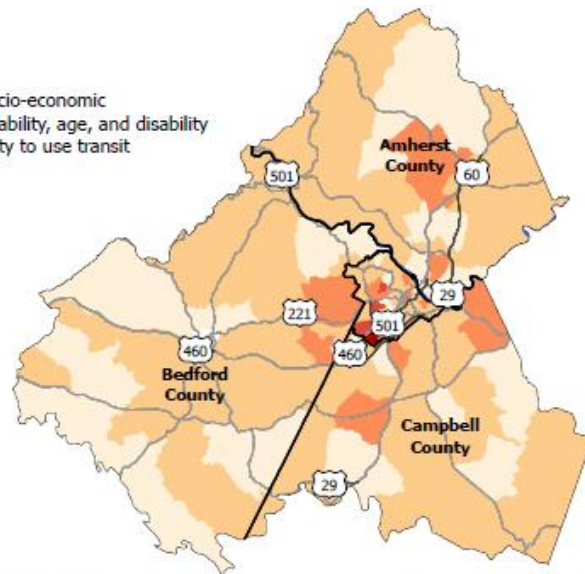
Source: Kimley-Horn, 2021.

SUITABLE BLOCK GROUPS

Bivariate mapping is a process using GIS to map transit potential and propensity using bivariate symbology, and it was used to determine suitable block groups for microtransit service. Block groups with lower levels of transit potential (low or moderate-low) and higher levels of transit propensity (moderate, moderate-high, or high) were deemed to be suitable potential and propensity for microtransit. An interim map of these block groups, prior to considering existing fixed-route service, is included as **Figure 9** in the **Appendix.**

Block groups that are suitable for microtransit have been identified within the City of Lynchburg, central Amherst County, northeast Bedford County, and northwest Campbell County. Approximately 55 percent of the identified block groups are within the City of Lynchburg and 60 percent are currently served by GLTC.

To align with GLTC's goal to provide microtransit service as an alternative to underperforming fixed-route service, the GLTC bus network was overlaid to identify which block groups were served by existing fixed-route bus service. To prevent overlapping microtransit service zones with high-performing fixed routes, block groups served by bus routes with higher-than-average productivity were eliminated from further consideration.

Productivity for bus routes was calculated using the average number of riders per revenue hour using January to July 2021 service data from GLTC. The systemwide average productivity was 5.56 riders per revenue hour during this time period. This calculation also identified several bus routes that could be investigated further for potential replacement with microtransit service. The routes performing below the system average productivity are shown in Table **5**. Given that ridership was lower in 2021 due to the ongoing COVID-19 pandemic, route performance was compared with pre-pandemic levels for the same January to July period in 2019. The routes listed in the table also performed below system average in 2019 with the exception or Routes 1B and 7 which had better relative performance in 2019, slightly above the system average at that time.

Figure 5 shows maps of microtransit suitable block groups either served by underperforming or no fixed-route service along with the relative productivity of the bus network overlaid.

TABLE 5: EXISTING ROUTES WITH PRODUCTIVITY BELOW SYSTEM AVERAGE

BUS ROUTE	AVERAGE PRODUCTIVITY (RIDERS PER REVENUE HOUR)
6/7X	0.61
6	0.94
12X	2.43
7	3.34
9	3.59
11	3.70
5	4.54
1B	5.50

Source: GLTC and Kimley-Horn, 2021.

FIGURE 5: MICROTRANSIT SUITABLE BLOCK GROUPS AND FIXED-ROUTE PRODUCTIVITY

Source: Kimley-Horn, 2021.

TRAVEL PATTERNS

The remaining block groups were then analyzed using StreetLight Data to identify travel patterns of trips originating in the microtransit suitable block groups. StreetLight Data is a big data platform that provides mobility data, such as origin-destination travel patterns, collected from anonymized location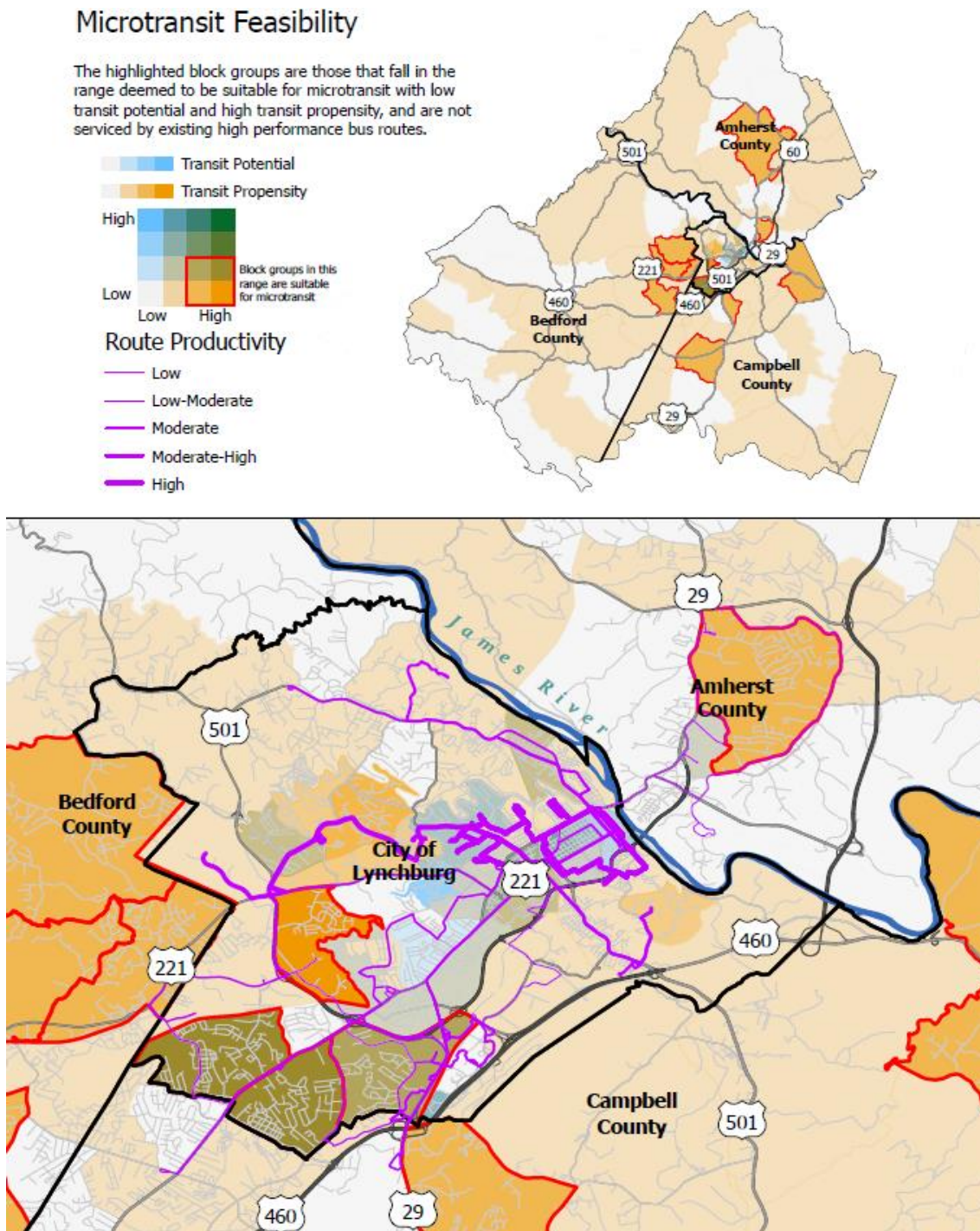-based services data (anonymized location records from smart phones and navigation devices in connected cars and trucks). This analysis helped define candidate microtransit service zones. An ideal microtransit zone would include common origin and destination locations for travel *within* the zone or provide connection opportunities to fixed-route service to reach common destination locations *outside* the zone. The data time period used in the StreetLight Data analysis was from March 1 through May 31, 2019.

Maps of this high-level, origin-destination analysis are included as **Figure 10** and **Figure 11** in the **Appendix** and show the magnitude of trips between the suitable block groups and each other block group in the study area for both weekdays and weekends, respectively.

> **One key takeaway from this analysis was that many of the suitable block groups, particularly those in the City of Lynchburg, showed that the majority of trips occurred within the block group or to an adjacent block group. These travel patterns are conducive to a microtransit zone that could serve both ends of trips within the zone.**

Block group transit mode share data from the ACS 2019 5-year survey was applied to the total daily trips from StreetLight Data to estimate potential transit trips originating from suitable block groups. See **Figure 12** and **Figure 13** in the **Appendix** for maps showing the total estimated transit trips originating in suitable block groups on both weekdays and weekends, respectively.

These results allowed for rankings of origin-destination pairs by total trips and estimated transit trips made on weekdays and weekends. Highlighting which of these top origin-destination pairs were adjacent or within the same block group allowed for logical microtransit service zones to be drawn. See **Figure 14** and **Figure 15** in the **Appendix** showing the top 10 origin-destination pairs on weekdays and weekends and for total trips and estimated transit trips, respectively. These maps show that the highest number of trips from microtransit suitable block groups occurred primarily in the southern portion of the City.

This high-level analysis was used to understand travel patterns for potential transit trips from suitable block groups and to form candidate service zones. However, microtransit demand is highly dependent on service characteristics—not just the zone geography.

CANDIDATE SERVICE ZONES

Three candidate microtransit zones were drawn around areas that were deemed suitable for microtransit using the results from the travel patterns analysis in conjunction with the previous transit potential and propensity analysis. The zones were drawn by joining together suitable block groups with large numbers of trips between them with considerations for major generators, connections to fixed-route bus services, and the road network. The zones overlap with at least one underperforming fixed-route bus service that could be considered for replacement with microtransit. The candidate

service zones have been drawn to maintain coverage of these routes should GLTC decide to replace the fixed-route service.

The three candidate microtransit service zones are:

1. **South Lynchburg: potential replacement of weekday Route 7; partial replacement of weekend Route 6/7X**

2. **West Lynchburg: potential replacement of weekday Route 6; partial replacement of weekend Route 6/7X**

3. **Madison Heights: potential replacement of weekday Route 5**

Figure 6 shows these zones and identifies the transfer opportunities to other fixed-route service as well as locations of expected trip generators within each zone.

FIGURE 6: CANDIDATE MICROTRANSIT SERVICE ZONES

Source: Kimley-Horn, 2021.

SUMMARY OF SERVICE ZONE EVALUATION

Three candidate microtransit service zones were identified that have a range of characteristics and provide an opportunity to meet GLTC's goal of replacing underperforming fixed-route service and improving transit service for hard-to-reach areas. The zones vary in size from under 3 square miles to just more than 12 square miles. The activity density in the zones also varies with the lowest being Madison Heights and the highest being south Lynchburg. Table **6** contains a comparison of the three candidate zones.

TABLE 6: CANDIDATE SERVICE ZONES COMPARISON

MICROTRANSIT ZONE:	SOUTH LYNCHBURG	WEST LYNCHBURG	MADISON HEIGHTS
Size (square mile)	7.2	2.7	12.2
Total Population [2]	14,633	5,174	6,624
Total Jobs [3]	7,836	2,538	2,773
Transit Mode Share [2]	1.288%	0.460%	0.003%
Average Transit Potential	4.9 people and jobs/acre (Low)	4.5 people and jobs/acre (Low)	1.2 people and jobs/acres (Low)
Average Transit Propensity	59.5 (Moderate)	54.9 (Moderate)	28.8 (Low-Moderate)
Potential Fixed-Route Replacement	7, 6/7X (partial)	6, 6/7X (partial)	5
Fixed-Route Productivity (Route)	3.39 (7), 0.61 (6/7X)	0.94 (6), 0.61 (6/7X)	4.54 (5)
Transfer Opportunities	Routes 4 and 12	Routes 4, 8, and 12	Routes 1A, 3A, 3B, 9
Top Trip Generators	Wards Road retail, STARTEK, J. Crew, CVCC, Cornerstone Development, Wyndhurst Development, Kroger, Heritage High School	Fresh Market, New Towne neighborhood, Waldon Pond Apartments, Old Mill Townhomes, Centra Rehabilitation, CVCC	Downtown Lynchburg, Walmart, Lowes, Food Lion
Land Use	Predominantly residential; commercial zones are concentrated on US 29 Business (Wards Road) and US 460 Business (Timberlake Road); most of the residential housing is single-family homes with some higher density zones around Timberlake Road	Mixture of residential, commercial and industry zoning; commercial zones are concentrated along US 221 (Lakeside Drive) and VA 126 (Graves Mill Road); the residential zones are further from the main roads bounding the zone and are a mixture of low to high density	Predominantly residential with commercial zones concentrated along US 29 Business (S. Amherst Hwy); limited multifamily residences exist in the south of the zone

Source: Kimley-Horn, 2021

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[2] American Community Survey 2019 5-year survey
[3] Longitudinal Employer-Household Dynamics 2018 dataset

The south Lynchburg zone encompasses the existing Route 7 from Central Virginia Community College (CVCC) and Wards Road to the J.Crew Customer Service and Distribution Center (J.Crew) and STARTEK just outside the City boundary with Campbell County. The existing circuitous fixed route could be replaced with a more rounded microtransit zone that may provide more direct access for riders to trip generators in the area or to transfer opportunities to Route 4 at CVCC or near Wards Road and Route 12 at J.Crew. The zone extends out into Campbell County along Timberlake Road with an approximate three-quarter mile buffer to maintain service to STARTEK. Route 7 has a productivity of 3.39 riders per revenue hour making it the second least productive route in the system.

The west Lynchburg zone could replace the existing Route 6. The zone extends from Fresh Market on Lakeside Drive to CVCC. It overlaps with the south Lynchburg zone along Wards Ferry Road to maintain direct service from CVCC to areas served by Route 6 but outside the south Lynchburg zone. The zone is bounded by Burton and Blackwater Creeks on the eastern side and Lynchburg Expressway (US 501) with transfer opportunities at Fresh Market to Routes 8 and 12 and at CVCC to Route 4. Route 6 is the least productive route in the network with a productivity of 0.94 riders per revenue hour.

The Madison Heights zone could replace the existing Route 5. The zone covers all existing bus stops in Amherst County and has a three-quarter mile buffer around the route. This buffer could be reduced to shrink the size of the zone if necessary while still providing similar coverage to Route 5. A transfer opportunity is provided to Routes 1A, 3A, 3B, and 9 at the 7th/Main Street bus stop in downtown Lynchburg, which the zone would cover. Route 5 has a productivity of 4.54 riders per revenue hour placing it in the lowest five performing routes.

The next section contains an evaluation of potential service models. It identifies alternative service models and the degree that they would fit with GLTC's current services and operations, and suitability to the candidate service zones.

SERVICE MODEL EVALUATION

Microtransit service can be operated by multiple service models. This section summarizes each service model applicability to GLTC and the opportunities, challenges, and suitability to the candidate service zones. The following section includes:

- Methodology and analysis used to identify and define service models
- Service model evaluation
- Summary and comparison of three service models

METHODOLOGY AND ANALYSIS

This section documents the methodology used to identify and evaluate potential service models that could fit within GLTC's current service and operations. **Figure 7** below highlights the methodology process.

