Greater Richmond Transit Company

Comprehensive Operations Analysis

Final Report

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GRTC TRANSIT SYSTEM

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Executive Summary

GRTC has built a strong transit system in the City of Richmond and portions of the adjacent communities offering fixed-route bus service, demand-responsive paratransit service (CARE) and shared-ride Welfare to Work service (C-VAN). The quality and quantity of GRTC services makes it possible for residents of the City to access the multitude of opportunities available within the City without depending on a personal automobile. The evaluation in this analysis is focused on the core fixed-route bus system, including the 24 local and 10 express routes as operated in the period beginning August 27, 2006, although some other special service routes were included in portions of the analysis as noted in the text. Changes and improvements have been made to the system since this work began including:

- Addition of two routes: Laburnum Connector (#91) and Central Gardens (#92)
- Elimination of some routes: Huguenot Express (#69)
- Re-routing of some routes throughout the service area.

Some of these ongoing changes may not be represented in these recommendations, but should be accounted for when detailed planning occurs.

The positive impact GRTC has on the lives of thousands of metropolitan Richmond residents is evident in a trend of stable ridership growth over the past several years. To further build on this success, GRTC must continue to refine its bus service to better meet the everyday transportation needs of as many residents as possible within the confines of a finite budget. Planning effective service now and for the future through a Comprehensive Operational Analysis (COA) requires examining all aspects of GRTC's operations, from riders to routes to the vehicle fleet. The information collected through this evaluation will provide the basis for enhancing the existing bus network, introducing new service, and attracting new markets.

The factual foundation of the COA consists of eight initial analyses:

- Demographics
- Historic GRTC trends
- Vehicle fleet
- Peer review
- Ridership
- On-board survey
- Route diagnostics
- Household survey

Based on these data collection efforts which began in August 2006, additional analyses were conducted to highlight GRTC's performance in providing service to its customers and provide information that can be used by GRTC to refine, expand and improve service offerings. These include the following analyses:

- Load Factor Analysis
- Service Standards Recommendations
- Adequacy Analysis

Finally, route by route recommendations were developed to help GRTC improve transit service in the Richmond area. These recommendations address the changing needs of the GRTC system and its riders and are presented in phases:

- Phase I: Immediate routing and service improvements
- Phase II: Identification and implementation of transfer center sites
- Phase III: Development of a Bus Rapid Transit line

Finally, the recommended implementation strategy for each phase of recommendations is presented. These strategies can be used by GRTC as they continue in the COA process to implement the recommended changes to the system.

The findings from the evaluation of each component of the GRTC system help to identify specific areas of the service that would most likely benefit from improvements or other changes. Below, the key findings and general observations identified through each analysis are presented. The full findings and technical documentation are available in the COA Final Report.

Demographics

Demographic data from the 2000 US Census reveal areas within the region containing high concentrations of households and residents displaying at least one of the five key indicators of transit dependence: living below the poverty line, having a mobility limitation, being age 65 or older, having no vehicle, and having one vehicle. Persons falling into these categories may have difficulty accessing major destinations—such as medical facilities, government offices, employment centers, and shopping areas—without adequate transit service.

The demographic analysis shows that residents with transit-dependent characteristics are generally concentrated in similar areas of the region. Downtown Richmond, the densest area in the region, exhibits the highest concentrations of residents likely in need of transit. Four areas outside of the urban core were also identified as having high densities of populations who would likely benefit most from transit: the northwest corridor extending from downtown into Henrico, the southwest corridor extending from downtown into Chesterfield, the northeastern border of the city with Henrico, and the southern border of the city in Chesterfield. Unlike downtown Richmond, these four areas have more limited transit service.

Historic GRTC Trends

A historic analysis of the GRTC system was conducted for a three-year period starting in FY 2004 based on data GRTC reported to the National Transit Database. This historic analysis provides a broader context for understanding the current performance of the GRTC system through identifying operational trends. Over the three-year period, GRTC successfully increased ridership each year. In FY 2006, GRTC recorded its highest level of service, operating cost, and ridership since 2004. GRTC was able to achieve these ridership gains without disproportionately raising its operating costs. Although costs did rise in line with the FY 2006 service increases, GRTC provided this additional service with a number of employees and vehicles unchanged from the previous year.

Vehicle Fleet

The condition of the GRTC vehicle fleet has important implications for the future of the service. Old and rundown vehicles will have maintenance problems affecting the reliability of the system, contributing to a poor perception of transit, and requiring significant near-term financial investment. Our evaluation of the GRTC fleet showed that all vehicles are in good or excellent condition with no vehicles exceeding their useful life. Further, GRTC possesses a healthy mix of vehicles of different lengths and seating capacities. As vehicles are replaced, GRTC has been integrating low-floor accessible buses into the fleet. GRTC has also maintained an adequate spare ratio, the number of spare buses kept in the fleet to ensure enough vehicles are available to cover the peak-hour operational requirements.