FIGURE 7. SERVICE MODEL EVALUATION METHODOLOGY

To develop an understanding of potential service models, a literature review was completed of existing research about microtransit. The following sections summarize the literature review followed by key takeaways to inform how microtransit could best serve GLTC. A literature review included the following documents:

- Demand Response Transit/Microtransit: A Guide for Implementing Flexible Transportation Services | 2019
- Fairfax County Department of Transportation Alternative Transit Service Feasibility Study | July 2020
- Forsyth County (GA) Public Transportation Master Plan Microtransit White Paper | December 2020
- GoDurham (NC) Microtransit Planning Study | June 2020
- Integrated Mobility Innovation Demonstration Research Program – Virginia Rural Microtransit Deployment Initiative | August 2019
- Microtransit Study, Town of Fuquay-Varina and Wake County, NC | December 2019
- Montgomery County Department of Transportation: Ride on Flex, Microtransit Performance Assessment | August 2020
- Eno Center for Transportation, UpRouted: Exploring Microtransit in the United States | January 2018
- Utah Transit Authority Microtransit Planning Project | September 2020

DEFINING SERVICE MODELS

There are a variety of approaches to delivering microtransit service that include software as a service (SaaS), transportation as a service (TaaS), and transportation network company (TNC). The following section defines each service model for the purposes of this analysis as well as introduce examples.

SOFTWARE AS A SERVICE

SaaS allows GLTC to operate the service with its vehicles and operators but requires acquiring the technology platform. The purpose of the technology platform is to provide an on-demand scheduling and dispatching platform that consists of a customer app, a vehicle operator app, and an administrative/dispatching platform. The customer app should have the capabilities to request, reserve, and pay for a ride as well as provide trip notifications. The operator app should allow for on-board vehicle location data, digital manifest, turn-by-turn navigation, and real-time communications. The administrative/dispatching platform should manage trips requests, batching and optimizing trip requests, scheduling call-in trips, managing communications to operators and riders, as well as monitor performance and reporting. The role of the technology provider is to offer an easy-to-use interface for riders and drivers as well as training for the GLTC technology users prior to launch. The technology provider also can collect and aggregate data from the trips and potentially integrate with a third-party payment system.

An example of a SaaS service model is in the City of Gainesville and Hall County, GA, northeast of the metro Atlanta region, where Hall Area Transit operates. Hall Area Transit implemented a rideshare transportation service to replace its dial-a-ride service. The new service, branded as WeGo, combines countywide point-to-point services with technology to create a rideshare service that seeks to be more efficient than dial-a-ride service. Hall Area Transit owns the vehicles and employs the drivers for WeGo. The customer app is a mobile application that is used to request trips and rate drivers. Via was selected as the vendor for the technology. The driver app is loaded onto Samsung tablets that were obtained by Hall Area Transit for the service. The driver app relays trip information to the drivers. The administrative tools allow Hall Area Transit staff to monitor the service in real time and provide support to drivers and riders as needed. The data and analytics suite are Federal Transit Administration (FTA) compliant and collects data for National Transit Database (NTD) reporting.

TRANSPORTATION AS A SERVICE

Similar to a SaaS model, under a TaaS service model, GLTC could contract the software and hardware for the service, but also the operation, maintenance, and ownership of the vehicles. The provider would be responsible for offering an easy-to-use mobile application for riders and drivers, provide training for the drivers on the new system prior to launch, collect and aggregate data from the trips, potentially integrate with a third-party payment system, and provide fleet ownership and maintenance, driver and vehicle operations management, and a customer support system.

The Via Rideshare in Arlington, TX, is an example of a TaaS model. In 2017, the Arlington City Council approved a contract with Via to develop and operate an on-demand rideshare program that provides service to select areas of the city during a one-year pilot project. The project was supported by the citizen-led Transportation Advisory Committee that also coincided with the Arlington City Council's Put Technology to Work and Enhance Regional Mobility priorities. Since January 19, 2021, the Via service area covers the entire City of Arlington where there was previously no fixed-route transit. The cost to riders was a flat fee of $3.00 for each trip until February 15, 2021. Fares have since changed to

be a distance-based structure. Via currently operates a fleet of six-passenger vans as well a limited number of wheelchair-accessible vehicles during the pilot program. While the Via vans are intended to pick up riders within a block or two of their location, the wheelchair-accessible vehicles will pick up riders at their doorstep as needed.

TRANSPORTATION NETWORK COMPANY

A TNC service would subsidize an already existing service such as Uber and Lyft to focus on specific areas or transfer points. The purpose would be to provide subsidized trips to riders. The service is typically designed to provide curb-to-curb mobility between all points in a predefined geography rather than to promote connections to transit service. Cost of fares for TNC partnership services would depend on the length of the customer trip. The discount or subsidy would be applied to the total TNC trip cost for eligible trips during the booking process.

One example of a TNC partnership is the Direct Connect program in Pinellas County, FL, administered by Pinellas Suncoast Transit Authority (PSTA). This program provides subsidized trips to and from 26 designated points that are transfer points to the PSTA fixed-route system. Three operators provide trips through this program: Uber, Taxi United, and a wheelchair operator. Most trips in the program are taken using Uber where riders use an in-app voucher to receive $5 off a trip that either starts or ends at one of the designated points. Riders who are unable to use the mobile app, need to make a cash payment, or require nonambulatory service, they can call either of the other two providers—Taxi United or the wheelchair operator—to get the Direct Connect service.

OVERVIEW OF SERVICE MODELS

SaaS provides the agency the software needed to run the microtransit service. The agency would be responsible for providing service, maintenance of vehicles, and operations management. Whereas a TaaS service model provides the agency with turnkey service where vehicles and drivers are provided by the microtransit company. TNC would simply subsidize eligible trips on an already existing service. **Table 7** summarizes the core attributes related to SaaS, TaaS, and TNC.

TABLE 7. SUMMARY OF SERVICE MODELS

SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Agency provides and manages vehicles and drivers	Vehicles and drivers are obtained through a contractor	Vehicles and drivers are already in operation through existing services
Agency is responsible for operations and maintenance of fleet	Contractor is responsible for operations and maintenance of fleet	Operations and maintenance are responsibility of TNC and its independent contractor drivers
Software is contracted to a third party	Software is contracted to a third party	Software is already in operation by the TNC*

Notes:
*Additional software may be needed from the transit agency to accommodate and schedule trips for call-in requests
Source: Kimley-Horn, 2021.

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SERVICE MODEL EVALUATION

OVERVIEW

Due to the differences in how each service model operates, key evaluation criteria were used to determine the benefits and drawbacks for each of them. These criteria included:

- Ease of Implementation
- Level of Infrastructure Needs (vehicles, technology devices)
- Upfront Costs
- Ongoing Costs
- Data Collection/Reporting/Performance Monitoring
- Scalability/Ease of Change
- Accessibility (for persons with disabilities/unbanked/no mobile phone)
- Outreach/Rider Experience

Assessing each service model in terms of these criteria allows comparisons to be made between them that can inform a recommendation as to which microtransit service model is most appropriate for GLTC to consider. A rating (high/medium/low) has been given to each service model for each criteria to show whether the characteristics of the service model would be more feasible (higher rating) or less feasible (lower rating) to GLTC given its current operations and organization.

EVALUATION CRITERIA

EASE OF IMPLEMENTATION

The ease of implementing a microtransit service is important as it defines how much time is required to plan the service prior to launch. Depending on the service model, different amounts of preparation is required. All three service models require defining a service area prior to launch, but a SaaS model requires acquiring vehicles, software, and training drivers while partnering with a TNC requires negotiating trip subsidies. These differences in planning tasks lead to varying time periods needed to prepare for launch. **Table 8** summarizes the ease of implementing each of the service models.

TABLE 8. EASE OF SERVICE MODEL IMPLEMENTATION

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Ease of Implementation	Use of existing vehicles streamlines process Most similar to existing operations Requires software procurement	Moderate implementation period that can vary by provider More oversight and less control than existing operations Requires contract negotiation	Level of control of the process for agency is low Largest shift from existing operations Potential for shortest implementation period but requires negotiation with providers and driver availability
Rating	High	Medium	Low

Source: Kimley-Horn, 2021.

Using a SaaS model would require GLTC to purchase or contract software from a technology vendor to manage dispatching. GLTC could decide to integrate its payment system with the purchased software; however, this may not always be feasible, and a separate fare payment process may be necessary. Additionally, GLTC may have to acquire vehicles to operate the service as well as train staff to operate the vehicles and the software. GLTC has 13 Americans with Disabilities Act (ADA) compliant paratransit vans, with a maximum of five being used for paratransit at any one time. These extra vehicles could be used for the microtransit service, which could make implementation easier and less expensive. The task of acquiring vehicles and ensuring the availability of drivers, which are distinct from the tasks required to implement the other service models, extends the time required to launch. Current ongoing supply chain issues in acquiring new vehicles may delay the launch further. Using vehicles already in the transit fleet and drivers that are familiar with driving smaller vehicles such as cutaways and vans can reduce the time taken and increase the ease of implementation. It should be noted that many transit agencies in Virginia are currently experiencing a driver shortage.

A TaaS model requires GLTC to contract with a service contractor who provides the software, vehicles, and drivers. The service provider still needs to acquire the vehicles and train operators, which will extend the time needed to launch the service, though this can be faster for the contractor than for GLTC. They may already have drivers or vehicles available from other areas or have streamlined methods for recruiting and onboarding drivers.

Partnering with a TNC has the potential for the shortest implementation period as the TNC will already have vehicles operating in the area with drivers that are familiar with the software. There does not need to be significant changes made to the TNC's service model to launch the service although implementation will depend on how quickly and easily GLTC is able to negotiate an agreement with the TNC. This presents a risk because the TNC will want to ensure that the partnership would be profitable for them, and that there would be sufficient supply of drivers for the TNC in the area. Lyft and Uber both operate in Lynchburg but the volume of drivers and whether enough of them will operate during the desired services hours is not guaranteed.

When launching a microtransit service, it is recommended to start by implementing a pilot program, regardless of the service model used. Pilot programs typically are at least a year long to enable riders to be educated about the service and give time for ridership to grow. Using a pilot program also would allow GLTC to budget for a shorter period of time to determine if microtransit is feasible before developing a long-term budget for the service.

LEVEL OF INFRASTRUCTURE NEEDS (VEHICLES, TECHNOLOGY DEVICES)

The potential service models all have varying infrastructure needs in terms of what would need to be acquired and maintained by GLTC. While all service models require the vehicles and technology to run the service, GLTC does not have to provide this infrastructure in all the service models. **Table 9** summarizes the level of infrastructure needs for each service model.

TABLE 9. LEVEL OF INFRASTRUCTURE NEEDS FOR EACH MICROTRANSIT MODEL

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Infrastructure Needs	GLTC provides all infrastructure although buses are already available Hardware could be provided by software provider	Private partner provides all infrastructure required to operate service	TNC provides all infrastructure TNC driver provides vehicle and device
Rating	**Medium**	**High (low needs)**	**High (low needs)**

Source: Kimley-Horn, 2021.

In a SaaS model, GLTC would typically need to provide all the infrastructure required to operate the service. Satisfying the vehicle need is made easier for GLTC if the additional paratransit vans are used. The technology hardware used on the vehicles also can be provided by the software provider for an additional fee.

Using a TaaS model means the infrastructure needed would be provided by the service contractor, though since the vehicles and technology would be used only for the microtransit service there would be higher costs to GLTC from the contractor to acquire the infrastructure required.

Partnering with a TNC means GLTC provides none of the infrastructure for the service since the TNC should have vehicles already operating in the area. Also, since a TNC model does not require a dedicated fleet, GLTC would not incur additional costs for new infrastructure for the TNC. TNC drivers provide their own vehicles and phones to run the driver app for service. The TNCs, like Lyft and Uber, can provide a technology platform that would allow GLTC to book trips on behalf or riders without a mobile phone capable of booking a trip, but GLTC would need to provide a call center service to take advantage of this.

GLTC could allow the microtransit service to make use of existing curbside infrastructure such as bus stops and pull outs to create a safer environment for getting into the vehicles. This does not necessitate more curbside infrastructure, but it could be added later if the service proves to be popular. SaaS and TaaS service models use branded vehicles so using GLTC's curbside infrastructure in the service does not present an issue. However, allowing a TNC to use pull outs and bus stops may be difficult to control as drivers may start to use this curbside infrastructure while performing trips that are not part of the microtransit service. Additionally, the TNC does not use a dedicated fleet for the service with branded vehicles meaning private vehicles also may start stopping in bus stops and pull outs after seeing TNC vehicles doing so.

UPFRONT COSTS

The upfront costs for implementing a microtransit service are closely related to the infrastructure needs of the service. The largest upfront capital costs come from acquiring vehicles and software, but other costs include marketing materials to advertise the new service and training for operators. In all three service models, a robust marketing campaign is recommended to spread awareness of the new service. **Table 10** summarizes the upfront costs for each service model.

TABLE 10. MICROTRANSIT SERVICE MODEL UPFRONT COSTS

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Upfront Costs	Costs for training, software, and potentially hiring operators Marketing costs solely covered by GLTC Branding controlled by GLTC, thereby increasing upfront cost	Costs for software and contracting Marketing costs shared by GLTC and contractor Branding controlled and funded by contractor	Contracting costs Marketing costs covered by GLTC since TNC has its own marketing campaign No unique branding. Uses TNC's brand. No additional costs for branding
Rating	**Medium**	**Medium**	**High (low costs)**

Source: Kimley-Horn, 2021.

In a SaaS model, the upfront costs include the vehicles and software acquisition (dispatching software and app) and operator training. These upfront costs can be reduced by using vehicles that are already part of the transit fleet and using operators that are familiar with them. Cost of software can vary depending on the sophistication of the dispatching software, level of standardization from other agency implementations, and whether the software and app is purchased directly from a vendor or if GLTC contracts with a private partner to run and maintain the software. The upfront capital costs for GLTC would be reduced by the use of available paratransit vehicles.

When contracting out to a TaaS, upfront costs may be higher compared to SaaS if GLTC does not have to purchase vehicles. Upfront costs would have to cover trainings, installation, and part of vehicle acquisition and facility purchase. The exact cost and what it covers will vary from contractor to contractor with some amortizing their fixed costs into monthly payments while others pass it on entirely as an upfront cost. Some upfront costs, not paid for directly by GLTC, will likely be necessary to enable the service contractor to acquire vehicles and train operators.

Partnering with a TNC will have the lowest upfront cost as neither the TNC nor GLTC will have to make investments in physical infrastructure or software to begin the service. In Monrovia, CA, $50,000 was spent on marketing and some infrastructure improvement in preparation for the launch of their partnership, GoMonrovia, with Lyft in 2018.

ONGOING COSTS

The ongoing costs for a microtransit service depends on the service model and relate to the cost of performing the rides, the maintenance of vehicles, and continuing marketing for the service. In some situations, an annual licensing fee may have to be paid for the software by GLTC. **Table 11** summarizes the ongoing costs for each service model.

TABLE 11. ONGOING COSTS FOR EACH MICROTRANSIT MODEL

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Ongoing Costs	Vehicle maintenance and operating costs, and software license fees Trip fare decided by GLTC	Charges per hour or per ride; overall service operation Trip fare agreed with service contractor	Charges per ride, costs flexible depending on ridership Trip fare controlled by TNC and subsidized by GLTC
Rating	**Medium**	**Medium**	**High (low costs)**

Source: Kimley-Horn, 2021.

SaaS models require the transit agency to pay a monthly or annual fee to the technology provider to continue using the software service. In addition, the transit agency incurs operating expenses for performing each trip (fuel and wages) and vehicle maintenance. SaaS models used in other jurisdictions where microtransit has replaced underperforming fixed routes has found that using SaaS can be cost neutral.

In a TaaS model, the service contractor may charge GLTC by hours in operation or by trip performed. There are benefits to the two cost structures though contracting to pay per trip or per mile can reduce costs as service and ridership ramp up.

TNCs will charge GLTC per each ride they complete at the agreed-upon subsidy. GLTC controls how much to subside each ride, leaving the remaining cost to be covered by the rider. This can provide the lowest per ride costs for GLTC but potentially an unaffordable service to the customer. The subsidy provided to the TNC will ultimately change how large the total cost for the service is, but the subsidy provided can be changed throughout the partnership to adjust the service. In Monrovia, CA, the service GoMonrovia had two price shifts in its first year of operation to account for the popularity of the service. In 2019, the program costed approximately $2.7 million annually to provide more than 70,000 trips per month. For GLTC, a low volume of drivers for TNCs operating in the city may result in higher costs for the rider or GLTC as prices per ride increase due to the lack of drivers. If GLTC provides a fixed subsidy per ride then riders may be burdened with higher costs, while if GLTC covers all costs above a certain dollar amount GLTC will incur the extra costs.

The budget to fund a microtransit pilot can be simpler than a typical transit budget due to its short time horizon. However, mid- and long-term plans for financing the project should be developed upfront to enable the service to properly grow as demand for it increases and in case the microtransit service becomes a permanent part of GLTC.

The revenue generated by the microtransit service can help offset some of the ongoing costs of the service. However, when implementing the new service, GLTC should consider offering it as zero fare to lower the barrier to using the service and help develop a strong initial rider base. While this may increase the costs of the service, other pilot programs have found it to be a major factor in their success.

DATA COLLECTION/REPORTING/PERFORMANCE MONITORING

Data collection helps improve service and understand whether the service is successful. Certain data also needs to be reported as a requirement to NTD. The level of data collected from each service model varies greatly between each model. Performance monitoring for each service model takes on different forms and it is the responsibility of different agencies depending on the service model. **Table 12** summarizes the data collection and reporting methods for each service model.

TABLE 12. DATA COLLECTION/REPORTING METHODS FOR EACH MICROTRANSIT MODEL

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Data Collection/ Reporting	Most data collected by software Additional data can be collected by GLTC operators	Data to be reported is negotiated with service contractor	Limited data reporting
Rating	**High**	**Medium**	**Low**

Source: Kimley-Horn, 2021.

A SaaS model would provide GLTC the ability to collect whichever data it wants, in line with the data currently collected on fixed-route service. This makes data reporting easiest. Depending on whether the app used is developed specifically for GLTC or a standard format from a software provider, it can change the ease at which data is reported. An app tailored to GLTC will include the data reporting format GLTC asks for, while a standard format used by a software provider will likely report data in a useful format and provide standard metrics since the service is intended to be used by transit agencies who all want similar if not the same data reporting requirements. GLTC would be solely responsible for monitoring performance as the operator of the service.

The level of data reporting from a TaaS service depends on what the service contractor is able to report as well as what data reporting is required in the contract between the provider and GLTC. The contractor takes on much of the burden for the data collection and reporting as the sole operator of the service. This reduces that data collection burden for GLTC. The partner also shares some of the responsibility for monitoring service performance as the operator and will support GLTC in the creation of performance metrics.

TNCs typically have more restrictions on the data they will share due to the more competitive nature of their primary service and the structure of the service model. The data reporting from TNCs can be negotiated as with providers in TaaS.

To ensure data is reported to the level required and that valuable performance metrics are measured, GLTC should determine the data reporting, operational, and technology priorities for the system and include them as requirements in the procurement process, including potential partners in designing requirements during the procurement process. Data sharing requirements need to be negotiated with the contractor involved with the service regardless of the service model used. To evaluate the success of a microtransit pilot, data on customer trips and service performance is critical.

SCALABILITY/EASE OF CHANGE

Being able to easily change the scale and the service is important to the success of the microtransit service. Being able to respond to data and customer feedback allows changes to be made to optimize the service as well as to allow the system to adapt quickly to improve service quality. When establishing a microtransit service, it is important to keep in mind that changes may need to be implemented quickly and that the service should be structured in such a way to make those changes as easy as possible. **Table 13** summarizes the scalability and ease of change for each service model.

TABLE 13. SCALABILITY/EASE OF CHANGE FOR EACH MICROTRANSIT MODEL

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Scalability/Ease of Change	Ease of changing service depends on GLTC to add drivers and change service area	Ease of changing service depends on service contractor's ability to add vehicles and GLTC to change service area	Changing service most easily done with TNC model if there are enough operators in the area, but this is outside the control of GLTC
Rating	**Medium**	**Medium**	**Medium**

Source: Kimley-Horn, 2021.

A SaaS model can be slower to respond to real-time or short-term changes due to its integration with the larger system. Labor agreements about working hours also have slowed changes in scale at other transit agencies. Scaling to increase service also can take time if there is no additional staff or vehicles available. The ease and speed of changing service depends on GLTC's vehicle availability, service change processes, and labor agreements. As GLTC has additional paratransit vehicles available, this would allow for a SaaS model to ramp up more quickly without having to acquire new vehicles.

In a TaaS model, changes can be slowed down by contract renegotiations to change the service zones as well as the same process that may slow changes in a SaaS model. A contract where GLTC pays per revenue hour should be negotiated such that there is no ceiling to revenue hours to make scaling easier. Increasing vehicles and staff for a TaaS provider can be faster than for GLTC.

Scaling service in a TNC model is in theory the easiest as no new vehicles or staff need to be hired while additional service can be added easily from the TNC's existing operators. It is easy to change the service area, the subsidy amount, or span of service. However, there is no guarantee that the TNC has enough operators in Lynchburg to accommodate for rising ridership and increasing the scale of the service. If there is a lack of drivers for the TNC, then the service is unable to expand and GLTC would not be able to resolve that.

Changing service hours and days would follow similar processes in the SaaS and TaaS model as scaling the service. In a SaaS model, GLTC would have to follow its service change procedures and have enough vehicles and operators to expand the service hours. A TaaS model would require a negotiation with the service contractor to expand service hours, or an option for changes to service hours and days could be included in the initial contract. For a TNC model it would once again rely on whether there were enough operators in the area to supply the expanded service hours and days.

ACCESSIBILITY (FOR PERSONS WITH DISABILITY/UNBANKED/NO MOBILE PHONES)

When launching a microtransit service it is necessary to ensure that it is accessible for all potential users at all stages of the service. The booking and payment system should have alternatives to allow for riders who are unbanked or do not have access to a smartphone or mobile phone. Vehicles also should be ADA accessible or have an alternative system made available. **Table 14** summarizes the accessibility for each service model.

TABLE 14. ACCESSIBILITY FOR EACH MICROTRANSIT MODEL

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Accessibility	GLTC able to implement strategies to make service accessible	GLTC can contract with providers that offer accessible service	TNC is unable to guarantee equivalent levels of service for persons with disabilities
Rating	**High**	**Medium**	**Low**

Source: Kimley-Horn, 2021.

Microtransit services often employ the use of mobile fare payments. Payments can be made in the same app as booking. This method is most familiar to people who ride with TNCs such as Uber and Lyft. This fare payment and booking system is only available to people able to use a smartphone, thus requiring alternative booking and payment methods to be made available.

In a SaaS model, GLTC has control over the vehicles used, and the design of the booking and payment systems. This allows GLTC to structure the service to be more accessible by including options such as a call center to book trips, accepting cash fares, or using ADA-compliant vehicles.

Using a TaaS model, GLTC can set requirements for accessibility for the service contractor to meet as part of the service contract. Drivers for the service contractor are likely to have less training and experience working with riders with disabilities. GLTC could incorporate a training requirement for operators as part of the contract, though this would likely increase service cost.

Partnering with a TNC limits the options for accessibility of the service. TNC's typically have a wheelchair-accessible vehicle booking option, but GLTC cannot control the number of these vehicles in service at any given time. Trip requests would be primarily handled through an existing TNC app, which limits how people are able to book and pay for rides. Agencies that have partnered with TNCs to provide microtransit service have additionally contracted with alternative service providers to provide an accessible service.

OUTREACH/RIDER EXPERIENCE

Outreach and the rider experience are important to attract and retain riders for the service. The level of outreach to inform customers of the new service should be the same for all service models, though riders may be more familiar with some service models than others. In all three service models, GLTC would have some responsibility for marketing the service. In some cases, partners also may advertise and be in charge of outreach. The rider experience varies with service model. **Table 15** summarizes the outreach and rider experience for each service model.

TABLE 15. OUTREACH/RIDER EXPERIENCE FOR EACH MICROTRANSIT MODEL

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Outreach/Rider Experience	Rider experience controlled by GLTC	Rider experience controlled by service contractor with input from GLTC	Little input from GLTC on rider experience
Rating	**High**	**High**	**Medium**

Source: Kimley-Horn, 2021.

In a SaaS model, GLTC would have the most control over the rider experience as they would be responsible for providing the vehicles, enabling them to control the branding and trip experience for riders, and can respond to rider feedback easily. GLTC could have control over the app used to book rides depending on the agreement with the software provider. The software provider also can provide a standard format for the app, which may be more familiar and easier to use for riders. These choices can alter GLTC's control over the rider experience.

A TaaS model would see the service contractor responsible for the rider experience as they would be providing vehicles and staff. Branding decisions and app design would be made in partnership with GLTC. Changes to the rider experience as a result of customer feedback may take longer to implement as it requires the provider to make the changes, though the partner will likely already have a support center through their app and may be more familiar with ways to troubleshoot technology issues, which also can improve the rider experience.

Partnering with a TNC means GLTC has little input on the rider experience. The rider experience is controlled by the TNC and its drivers; however, riders may already be familiar with rides performed by the TNC.

A major takeaway from the experience of previous microtransit pilots has been around effective outreach, marketing, and communication with riders about the service to ensure they understand changes that may affect them. An effective marketing campaign not only will ensure existing riders understand the new service but can also attract new riders. The marketing campaign for the GoMonrovia service in California increased ridership for separate transit modes in the city as well as attracted ridership to the microtransit service.

SUMMARY OF SERVICE MODEL EVALUATION

Table 16 below summarizes the evaluation criteria for each of the service models as it relates to GLTC. Based on the key assumption that vehicles are currently available for operating the service, this service model evaluation indicates that a SaaS model would be most effective for GLTC. If there is a desire to have a more hands-off approach or limited staff available to operate and administer the service, the TaaS model would be an effective one to pursue. A TNC model is not recommended due to uncertain levels of service available to GLTC from existing TNC services and the least amount of control provided to GLTC. It is recommended that even with multiple zones, GLTC should use one service model throughout the system for consistency and ease of implementation.

TABLE 16. COMPARISON RATINGS SUMMARY OF EACH SERVICE MODEL

CRITERIA	SOFTWARE AS A SERVICE	TRANSPORTATION AS A SERVICE	TRANSPORTATION NETWORK COMPANY
Ease of Implementation	High	Medium	Low
Level of Infrastructure Needs	Medium	High (low needs)	High (low needs)
Upfront Costs	Medium	Medium	High (low costs)
Ongoing Costs	Medium	Medium	High (low costs)
Data Collection/Reporting	High	Medium	Low
Scalability/Ease of Change	Medium	Medium	Medium
Accessibility	High	Medium	Low
Outreach/Rider Experience	High	High	Medium
Overall	**Medium-High**	**Medium**	**Medium**

Source: Kimley-Horn, 2021.

RECOMMENDATIONS AND REQUIREMENTS

This section presents recommendations and requirements for GLTC to consider when planning and implementing a future microtransit service.

RECOMMENDATIONS

Multiple service zones and service model options are available to GLTC for microtransit service, as detailed in the previous sections.

> **Based on the analysis completed, it is recommended that GLTC pursue a microtransit pilot for the service zone and model combination that offers the greatest feasibility:**
> **A SaaS model in the south Lynchburg zone.**

GEOGRAPHIC ZONE

While this study identified the south Lynchburg zone and SaaS model as the best options for GLTC, the other candidate zones and service models remain options for GLTC to consider in the future if desired by GLTC leadership and the GLTC Board of Directors. The other two identified zones could be used as later phases should the microtransit service be successful and expand.

Table 17 highlights the level of service comparison between the existing fixed route(s) that would be affected and the proposed microtransit.

TABLE 17. COMPARISON OF EXISTING AND PROPOSED MICROTRANSIT SERVICE LEVELS

		EXISTING FIXED ROUTE			PROPOSED MICROTRANSIT		
		Span	Headway	Vehicles	Span	Headway	Vehicles
Route 7	Weekday	5:15 AM – 7:15 PM	60 minutes	1	5:15 AM – 7:15 PM	On-demand	1 to 2 (+ 1 spare)
Route 6/7X*	Saturday	6:45 AM – 6:45 PM	90 minutes	1	6:45 AM – 6:45 PM		
Route 6/7X*	Sunday	8:15 AM – 6:45 PM	90 minutes	1	8:15 AM – 6:45 PM		

*Route 6/7X could remain operational on weekends, as discussed in **Potential Changes to Fixed Routes**
Source: Kimley-Horn, 2021.

The south Lynchburg zone (see Figure **8**) is recommended because 1) it had the highest transit propensity of the three candidate zones identified, 2) residents in the zone are more likely to make use of transit, 3) the zone has a low transit potential making it difficult to sustain a productive and efficient fixed-route bus service. The zone has several trip generators in it such as CVCC and several large residential developments. As a predominantly low-density residential area with commercial activities concentrated on two corridors, the zone is a good candidate for microtransit as many trips are being conducted internally—this was confirmed using StreetLight Data. The zone also provides

connections to more productive fixed routes on its edges allowing riders to still transfer to the rest of the GLTC system. Route 7 falls completely within the south Lynchburg zone, which makes it possible for the microtransit pilot to replace this route while still maintaining existing coverage, ending an unproductive route and potentially creating cost savings for GLTC.

The service zone boundaries should be verified and refined as needed before launch in collaboration with the service and/or technology provider, and could also be altered during the pilot to better serve riders as data is gathered on how they use the service. The southern end of the zone extends outside of city limits along Timberlake Road to Waterlick Plaza and STARTEK, which GLTC continues to serve since it relocated to this location in 2015. This area will still be maintained by a transit service should Route 7 be replaced by a microtransit service. The zone could be expanded into Campbell County and rounded out to include residential areas on either side of Timberlake Road if many riders are walking from outside of the zone to make trip requests and if this expanded coverage is desired by GLTC in the future.

FIGURE 8: RECOMMENDED MICROTRANSIT SERVICE ZONE
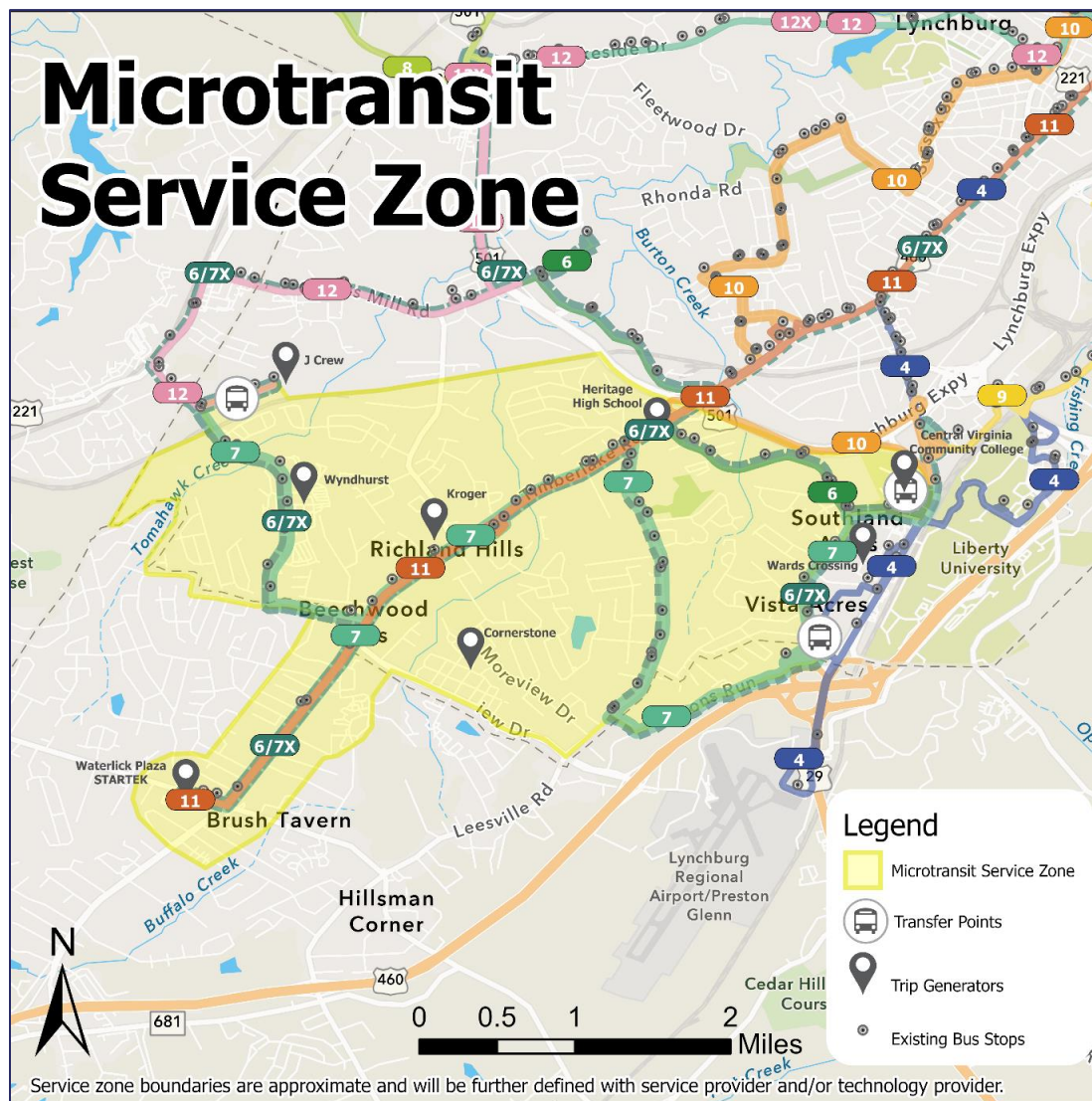
Source: Kimley-Horn, 2021.

SERVICE MODEL

It is recommended that GLTC operate microtransit service with a SaaS model. A SaaS model would have lower upfront costs, particularly since GLTC could repurpose some of its paratransit vehicles for the service, which makes the pilot more feasible. The operating costs per vehicle revenue hour would likely be slightly lower than that of fixed-route bus service given the smaller vehicles. The use of a SaaS model also would offer GLTC more control in service levels and scaling as needed during the pilot and would not require negotiation with a third-party to change service. Fares could be fully integrated with the fixed-route fare system allowing a consistent fare structure and ensuring transfers are kept as simple as they currently are for transferring between fixed routes. GLTC would be able to leverage existing services it currently provides such as customer service activities and the maintenance facility for storing and maintaining the vehicles. In a TaaS model, GLTC would have to pay a contractor to duplicate these services, potentially increasing the pilot cost.

IMPLEMENTATION CONSIDERATIONS

Table 18 summarizes implementation considerations for a microtransit pilot in the south Lynchburg zone. This information also can be used by GLTC to specify requirements for a request for proposals for components of the pilot that need to be contracted. While a SaaS model is recommended, considerations for TaaS also are included when they differ in case GLTC wants to pursue this option in the future. Additional details on each service model are provided following the table.

TABLE 18: MICROTRANSIT REQUIREMENTS

SERVICE MODEL:	SOFTWARE AS A SERVICE MODEL	TRANSPORTATION AS A SERVICE MODEL
Service Zone	South Lynchburg 7.2 square miles	
Transfer Opportunities	Routes 4, 6, 11, and 12	
Potential Changes to Fixed Routes	Potential replacement of weekday Route 7 (weekday). Adjustments to Route 6/7X (Saturday and Sunday).	
Access	Service open to all potential riders with no eligibility requirements aside. Eligibility only pertains to pick-up and drop-off locations within the zone during eligible hours. Service must comply with ADA and Title VI requirements.	
Service Day and Hours	The same as Routes 7 and 6/7X existing service days and hours: Weekdays 5:15 a.m. to 7:15 p.m. Saturday 6:45 a.m. to 6:45 p.m. Sunday 8:15 a.m. to 6:45 p.m.	
Technology	Administrative/dispatching platform, vehicle operator interface, customer interface supplied by technology provider and operated by GLTC.	All technology provided and operated by service contractor
Booking Method	Booking method must provide alternatives to not limit access to those without smartphones. Smartphone app, website, call center.	
Fares and Fare Media	Fare policies are consistent with current GLTC fares. Integration with GLTC fare system and passes, if possible.	
Payment Methods	Payment methods must provide alternatives to not limit access. Make use of GLTC passes, if possible. App-based (bank cards, mobile wallet), cash (exact change only), GLTC passes, prepaid debit card, zero-fare promotion option	

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SERVICE MODEL:	SOFTWARE AS A SERVICE MODEL	TRANSPORTATION AS A SERVICE MODEL
Customer Service	Customer service operated by GLTC. Could be integrated with existing customer service operation.	Customer service operated by service contractor. Contractor must provide GLTC access to all comments, questions, and requests made.
Data Collection and Reporting	Data collected and reported through technology platform by GLTC.	Data collected and reported to GLTC by service contractor.
Fleet and Operators	2 to 3 vehicles. Using existing GLTC paratransit vehicles. Vehicles operated and maintained by GLTC.	2 to 3 vehicles. Vehicles acquired, operated, and maintained by service contractor.
Facilities	Use of existing GLTC facilities.	Service contractor responsible for vehicle storage and maintenance.
Upfront Costs	Technology platform start-up and installation, training, vehicle wraps, vehicle hardware, marketing	Fees charged by service contractor at signing of contract.
Ongoing Costs	Per vehicle cost comparable to current fixed-route operating expenses.	Operating expenses slightly lower due to not having to pay for operators.
Funding Opportunities	DRPT's MERIT Demonstration Project Assistance Grant Program. FTA's Section 5310 Enhance Mobility of Seniors and Individuals with Disabilities. FTA's Integrated Mobility Innovation Grant Potential savings from joint purchases with other agencies implementing microtransit.	
Marketing, Education, and Outreach	GLTC primarily responsible for marketing campaign. Potential to contract with technology provider for marketing support. Meet GLTC Title VI outreach requirements when making service changes.	Contractor runs marketing campaign with cooperation from GLTC. Meet GLTC Title VI outreach requirements when making service changes.
Pilot Period	A minimum of 18 months to allow for rider adoption and pilot evaluation.	

Source: Kimley-Horn, 2021.
Note:
FTA   =   Federal Transit Administration.

SERVICE ZONE

The recommendations and requirements for this pertain to the south Lynchburg zone (see **Figure 8** above). The zone covers the areas around Timberlake Road and Wards Road. The zone is bounded by US 501 (Lynchburg Expressway) to the north, and Enterprise Drive and Old Graves Mill Road south of the Norfolk Southern railroad to the west, Wards Ferry Road to the east, and the city limit to the south. It also includes a spur that extends along Timberlake Road into Campbell County to maintain service to STARTEK should the service replace Route 7. The service zone covers 7.2 square miles that includes approximately 14,600 residents and 7,800 jobs. The zone will be the same whether the service model chosen is SaaS or TaaS. The exact zone boundaries should be verified and refined, as needed, in partnership with the technology provider or service contractor prior to launch.

TRANSFER OPPORTUNITIES

The south Lynchburg zone allows transfers between microtransit and Route 12 at the J. Crew on Dillard Drive, Route 4 on Wards Road, Route 11 at Waterlick Plaza, and Route 6 at CVCC. These transfer points would be available to both SaaS and TaaS service models. They also can be displayed as suggested origins and destinations on the customer booking interface for ease of use.

Scheduled time points for the microtransit service are not recommended at these transfer locations; however, coordinating between fixed-route and microtransit schedules could be explored in the future if riders are regularly transferring between the two services. It also is possible that riders may make transfers to fixed-route service at other locations. Routes 6 and 11 pass through the service zone and microtransit users could transfer to those routes at bus stops within the zone.

POTENTIAL CHANGES TO FIXED ROUTES

The south Lynchburg zone overlaps with three existing fixed-route services: Routes 7, 6/7X, and 11.

Route 7 could be replaced with the microtransit service since the entire route is inside the service zone. Matching the service hours of the microtransit service to those of Route 7 would ensure that there are no service reductions, and since the transfer points for Route 7 to other routes are included in the zone, there would be no decrease in connectivity for riders. The replacement of Route 7 could result in cost savings that could provide funding for the microtransit service in the future. Other transit agencies have found replacing low-performing fixed routes with microtransit is often cost neutral. Some agencies also have run the two services concurrently to avoid having to remove a route before proving the effectiveness of microtransit. Alameda-Contra Costa Transit (AC Transit) in California operated a microtransit service parallel to a fixed route for 6 months before ending the fixed-route service due to the success of the microtransit pilot. However, running the two services concurrently eliminates savings that may be achieved from ending the fixed-route service.

Route 6/7X travels through the service zone on weekends in a one-way loop and extends beyond the service zone from J.Crew to Fresh Market via Forest Road and Graves Mill Road. Three alternatives have been identified for potential changes to this route. All three of these options will still require one bus and operator for Route 6/7X, so no significant cost changes are anticipated. These three options include:

- **Continue operating Route 6/7X on its existing alignment on weekends in parallel to the microtransit service.** This would allow GLTC to monitor and collect data on how riders use each service.

- **Modify Route 6/7X to follow the weekday Route 6 alignment and expand the weekend microtransit zone to maintain coverage.** Expanding the microtransit zone northwest to the intersection of Forest Road and Graves Mill Road on weekends is required to prevent a decrease in existing service, but having different weekday and weekend service zones may not be a user-friendly solution. The realigned Route 6/7X would not overlap with the microtransit zone and would improve weekend headways from 120 minutes to 60 minutes.
- **Modify Route 6/7X to an alternating service pattern between Forest Road/Graves Mill Road and Fresh Market on weekends.** Pattern A would travel out and back from River Ridge Mall to Fresh Market via Wards Ferry Road, Gravel Mill Road, and the Lynchburg Expressway. Pattern B would travel out and back from River Ridge Mall to J.Crew via Wards Ferry Road, Graves Mill Road, Forest Road, and Enterprise Drive. The realigned Route 6/7X would not overlap with the microtransit zone and would improve weekend headways from 120 minutes to 60 minutes for the route segment between River Ridge Mall and Nationwide.

Route 11 transects the middle of the service zone by providing a direct connection to downtown Lynchburg and Kemper Street Station. No changes to this route are required; therefore, allowing it to continue providing a direct route between STARTEK and the transfer station while also providing a connection for microtransit riders.

These potential changes to the fixed-route services in the service zone are independent to the service model used. Any service change decisions will be made by GLTC and the Board of Directors and will require compliance with GLTC's Title VI procedures to ensure there is community outreach and input on the proposed changes.

ACCESS

The microtransit service must be available to all potential riders and have no eligibility requirements for users, complying with FTA civil rights and ADA regulations. An important step to achieve this is the use of wheelchair accessible vehicles. The vehicle GLTC would use in a SaaS service model are ADA accessible. Additionally, provisions must be made to ensure that booking and payment of rides is accessible to all riders. These requirements are elaborated in more depth in the following sections (e.g., Booking Method and Payment Methods). The only eligibility requirement is that rides must pick-up and drop-off at eligible locations (within zone) during eligible service hours.

The requirements for accessibility are the same whether the service uses a SaaS or TaaS model, though the potential strategies to achieve an accessible service can vary between the two.

Microtransit is intended to deliver grouped trips through shared rides and is structured to batch trip requests together to carry multiple riders simultaneously. The service is not intended to be a pick-up and drop-off service for individual trips and so vehicles must be large enough to accommodate several riders at the same time.

SERVICE DAYS AND HOURS

The service days and hours of the microtransit service should be aligned with the service hours of the existing fixed-route service in the service zone, particularly if Route 7 is replaced to ensure there is no reduction in service levels (see **Table 19)**. Aligning service hours with the existing fixed-route service enables transfers to and from the fixed-route network for microtransit riders. Maintaining the same service hours also will make the transition to the new service easier for riders as they will be familiar

with the existing service hours. Service days and hours do not vary between the SaaS and TaaS service models.

TABLE 19: SERVICE DAYS AND HOURS

SERVICE DAYS	SERVICE HOURS
Weekdays	5:15 a.m. – 7:15 p.m.
Saturday	6:45 a.m. – 6:45 p.m.
Sunday	8:15 a.m. – 6:45 p.m.

Source: Kimley-Horn, 2021.

Under the SaaS model, GLTC would have greater control to modify these hours during a pilot to accommodate for demand. If GLTC receives public requests for rides outside the existing service hours, GLTC could extend service hours by using its existing vehicles and operators.

With a TaaS model, the service hours of the pilot would be set prior to the launch of the pilot and written into the contract. Provisions allowing for changes to service hours can be included in the contract; however, any changes would require negotiation with the service contractor, which can delay implementation of changes. The contract also can include a provision for a predefined expansion of service hours partway through the pilot. This can make it easier for GLTC to expand service hours within the predefined limits, but could restrict GLTC to make changes outside of the agreed range.

TECHNOLOGY

The level of technology that GLTC is required to acquire and operate to run the microtransit service varies between the two service models. It is important to note that the technology, software, and hardware for the pilot would be independent from systems already in use by GLTC such as its automated vehicle location (AVL) system and its paratransit scheduling software. This is due to the complexity and challenge of completing integration with the schedule and budget for a pilot. The one exception may be fare collection equipment, which is discussed further in **Fares and Fare Media** and **Payment Methods**.

In the SaaS model, GLTC would acquire the required technology from a technology provider, and GLTC would use it to operate the service. The required technology platform should include the following components and features:

- **Internet browser/cloud-based administrative/dispatching platform**
    - Platform, data storage, applications, and tools that are accessed via an Internet browser instead of a local computer or server
    - Trip booking system that aggregates inputs from multiple booking methods such as app, website, and call-in
    - Route generation algorithm that batches trip requests and optimizes based on waiting time and travel time
    - Data analytics tools and dashboard to monitor performance; ability to create reports and export data (see Data Collection and Reporting)

- Live map for monitoring active trips and vehicle location
- Ability to:
    - Preschedule trips and schedule standing or recurring trips
    - Modify service characteristics such as service zone, service days, service hours, and number of vehicles
    - Customize maximum walking distance from requested pick-up/drop-off locations
    - Exchange data in real-time to vehicle operator interface and customer interface

- **Vehicle operator interface**
    - Software for providing operators with real-time trip requests from administrative/dispatching platform and providing audio and visual directions and notifications
    - On-board hardware (e.g., tablet) capable of tracking vehicle location and exchanging data to administrative/dispatching platform in real-time
    - Ability to:
        - Notify operator of need for on-board payment or if customer prepaid
        - Notify operator if upcoming passenger will require assistance with mobility devices
        - Add walk-up trip requests to booking system
        - Manually adjust count of number of passengers if different from request
        - Cancel trips and provide reason (e.g., no-show customer)
        - Enter time and location for all pick-ups and drop-offs
        - Enter user ID and vehicle ID

- **Customer interface**
    - App for riders to book and pay for trips; available to download on Android and iOS devices; "white label" with ability to brand for GLTC's microtransit service
    - Website for booking trips
    - Ability to:
        - Display service zone
        - Display suggested origins and destinations on map (e.g., transfer points to fixed route)
        - Enter desired pick-up and drop-off locations
        - Preschedule trips and schedule standing or recurring trips
        - Specify the number of passenger and mobility devices
        - Book trips on behalf of other people
        - Notify customer if trip request was accepted or is ineligible because of pick-up or drop-off location or service hours
        - Display estimated pick-up and drop-off times before and after booking
        - Notify customer of required pick-up and drop-off locations (if different from customer-entered information)
        - Display real-time updates on vehicle location
        - Create user profile
        - View prescheduled and standing or recurring trip request information

- Prepay for trip using multiple payment methods (bank card, mobile wallet, PayPal, etc.) or indicate if payment will be made on-board
- Enter promotional code for trip discounts
- Save bank card information
- Submit comments, complaints, ratings, and other information

It is expected that data would be reported and shared in the formats requested by GLTC (see Data Collection and Reporting). The provider could provide ongoing technical support to help GLTC maintain the technology and implement improvements as well as installation services and training for operators. Additional services may be available depending on the provider such as operational planning guidance and support services.

In the TaaS model, GLTC would not be required to acquire and operate the technology. Instead, the contractor operating the service would provide the necessary technology including a customer app to enable booking and payment. Like in the SaaS model, this app must be available to download on both Android and iOS devices. All other technology would be operated by the service contractor, but GLTC could require certain features such as those in the bulleted list above. Data would be reported regularly to GLTC in a format specified in the contract.

BOOKING METHOD

Microtransit is typically booked through an app available on smartphones. The app, whether using a SaaS or TaaS model, must be available to download on Android and iOS devices at a minimum. To make the booking method accessible, there also must be alternative booking methods available. These should be suitable for those without smartphones and with speech impairments, hearing impairments, low English proficiency, dexterity issues, or cognitive disabilities. **Table 20** shows how some booking methods may be accessible or inaccessible for riders.

TABLE 20: BOOKING METHOD ACCESSIBILITY

BOOKING METHOD	SUITABLE FOR	UNSUITABLE FOR
Smartphone App	- Hearing impairments - Speech impairments - Language barriers	- Nonsmartphone owners - Visually impaired - Dexterity issues
Website	- Hearing impairments - Speech impairments - Nonsmartphone owners - Language barriers	- Visually impaired - Dexterity issues
Call Center	- Nonsmartphone owners - Visually impaired - Dexterity issues	- Hearing impairments - Speech impairments - Language barriers

Source: Kimley-Horn, 2021.

Providing a call center as a way of booking rides, where riders call-in and the ride is booked on their behalf, makes it accessible to people without access to smartphones as well as people who are visually impaired or may have difficulty operating a smartphone. In a SaaS model, this call center would be operated by GLTC. This service could be integrated with GLTC's existing paratransit booking activities. In a TaaS model, the service contractor should operate the call center, but GLTC would likely have to work in close coordination with them to field general questions related to GLTC's fixed-route service or customer service questions that may arise.

Using a website for booking rides enables people without smartphones to make bookings as well as facilitate bookings for people with low English proficiency and hearing and speech impairments. The website would by operated by the technology provider in a SaaS model or by the service contractor for a TaaS model. GLTC would not have to host or maintain the website, but should provide a link to it from GLTC's website.

Policies for booking recurring or advance trips should be established to enable people making the same trip regularly to be able to schedule them and to expect a reliable service each time. When prebooking, customers could be prompted to select a time window (e.g., 15 minutes) to provide more opportunity to optimize service. This is sometimes viewed as an additional service to be provided and may result in higher software costs in a SaaS model. A service contractor operating a TaaS model may charge more as part of its services if prebooking is required.

Polices regarding no-shows must be developed for both service models. A no-show is when a customer requests a trip but does not arrive. Consistent no-shows can cause service to slow down and become unreliable. Other agencies combat this by suspending service for riders if they have multiple no-shows. This can incentivize riders to be punctual with their booking; however, long-term or permanent suspensions risks excluding people from GLTC's wider bus network, particularly if Route 7 is discontinued, preventing them from using the microtransit service to transfer to other fixed routes.

FARES AND FARE MEDIA

Fare for the microtransit service should be kept consistent with GLTC's current fare structure. To avoid changes to paratransit fare levels to remain compliant with ADA regulations (e.g., not more than twice the fare that would be charged on the fixed route system), microtransit fares should not be set higher than the current fare structure. Following the current fare structure would ensure non-peak fares for seniors, people with disabilities, and Medicare cardholders do not exceed half of the peak fare, as required under 49 U.S.C. Section 5307(d)(1)(D) of the Federal Transit Act. It also ensures that the service is still financially accessible to riders of existing fixed-route service. Single rides would cost $2.00 and fare passes should be accepted. The half fare program also should extend to the microtransit service. These fares should be used with both service models.

In a SaaS model, GLTC would be able to use its fareboxes on the vehicles to collect fares, thus allowing for easy integration with the rest of the system.

In a TaaS model, fares would be collected by the service contractor who will likely have a preferred method of fare collection. To keep the service integrated with the GLTC fare system, the contractor will need to have a requirement to have GLTC fareboxes installed on vehicles.

Policies regarding transfers should be kept consistent between the microtransit service and fixed-route services. Currently, a rider using a single pass will have to purchase a new pass when transferring between buses, but any other pass provides for free transfers. This should work the same with transfers between microtransit and fixed-route buses. If GLTC fareboxes are used on the vehicles, in both a SaaS and TaaS model, this can be done by having transferring riders pay on the vehicle as opposed to on the app. In Montgomery County, MD, the Flex service is geared towards transfers and so does not allow app-based fare payment as it would limit transfers and would be too difficult to integrate with the regional SmarTrip system.

However, if a TaaS service contractor is unwilling or unable to install GLTC's fareboxes, the microtransit service will have to operate on a distinct fare system, meaning transfers would either require the purchase of an additional ticket or operators would have to perform visual inspections to validate passes.

At the launch of the pilot, GLTC could implement a zero-fare promotion for a limited period to attract new riders. Operating the microtransit pilot as zero-fare for the duration of the pilot would eliminate the need for fare collection to be integrated with the GLTC system and the need for new fareboxes to be installed on vehicles; however, this could make it challenging to transition to fare collection in the future. It could also benefit customers with shorter wait times and trip durations by not requiring fare payment.

PAYMENT METHODS

Payment methods also must be accessible and not exclude potential riders to comply with Title VI requirements. Payment typically takes place through the smartphone app (bank cards, mobile wallet, PayPal, etc.), but alternative payment methods must be made available to nonbanked individuals and those unable to use or access a smartphone. Cash payments should be available to riders on-board microtransit vehicles using exact change. Cash and fare card inspection methods impact wait times and the overall trip duration. On-board or cash payment methods generally take longer than pre-paying methods.

If a TaaS model is used that does not integrate fare collection with the GLTC system, microtransit operators could visually inspect fare cards of riders with existing GLTC passes to verify their validity to enable free transfers.

Not requiring payment by operating the service as zero-fare for the duration of the pilot could result in cost savings from having to install fareboxes on vehicles while also resolving interoperability challenges between TaaS microtransit and fixed-route fare payment.

Table 21 summarizes some of the benefits and drawbacks of different payment methods discussed. The methods can be operated in conjunction or alone as the sole payment method, provided it complies with Title VI requirements.

TABLE 21: POTENTIAL PAYMENT METHODS

PAYMENT METHOD	SUITABLE FOR	UNSUITABLE FOR
App-Based (Bank Cards, Mobile Wallet, PayPal)	▪ Ease of use for riders ▪ Ease of implementation	▪ Inaccessible for unbanked individuals and nonsmartphone users ▪ Currently cannot be integrated with fixed-route fare system
GLTC Passes	▪ Integration with fixed-route bus fare system ▪ Familiarity with fare system	▪ Requires GLTC fareboxes to be installed or additional operator responsibilities (visual inspection)
Cash	▪ Ease of use for riders	▪ Requires cash handling responsibilities for TaaS contractor if farebox is not installed
Zero-Fare Promotion	▪ Promotes ridership ▪ Ease of implementation ▪ Reduces technology requirements	▪ Loss of potential revenue ▪ Resistance to introducing fares in the future

Source: Kimley-Horn, 2021.

CUSTOMER SERVICE

GLTC already operates a customer service division which can be leveraged in a SaaS model. Customer service for the pilot would be run by GLTC's existing customer service staff and the only increased costs would be training costs needed to get customer service staff familiar with the technology being used to operate the service.

In a TaaS model, GLTC would have minimal customer service requirements and would need to respond to general program questions and direct riders to the customer service operated by the service contractor. The contractor would be required to provide a full suite of customer service and driver support as part of its service, and provide GLTC access to all comments, questions, requests, and complaints made to the contractor's customer service.

DATA COLLECTION AND REPORTING

Data from the pilot is crucial to evaluating its success during and at the end of it. Data collection during the pilot can inform decision-making for adjusting service and optimizing it. An evaluation at the end of the pilot will help decide whether the service is a sustainable transportation service to be continued and meets GLTC's goals. In either service model, GLTC should require full access to, and ultimate ownership of, all data associated with the pilot.

In a SaaS model, data would be collected and reported through the technology platform. The metrics and format reported to GLTC should be specified in the contract when licensing the technology. GLTC also would be able to collect additional data because the service is directly operated.

A TaaS model would require all data to be reported by the service contractor to GLTC. The metrics reported should be specified in the contract. The service contractor should have a person assigned to be familiar with all requirements for NTD reporting.

Table **22** provides a list of recommended data that should be collected.

TABLE 22: RECOMMENDED DATA COLLECTION

TYPE	MEASURE
Individual Ride Data	Request origin
	Request destination
	Request passengers
	Booking method
	Vehicle occupancy snapshots (on a trip-level basis)
	Date and time of ride
	Length of ride (total travel time and miles)
	Estimated and actual wait times
	Trips cancelled
	No-shows
	Completed trips
Aggregated Service Data	Fare paid
	Payment method
	Dwell time
	Vehicle number
	Completed rides
	Active drivers (TaaS)
	Total vehicle hours
	Total vehicle miles
	Vehicle revenue hours
	Vehicle revenue miles
	Utilization (trips per vehicle revenue hour)
	Average trip duration
	Percentage of riders requiring assistance with mobility devices
	Number of unique users
	Users with no rides

TYPE	MEASURE
	Users with one ride
	Users with multiple rides
	Average walking distance to pickup
	Prescheduled or recurring rides
	Out of zone requests
	Out of hours requests
Performance Standards	Average wait time
	Percentage of on-time rides
	Percentage of completed rides
	Rides not completed
	Rides unable to be accepted
	Rider satisfaction metrics
Historical Trends	Overall ride volume
	Top requested origins and destinations

Source: Kimley-Horn, 2021.

The data measures can be used to evaluate the performance of the service. **Table 23** highlights some potential performance measures. The performance metrics highlighted in bold help to measure progress to the stated goals for the microtransit service, which are replacing underperforming fixed-route service, improving transit in hard-to-reach areas, implementing a cost-effective service, and providing connection opportunities to the fixed-route bus service. Performance metrics and targets should be set once the service parameters are finalized with the technology provider as well as after the decisions on existing fixed routes (6 and 6/7X) are made.

TABLE 23: POTENTIAL PERFORMANCE MEASURES

TYPE	PERFORMANCE MEASURE	DEFINITION
Productivity	**Completed Daily Trips**	**Total or average trips completed per day**
	On-Time Performance	Proportion or rides that arrive when estimated
	Passenger Trips per Vehicle Revenue Hour	**Passenger trips/vehicle revenue hours**
	Passenger Trips per Vehicle Revenue Mile	Passenger trips/vehicle revenue miles
	Peak Capacity	Maximum number of passenger trips per hour
	Deadhead Miles per Day	Miles driven per day with no passengers
	Deadhead Hours per Day	Hours driven per day with no passengers
	App Downloads	Number of downloads for service app
Cost Effectiveness	Cost per Vehicle Revenue Hour	Operating cost/vehicle revenue hours
	Cost per Vehicle Revenue Mile	Operating cost/vehicle revenue miles
	Cost per Passenger Trip	**Operating cost / passenger trips**
	Fare Collected per Passenger Trip	Average fare collected per passenger trip
	Annual Subsidy	Required operating funding
Shared Rides	Percentage of Shared Rides	Percentage of total rides with more than one passenger on-board
	Utilization	**Riders in vehicle/vehicle capacity**
	Percentage of Multipassenger Trips	Percentage of completed trips with more than one passenger per booking
Transfers	Number of Trips to/from Bus Stops	Number of daily trips linked to GLTC fixed-route service
Rider Satisfaction	Returning Riders	Percentage of riders with more than one completed trip
	Wait Time	**Time between trip request and vehicle arrival**
	Cancelled Trips	Number of trips cancelled following a booking
	Missed Trips	Number of trips unable to be completed due to demand

Source: Kimley-Horn, 2021.

Understanding the productivity and cost-effectiveness of the service allows it to be compared to other fixed-route services in GLTC's system as well as evaluate if it is a suitable replacement for underperforming fixed routes. Many of these metrics are made easier to track and monitor through the technology platform. Tracking shared ride metrics allows GLTC to evaluate whether the microtransit is operating efficiently and effectively in aggregating trips or if it is operating as a direct pick-up and drop-off service for individuals. Tracking trips with transfers will allow GLTC to evaluate if microtransit is predominately being used to connect to the rest of the bus system and if there is a need to coordinate service schedules. Customer satisfaction is important to track as in any public service to ensure quality is acceptable since good customer satisfaction will lead to return riders.

For GLTC to evaluate improvements in access and service in hard-to-reach areas as a result of implementing the microtransit service, data from the requested origins and destinations can be used to determine how many trips are beginning or ending in areas beyond ¼ mile from the fixed-route bus stops.

FLEET AND OPERATORS

Microtransit service in the south Lynchburg zone is estimated to require two to three vehicles. This would include one vehicle to be on standby while the other one or two vehicles operating in the zone. Initially, only one vehicle would be needed if ridership is similar to that of Route 7; however, if ridership begins to increase it would be beneficial to have a second vehicle ready to begin operating quickly to serve the rising demand. The vehicle used in the service would need to be branded and wrapped to match the microtransit service's brand regardless of the service model used.

The SaaS service model would make use of GLTC's existing paratransit vehicles and operators. The vehicles are 23-foot cutaway buses with a passenger capacity ranging between 10 and 16. These vehicles are all ADA accessible. There are currently 13 paratransit vehicles in the fleet, which is more than enough to support a new microtransit service alongside the existing paratransit service. GLTC typically uses five of these vehicles for paratransit service. Using GLTC's own vehicles enables service to scale more easily to respond to demand and allows cost savings from not having to acquire new vehicles. Tablets that will be used to provide the vehicle operator interface can be mounted in the vehicle. The operators would need additional training to operate the software platform on the tablets, and call center staff would need training to operate the dispatching platform. As noted in the **Software as a Service** section, the technology provider is responsible for training the GLTC technology users prior to launch.

Using a TaaS model requires the service contractor to supply the vehicles and operators, which allows for more consideration of vehicle requirements. The use of smaller vehicles allows for the service to access hard to reach areas along small roads while also still being able to seat multiple riders and achieve the goal of trip aggregation. Cutaway buses, like those GLTC would use in the SaaS model, would serve this purpose, though at off-peak or times of low ridership may be too large and inefficient. They also have higher fuel consumption and are nosier than more compact vehicles. Using vans with lower capacity would be more efficient in low density zones and they are more maneuverable. However, a van may not be able to handle sudden spikes in demand within the zone. The use of sedans is not recommended because it would greatly reduce the opportunity for trip aggregation as they have a much lower capacity than cutaways and vans,

Additional vehicle requirements can be set for the contractor such as their useful life or if the whole fleet must be ADA accessible. If federal funds are used, then FTA requirements such as Buy America

will be required too. Due to the small number of vehicles required for this service area, it is recommended that all vehicles used by a service contractor be ADA accessible.

Furthermore, with the TaaS model, the service contractor would be responsible of ensuring that all relevant federal, state, and local regulations are complied with, including trainings, certification, and/or licensure, as needed. This also includes a comprehensive antidrug use and alcohol misuse program in place that meets or exceeds all federal requirements.

FACILITIES

Maintenance and storage facilities are necessary for the vehicles used during the pilot. In a SaaS model, the vehicles used by GLTC could be stored and maintained in the same location where the paratransit vehicles currently are. This provides cost savings as the cost for the facility is spread across multiple services as well as avoiding having to acquire a new facility.

A TaaS model would require the service contractor to provide its own maintenance and storage facilities for the vehicles. It may be possible that the contractor could contract with GLTC to provide these services to them, which would create cost-saving efficiencies for GLTC.

UPFRONT COSTS

The upfront costs for the pilot vary between the SaaS and TaaS service models. The SaaS model would typically require the purchase of new vehicles; however, it is recommended that GLTC use some of its existing paratransit vehicles for the service to reduce cost. There would still be costs for branding or wrapping the vehicles for the service. The main upfront cost for SaaS is in the technology platform and installation, which ultimately depends on what is negotiated. This cost includes optimizing the algorithm for the proposed service zone and instruction and training for drivers, dispatchers, and managers. Software costs can increase depending on the size of the deployment. Microtransit pilots also can significantly benefit from dedicated marketing resources, which can be budgeted as an upfront cost. **Table 24** shows an estimated range of upfront costs for a SaaS pilot.

TABLE 24: ESTIMATED SOFTWARE AS A SERVICE UPFRONT COSTS

UPFRONT COST	LOW ESTIMATE	HIGH ESTIMATE
Vehicles and Wraps[1]	$10,000	$15,000
Technology Platform Start-Up and Installation[2]	$15,000	$50,000
Vehicle Hardware[3]	$2,000	$4,000
Marketing Campaign[4]	$10,000	$25,000
Total Upfront Cost	**$37,000**	**$94,000**

Notes and Assumptions:
[1]$5,000 per bus; Low = 2 vehicles; High = 3 vehicles; no vehicle acquisition cost for GLTC
[2]$15,000 to $50,000 from industry examples
[3]4 tablets (including spares), mounting, cabling; Low = $500 each; High = $1,000 each
[4]$10,000 to $25,000 from industry examples
Source: Kimley-Horn, 2021

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Estimating the upfront costs for TaaS is challenging as it depends on the contractor, what is negotiated in the contract, and the scale of service. Some contractors will charge all of their fixed costs upfront at contract signing while others will amortize the costs into the ongoing hourly rate for providing the service. In Arlington, TX, Via charged some of its fixed costs at contract signing and some amortized into the monthly fee. Due to these differences, upfront costs for a TaaS pilot are estimated in **Table 25** as a percentage of annual ongoing costs, which are described in the next section. The range in cost reflects the differences in how service contractors may price their services.

TABLE 25: ESTIMATED TRANSPORTATION AS A SERVICE UPFRONT COSTS

UPFRONT COST[1]	LOW ESTIMATE	HIGH ESTIMATE
Fixed Costs and Service Initiation	$72,000	$185,000

Notes and Assumptions:
[1] *Assuming 25 percent of annual ongoing costs; see **Table 27***
Source: Kimley-Horn, 2021

ONGOING COSTS

The ongoing costs for the SaaS model include the monthly fees for using the technology platform and supplemental support services. Examples of these are enhanced marketing support, operational support and system adjustments, and expert consulting. Technology costs are often invoiced on a per-vehicle basis.

Besides technology-specific costs, there also are operating and maintenance costs associated with GLTC running the service. An estimated operating expense of $75 per vehicle service hour was assumed for GLTC to operate the service. This rate is based on historical operating expense per vehicle revenue hour for both paratransit and fixed-route bus reported to NTD. Hourly operating expenses for microtransit are expected to be closer to that of paratransit service rather than fixed-route bus.

Table 26 shows an estimated range of ongoing costs for a SaaS pilot. Route 7 operating expenses, assuming $100 per vehicle service hour, also are shown in addition to a total net cost should Route 7 be replaced with microtransit service. The low and high levels are largely based on the quantity of vehicles operating at once—low with one vehicle and high with two vehicles.

TABLE 26: ESTIMATED SOFTWARE AS A SERVICE ONGOING COSTS

ONGOING COST	ESTIMATE	MONTHLY	12 MONTHS	18 MONTHS
GLTC Operating Expenses[1]	Low	$29,900	$358,800	$538,200
	High	$59,800	$717,600	$1,076,400
Technology Cost[2]	Low	$1,000	$12,000	$18,000
	High	$3,000	$36,000	$54,000
Supplemental Support Services[3]	Low	$750	$9,000	$13,500
	High	$1,500	$18,000	$27,000
Total Cost	**Low**	**$31,650**	**$379,800**	**$569,700**
	High	**$64,300**	**$771,600**	**$1,157,400**
Route 7 Operating Expenses[4]		$30,300	$363,600	$545,400
Total Net Cost (Saving) with Route 7 Replacement	**Low**	**$1,350**	**$16,200**	**$24,300**
	High	**$34,000**	**$408,000**	**$612,000**

Notes and Assumptions:
[1] $75 per vehicle service hour; Low = 1 vehicle in continuous operation, High = 2 vehicles in continuous operation; 14 hours on weekdays, 12 hours on Saturday, 10 hours on Sunday
[2] Low = $500 per vehicle per month (two total vehicles); High = $1,000 per vehicle per month (three total vehicles)
[3] $150 per hour; Low = 5 hours per month; High = 10 hours per month
[4] $100 per service hour; 14 service hours per weekday
Source: Kimley-Horn, 2021.

The ongoing costs for the TaaS model cover a broader range of tasks than just technology, and can include contracted operations, customer service, performance monitoring, and marketing. Recent planning projects and microtransit deployments show variable costs, with a fully-loaded rate that can range between $60 and $100 per vehicle service hour. **Table 27** shows an estimated range of the ongoing costs for a TaaS pilot in addition to Route 7 operating expenses and a total net cost should Route 7 be replaced with microtransit service.

TABLE 27: ESTIMATED TRANSPORTATION AS A SERVICE ONGOING COSTS

ONGOING COST	ESTIMATE	MONTHLY	12 MONTHS	18 MONTHS
Vehicle Cost[1]	Low	$5,600	$67,200	$100,800
	High	$18,300	$219,600	$329,400
Driver Pay[2]	Low	$7,600	$91,200	$136,800
	High	$25,500	$306,000	$459,000
Customer Service[3]	Low	$10,800	$129,600	$194,400
	High	$17,900	$214,800	$322,200
Total Cost	**Low**	**$24,000**	**$288,000**	**$432,000**
	High	**$61,700**	**$740,400**	**$1,110,600**
Route 7 Operating Expenses[4]		$30,300	$363,600	$545,400
Total Net Cost (Saving) with Route 7 Replacement	**Low**	**$(6,300)**	**$(75,600)**	**$(113,400)**
	High	**$31,400**	**$376,800**	**$565,200**

Notes and Assumptions:
Assumes 14 service hours on weekdays, 12 service hours on Saturday, 10 service hours on Sunday
[1] Low = one vehicle in operation, $14 per service hour, High = two vehicles in operation, $23 per service hour
[2] Low = one vehicle in operation, $19 per service hour. High = two vehicles in operation, $32 per service hour
[3] Low = $27 per service hour. High = $45 per service hour
[4] $100 per service hour; 14 service hours per weekday
Source: Kimley-Horn, 2021.

It should be noted these TaaS costs are based off examples with larger service areas where contractors may have greater efficiencies in operating several vehicles at a time. Actual unit costs charged to GLTC may be higher for a relatively small service pilot in Lynchburg.

Some agencies have found that running a microtransit service to replace poor performing fixed-route services can be cost neutral. For GLTC, the estimated annual cost of running Route 7 is $363,600 based on an hourly operating expense of $100. **Table 28** summarizes the estimated annual ongoing cost for SaaS and TaaS and the potential additional cost or savings after replacing Route 7.

TABLE 28: COMPARISON OF ANNUAL ONGOING COSTS

SERVICE MODEL	ESTIMATE	ANNUAL ONGOING COST	NET WITH ROUTE 7 REPLACEMENT
Software as a Service	Low	$379,800	$16,200
	High	$771,600	$408,000
Transportation as a Service	Low	$288,000	$(75,600)
	High	$740,400	$376,800

See **Table 26** and **Table 27** for notes and assumptions.
Source: Kimley-Horn, 2021

FUNDING OPPORTUNITIES

There are several funding sources that GLTC could approach to secure funding for the microtransit pilot. Savings from replacing Route 7 may be able to provide funding for the pilot; however, these savings would not be realized in time for upfront capital costs, and it is possible that they may not be enough to cover total costs depending on service model chosen.

DRPT's MERIT program includes the Demonstration Project Assistance Grant Program that supports innovative investments in public transportation. These grants provide funding for a limited timeframe, typically for one year, to fulfill up to 80 percent of initial funding needs for new services or technologies. DRPT requires project sponsors to demonstrate that funding sources beyond the initial grant period have been identified and are feasible to continue operation of any new service or technology. GLTC does not currently receive funding through this program, but this could be used to fund a microtransit pilot. Eligible projects must either include the deployment of a new traditional service in new markets or the project should be designed to test the proof of concept for a new technology. This section specifically calls out the deployment of microtransit as a potential recipient. Funded projects should conclude within one to two years. Eligible expenses include administrative costs such as advertising, operating costs, and capital costs.

The FTA's Section 5310 funds for Enhanced Mobility of Seniors and Individuals with Disabilities is a program to provide funding for the purpose of assisting nonprofit groups in meeting the transportation needs of older adults and individuals with disabilities. It supports public transportation projects that improve access to fixed-route service and decrease reliance by individuals with disabilities on complementary paratransit. Projects that receive funding through the program must either be traditional allowing for transit-related information technology systems including scheduling/routing/one-call systems, and mobility management programs, or nontraditional projects that could cover the purchase of new vehicles for accessible ride sharing and/or vanpool programs. A SaaS microtransit service may be able to find funding in these categories while a TaaS system could be funded since the acquisition of public transportation service is an eligible capital expense under the program.

The FTA also provides funding through its Integrated Mobility Innovation (IMI) competitive grant program for projects that meet its goals of exploring new business approaches and technology solutions to support mobility, enable communities to adopt innovative mobilities solutions, or

facilitate the widespread deployment of proven mobility solutions to expand personal mobility. Eligible activities include projects that acquire equipment, service, and software to implement a mobility project that provides data to support performance measurement and evaluation. The microtransit project could fall under this since funds would be used for the acquisition of software or a service that would expand personal mobility through the use of technology solutions.

There also may be opportunities for joint purchasing with other agencies looking to implement microtransit to create savings. Not only does this mean that additional services charged, such as customer service in TaaS models or additional software features for a SaaS model, can be funded jointly by agencies, but economies of scale can be achieved with greater quantities of vehicles deployed. The Via contract with Bay Transit and MEOC reduces the software cost per vehicle for each increment of five vehicles. The proposed GLTC pilot is not large enough to take advantage of this but partnering with other agencies would increase the number of vehicles in operation, thereby decreasing the price paid per vehicle.

MARKETING, EDUCATION, AND OUTREACH

Robust marketing and communication are critical for a successful pilot in both service models, but the degree of responsibility for GLTC varies between the two models. The microtransit service should have distinct branding that is used in marketing materials and vehicle wraps. Outreach and education ensures that all current and potential customers understand how to use the service. Potential marketing strategies include:

- Developing strong branding and key messaging
- Identifying core use cases and uses to tailor content and messaging
- Distributing material to businesses and residences, specifically local employers, housing complexes, and other key activity centers
- Developing promotional and instructional "how-to" videos and materials
- Creating digital advertising
- Creating in-bus advertising on GLTC fixed routes and at bus stops
- Developing incentives or giveaways to encourage use shortly after launch
- Advertising in local newspapers
- Conducting direct mail to residences within the service area

In a SaaS model, GLTC would be primarily responsible for marketing the service and outreach. Software providers may provide marketing support, which Via currently provides to Bay Transit and MEOC, which can include help in setting up promotions and digital marketing. Should a technology vendor provide these services it may be useful to include them in a contract to access their experience in marketing microtransit specifically.

In Montgomery County, MD, the marketing and outreach campaign for the Flex service began five months before the pilot launched. It began with community focus groups and emailing neighborhood listservs and then culminated with a major marketing blitz on social media and traditional media outlets. After launch, the marketing campaign decreased but continued with ads in transit stops and community centers. AC Transit in California heavily focused marketing on the fixed-route buses they intended to replace to inform existing riders of the availability of the new microtransit service and the coming end of the fixed-route service.

In a TaaS model, the service provider would be responsible for running the marketing campaign with support from GLTC. A service provider would work closely with GLTC to create a marketing and

promotional campaign that increases community awareness of the pilot and maximize its success. GLTC would cooperate with the contractor and support them by providing local knowledge and leveraging existing marketing platforms to amplify the pilot. The TaaS contract can provide requirements or guidelines on the form and size of the marketing campaign implemented by the service contractor. The Via contract with Arlington, TX, specified they must hold a minimum of five marketing initiatives to promote the service in which the city would collaborate.

GLTC's outreach requirements are highlighted in its Title VI plan. During the planning process for the service, GLTC will have to make every effort to reach minority and low-income communities that may be impacted by decisions. Provisions must be made to allow comments to be made in a form other than writing and hold meetings in locations that are accessible by riding GLTC (if not, service from transfer station will be provided), and that are convenient and accessible to minority and low-income communities. A public hearing will be required if fixed-route changes are pursued by GLTC alongside the microtransit pilot.

PILOT PERIOD

The important factor in deciding the pilot period is allowing enough time for customer adoption and reliable data collection to evaluate the microtransit service. To have accurate data on the performance of the pilot, enough time must be given so that customer adoption allows ridership to reach a level that can be expected for the service. Other pilots have lasted between 12 and 24 months to ensure this point is reached. It is recommended that the pilot period extend at least 18 months as it should allow for sufficient adoption as well as fall within the time range for MERIT funding. The current Via contracts with Bay Transit and MEOC in Virginia extended their minimum of 18 months with an option to extend by 12-month periods for a total of 66 months. AC Transit in California conducted a 20-month period with the first 8-months running in parallel to fixed service before it was replaced.

Constant evaluation of the service should be conducted during the pilot period to optimize the service as data comes in and to makes changes to improve the service. This flexibility has contributed to the success of microtransit pilots conducted by other agencies. Key metrics include top origin and destination requests to evaluate if many requests are clustered on the edge of the zone, thereby indicating people walking into the zone to make trips and where the zone could be extended. The utilization of vehicles should be tracked to measure if there are enough seats to supply the demand and evaluate if more vehicles need to be added or if smaller vehicles may be more appropriate. Monitoring the completed daily trips and passenger trips per vehicle revenue hour will provide a measure of the productivity of the service, which can be compared to that of the Route 7. Tracking the cost per passenger trip will allow GLTC to determine if the service is being cost effective. The pilot could be considered successful in being a good replacement for low productivity fixed-route service if the cost per passenger trip and wait time is lower than the headway for Route 7, having customers provide a high satisfaction rating, and having the trips per vehicle revenue hour, daily trips, and utilization are all higher than Route 7. GLTC should conduct monthly reporting and a full evaluation near the end of the pilot to determine if service should continue.

CONCLUSION

This feasibility study was completed to understand how microtransit service may function in GLTC's service area and options for GLTC to consider for a pilot. The analysis identified candidate service zones, which resulted in the recommended south Lynchburg zone centered on Timberlake Road as the most suitable due to activity density and transit propensity, but lower potential to sustain productive fixed-route transit. This also provides an opportunity to replace low performing fixed routes, Route 7 and a portion of Route 6/7X, with a service that is more flexible and responsive to customer demand. A comparison of benefits and drawbacks of different service models that could be used to operate the service was completed to identify which service model is best suited for GLTC. A SaaS model, in which GLTC contracts with a technology provider but operates the service itself, is recommended since it would provide the greatest control over service levels and has the possibility for lower upfront costs if GLTC operates the service with spare paratransit vehicles. A TaaS model remains an option, but it may be inefficient for a service contractor to operate such few vehicles in a small area given fixed costs of starting up operations.

Implementation considerations for a pilot were provided in the last section to assist GLTC in specifying requirements and defining the various components of a microtransit service. Going forward, should GLTC decide to implement the microtransit service in the south Lynchburg zone using a SaaS model, funding would need to be secured for a pilot program prior to acquiring the technology platform. Upfront costs for the pilot could range from approximately $40,000 to $100,000. An 18-month pilot would require total ongoing costs ranging from $600,000 to $1,250,000 during this period. The low end of the range reflects ongoing operations with one vehicle and the high end with two. However, this could be partially offset by nearly $550,000 if Route 7 is replaced with this service.

A microtransit pilot would provide GLTC with an opportunity to test the "proof of concept" of a new service type that could provide a flexible alternative to underperforming fixed routes. GLTC will be able to utilize lessons learned from this experience to explore other innovative ways to create a more responsive and effective transit system for the future.

Kimley»Horn

DRPT
Virginia Department of Rail and Public Transportation

APPENDIX

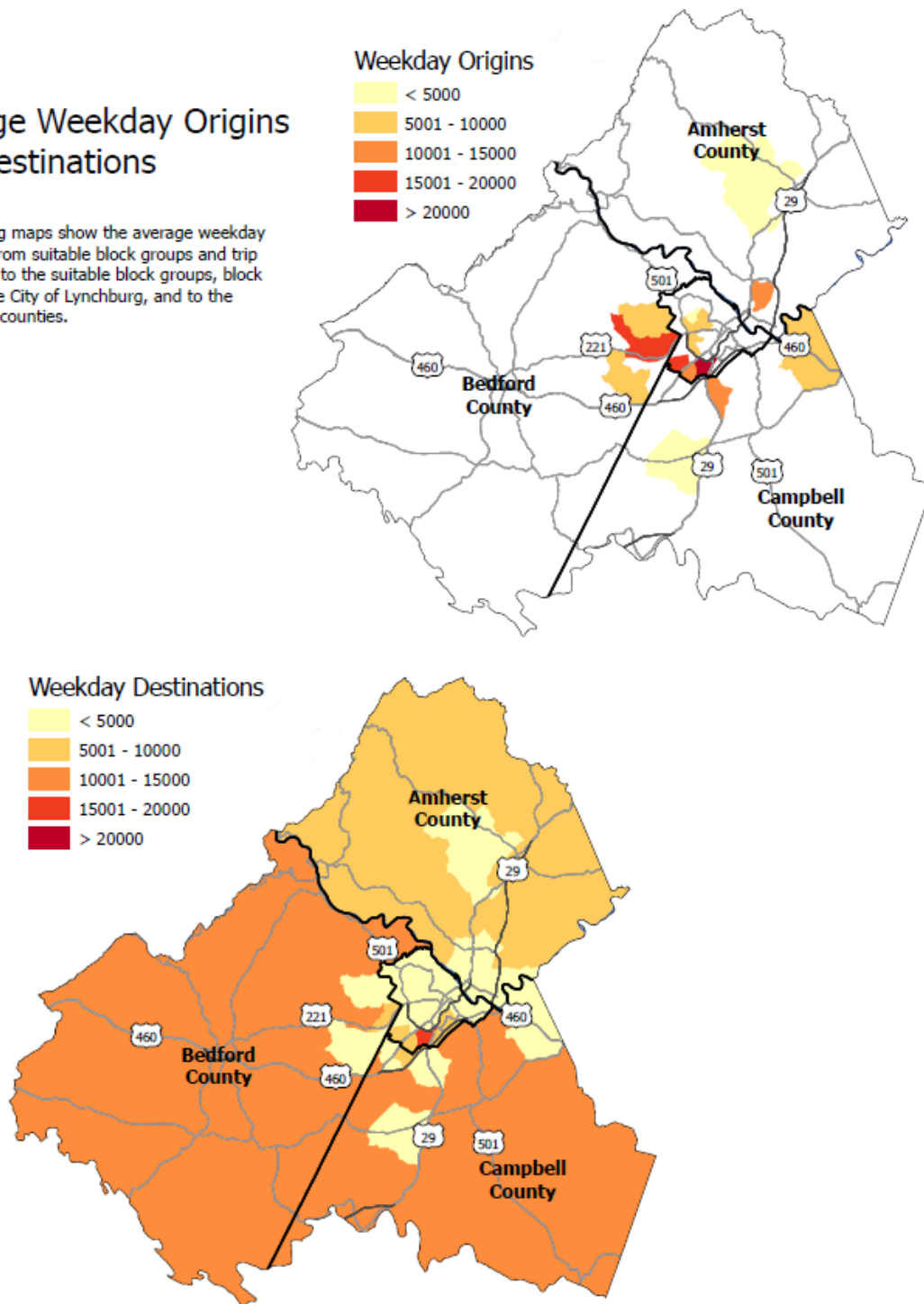**FIGURE 9: MICROTRANSIT SUITABLE BLOCK GROUPS - PRIOR TO FIXED ROUTE PERFORMANCE CONSIDERATIONS**
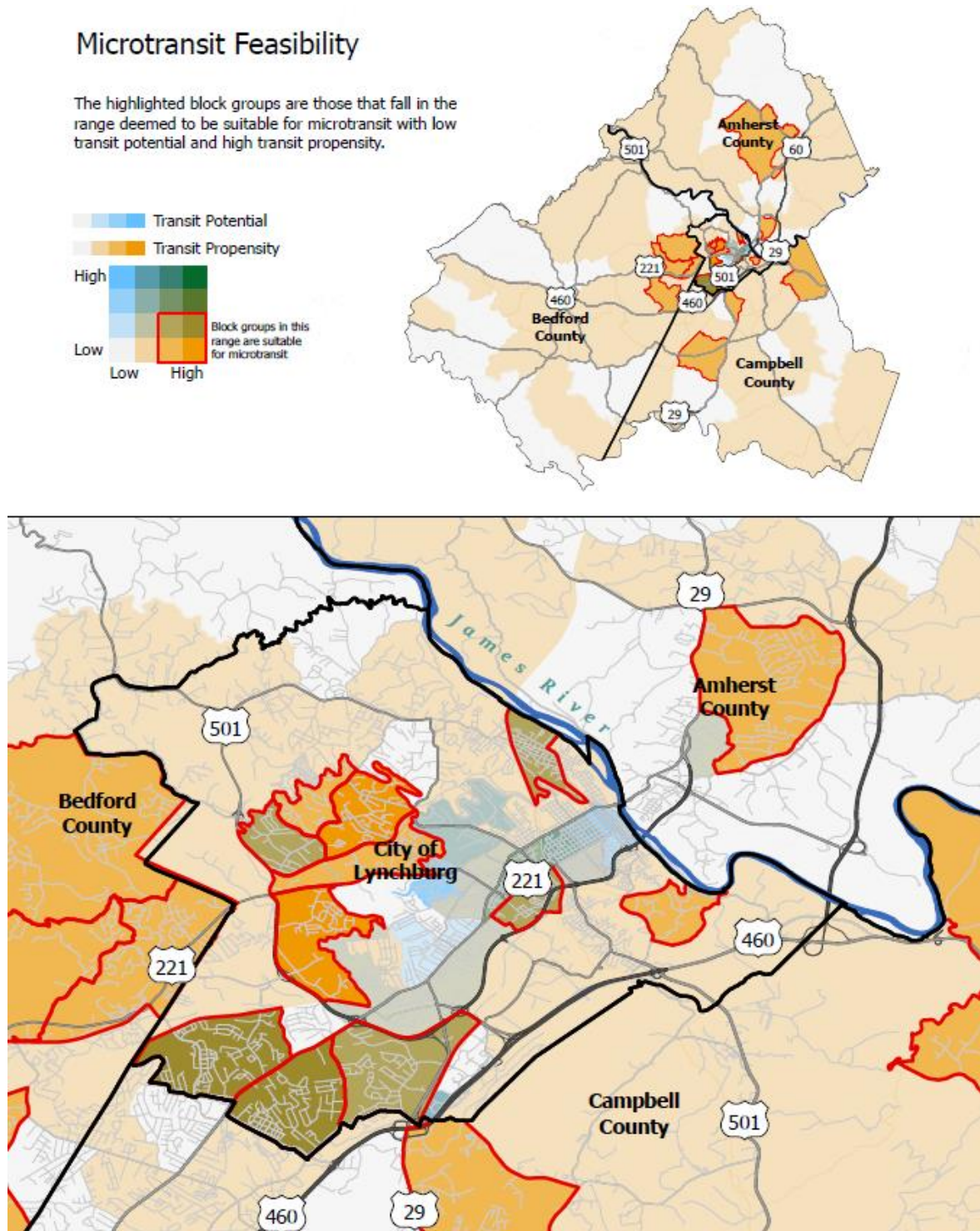
Source: Kimley-Horn, 2021

FIGURE 10: AVERAGE WEEKDAY TRIPS FROM MICROTRANSIT SUITABLE BLOCK GROUPS

Average Weekday Origins and Destinations

The following maps show the average weekday trip origins from suitable block groups and trip destinations to the suitable block groups, block groups in the City of Lynchburg, and to the neighboring counties.
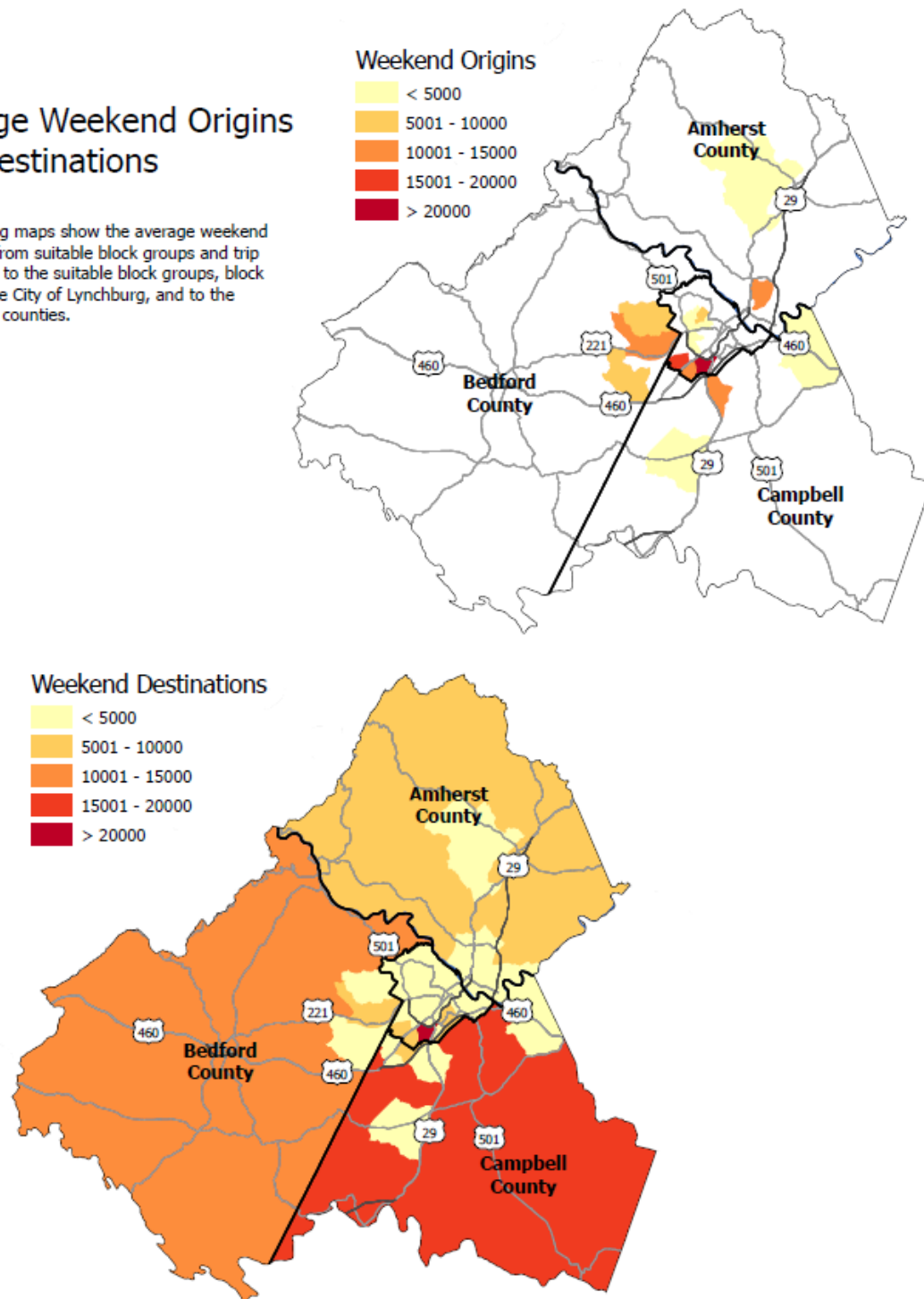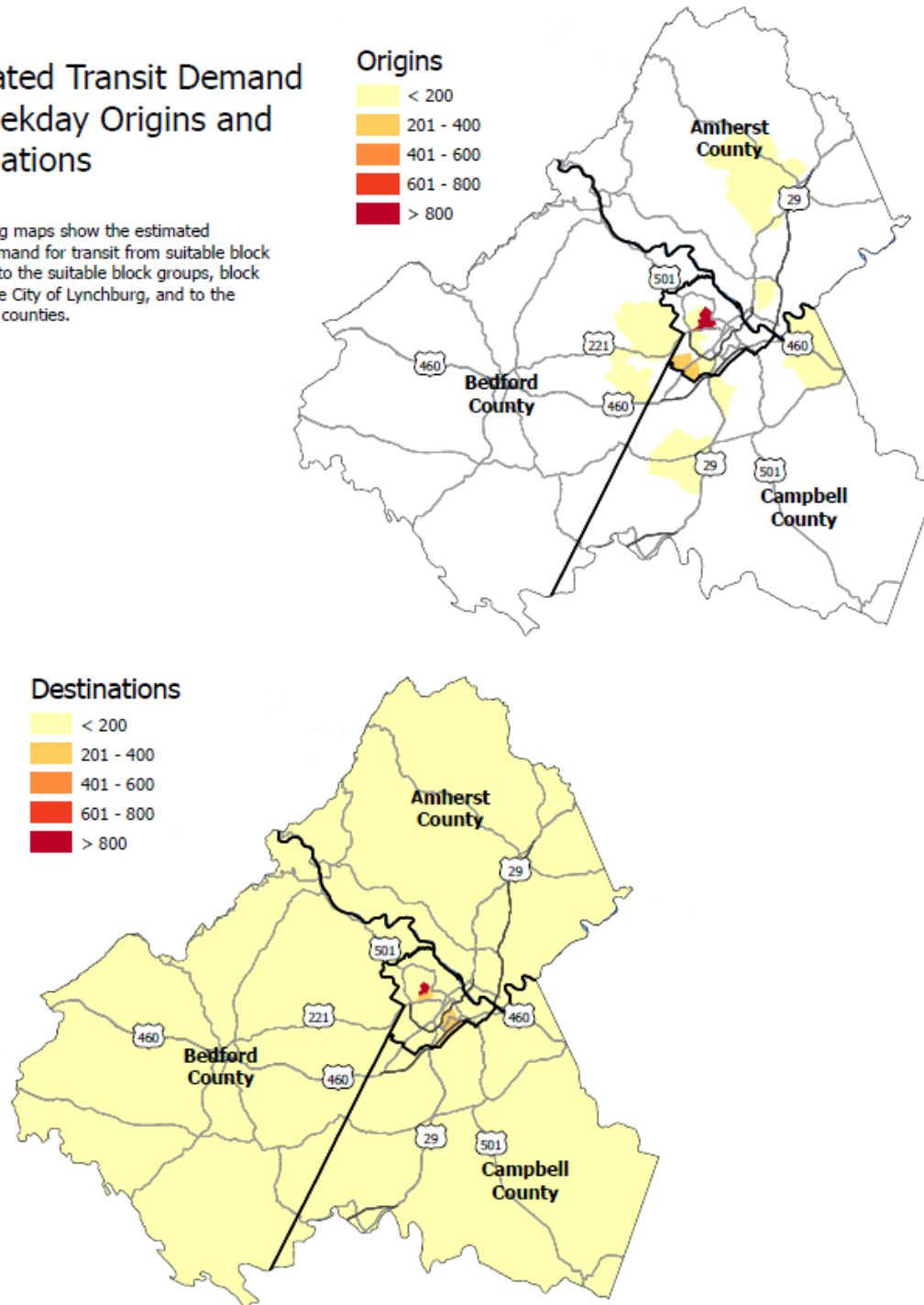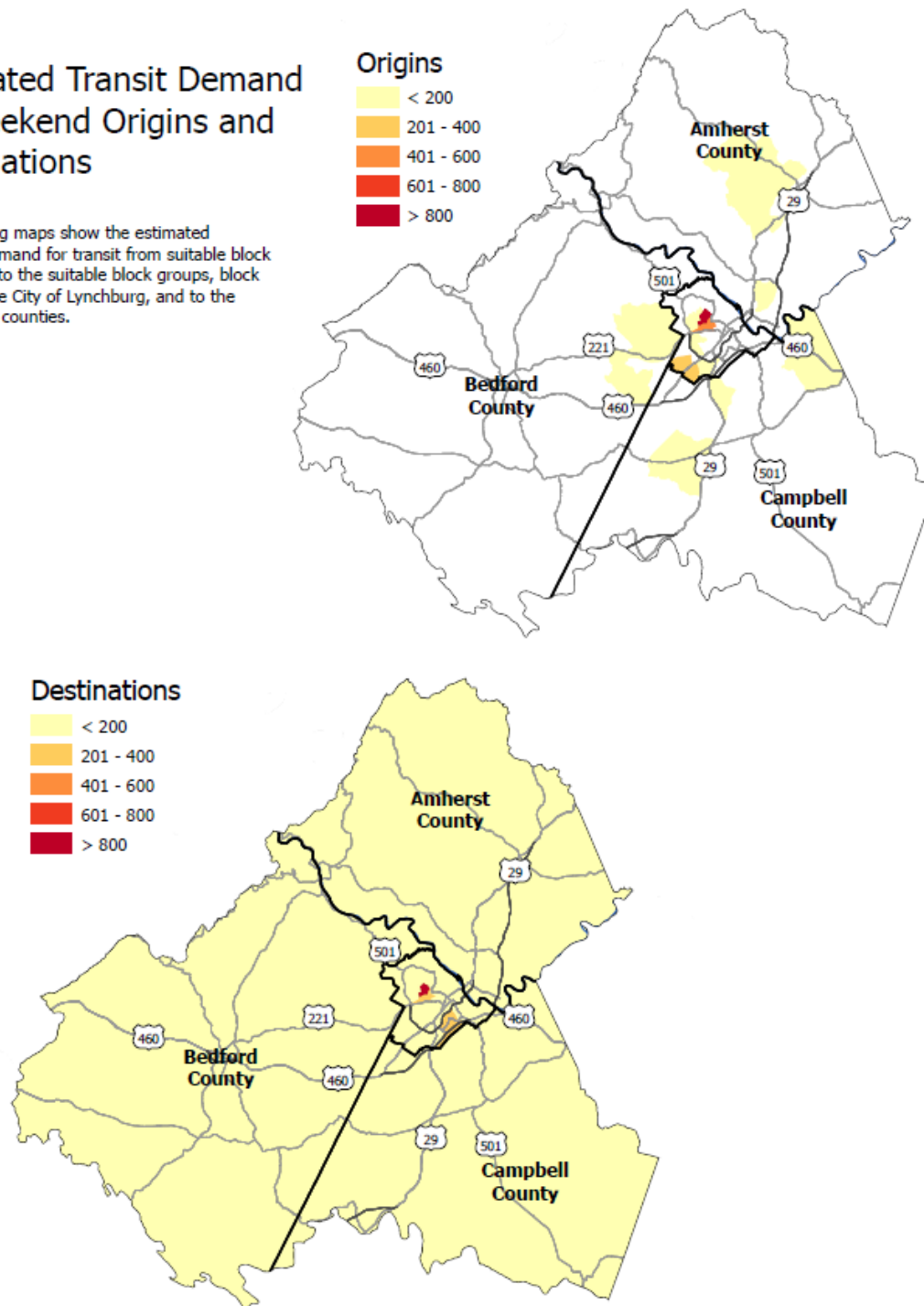

Source: Kimley-Horn, 2021

**FIGURE 11: AVERAGE WEEKEND TRIPS FROM MICROTRANSIT SUITABLE BLOCK GROUPS**

Average Weekend Origins and Destinations

The following maps show the average weekend trip origins from suitable block groups and trip destinations to the suitable block groups, block groups in the City of Lynchburg, and to the neighboring counties.

Source: Kimley-Horn, 2021

FIGURE 12: ESTIMATED WEEKDAY TRANSIT TRIPS FROM MICROTRANSIT SUITABLE BLOCK GROUPS

Estimated Transit Demand by Weekday Origins and Destinations

The following maps show the estimated weekday demand for transit from suitable block groups and to the suitable block groups, block groups in the City of Lynchburg, and to the neighboring counties.

Origins
- < 200
- 201 - 400
- 401 - 600
- 601 - 800
- > 800

Destinations
- < 200
- 201 - 400
- 401 - 600
- 601 - 800
- > 800

Source: Kimley-Horn, 2021

FIGURE 13: ESTIMATED WEEKEND TRANSIT TRIPS FROM MICROTRANSIT SUITABLE BLOCK GROUPS

Estimated Transit Demand by Weekend Origins and Destinations

The following maps show the estimated weekend demand for transit from suitable block groups and to the suitable block groups, block groups in the City of Lynchburg, and to the neighboring counties.

Source: Kimley-Horn, 2021

FIGURE 14: TOP TEN ORIGIN-DESTINATION PAIRS (TOTAL TRIPS) FOR MICROTRANSIT SUITABLE BLOCK GROUPS
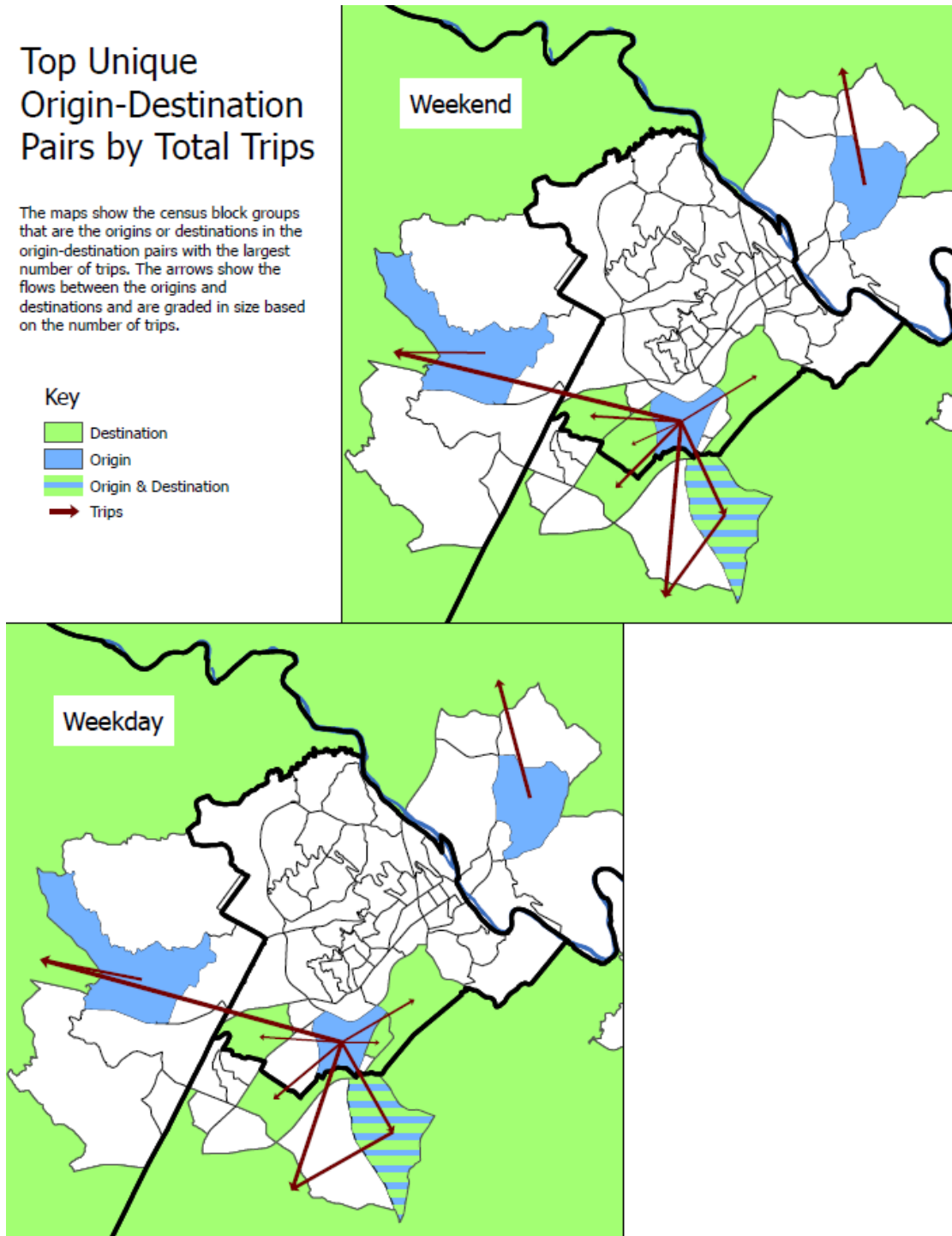
Source: Kimley-Horn, 2021

FIGURE 15: TOP TEN ORIGIN-DESTINATION PAIRS (POTENTIAL TRANSIT TRIPS) FOR MICROTRANSIT SUITABLE BLOCK GROUPS
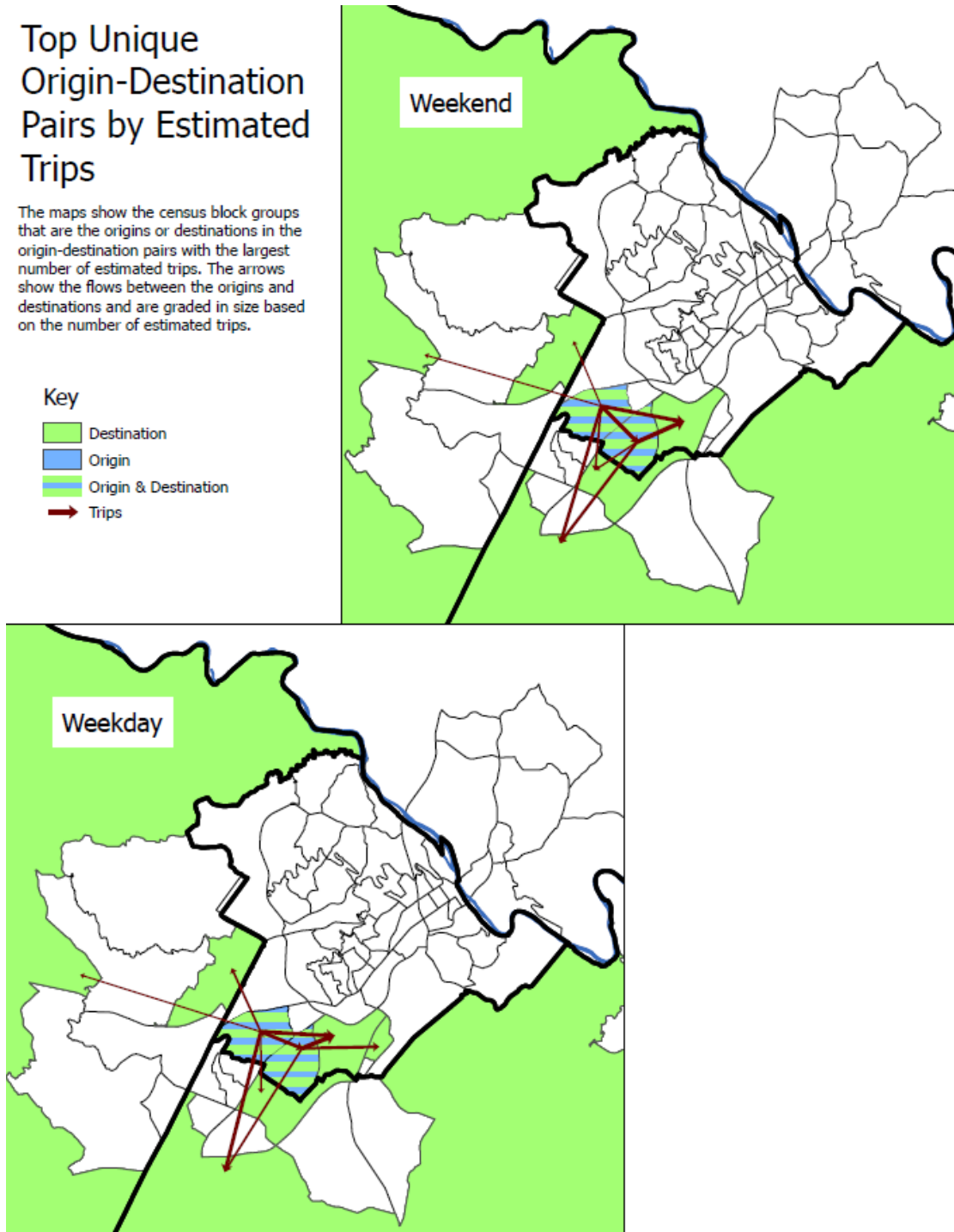
Sources: Kimley-Horn, 2021.