Peer Review

Peer reviews provide additional context for the evaluation of a single transit system. Through comparing GRTC to a group of select peers, it is possible to rate its performance in relation to operational statistics of similar transit operators. Compared to a group of peers, GRTC excelled in measures of financial efficiency, cost effectiveness, and revenue generation. The numbers show that GRTC provides a greater percentage of its service at peak times than other agencies. Service effectiveness as measured by passengers per mile, per peak vehicle and per revenue hour was higher than average. Service per capita and service span were near average, which is good when compared to many systems of greater size serving larger populations.

Transportation and vehicle efficiency were the two major categories in which GRTC ranked below its peers. The low Peak-to-Base Ratio provides the reason for fewer miles and hours being put on each bus, since many buses are not used at non-peak times. The lower average speed of the buses for GRTC could indicate that buses operate through congested areas with frequent stops during peak periods.

GRTC does achieve high rankings in cost effectiveness, financial efficiency, and revenue generation. However, in order to achieve these high scores only limited service is provided during non-peak times.

Ridership

A one-day sample of weekday on-off counts was manually collected to identify ridership trends throughout the system. These counts provide in-depth details about ridership patterns, specifically boardings and alightings by stop and passenger load—the number of passengers on board a bus at one time—by route segment. These data reveal the bus stops and route segments that are used most heavily as well as the aspects of the system that attract few riders. Based on this information, service can be better tailored to meet existing demand and improve operational efficiency.

Although ridership is spread throughout the system, there are a few routes and stops that attract a disproportionate share of riders. The downtown stops located along the east-west corridor following Broad Street and Marshall Street between 1st Street and 9th Street generate the most boarding and alighting activity on a daily basis. These stops are located at the hub of the entire bus network in the urban center, making them the logical ridership hotspot in accordance with population density, employment density, and bus transfer opportunities. Other stops that attract high numbers of riders have proximity to major destinations in the region, such as medical and shopping centers. These stops are good candidates for service increases and bus stop amenities.

Passenger loads indicate how heavily passengers use each segment comprising a full route. Routes 3-4, 6, and 62-63 appear to contain the individual segments with the most intense use in terms of total ridership numbers. In general, system-wide passenger loads are largest on the route segments approaching or leaving the downtown center, where the maximum number of passengers is on board traveling from the outlying region to downtown or vice versa. These route segments may benefit from increased service frequency to keep passenger loads and wait time at reasonable levels.

Total ridership tallies were also collected by route for a typical Saturday and Sunday for comparison to weekday ridership. In line with the reduced bus service available on weekends, ridership drops significantly on the weekends. Saturday ridership is 50 percent of weekday ridership and Sunday attracts 27 percent of the ridership of a weekday. Although weekend service provides essential transportation for residents without other options, the routes with the lowest demonstrated ridership demand should be investigated for possible service reductions.

On-Board Survey

One of the best methods for learning about the quality of a transit system and the needs of its riders is through an on-board rider survey. An on-board survey

administered throughout the GRTC system revealed key findings about who is using the system and how they are using it:

- 86 percent of respondents live in the City of Richmond
- 71 percent of respondents self-identified as African-American
- Almost half of survey respondents have a valid driver's license
- 58 percent of respondents live in households with an available vehicle
- 44 percent of respondents live in households where a vehicle is available to each employed member of the household
- 51 percent of surveyed trips were being made between work and home
- The majority of respondents walked to (85 percent) and from (94 percent) a GRTC bus while traveling between their point of origin and destination
- 68 percent of respondents used the same GRTC route 5 days or more per week
- 28 percent of respondents had a private vehicle available for their bus trip

These findings suggest that while the primary GRTC ridership base is composed of transit-dependent residents living in the City of Richmond, there are also many passengers who are riding GRTC even though other options are available. At the time they were surveyed, the majority of riders did not have a private vehicle available for their trip and they were making an essential trip between work and home. Service enhancements aimed at improving bus service in Richmond will benefit the majority of riders currently on board the GRTC system. The survey findings also indicate that GRTC has an opportunity to offer service improvements targeting choice riders.

Route Diagnostics

Five procedures were employed to assess current route performance and provide different perspectives of gauging route level efficiency and effectiveness: cost centers, contribution analysis, strategic planning, ordinal ranking, and supply and demand review. These techniques offer a basis for comparing GRTC routes to one another and the system average as a way of identifying superior as well as underperforming routes. The best routes may offer lessons that can be successfully transferred to other routes and the underperforming routes identify the aspects of the system most in need of help. This multifaceted analysis revealed the following key findings:

Farebox Recovery

- Passengers pay 27.18 percent of all costs and receive a subsidy of $2.68 per dollar paid in fares
- Nine routes exceed the regular route system average, with 27 routes below the average
- Route 37 has the highest farebox recovery of 48.47 percent
- Route 60 recovers less than one percent of its costs from the farebox (this route has been terminated by GRTC since the time of the analysis)

Route Subsidy

- Route 32 has a relatively high farebox recovery, but needs substantial subsidy (i.e., more than a million dollars) to operate
- Route 20 has a farebox recovery less than the system average (i.e., ranked 30th), but only requires an annual subsidy of $100,900.

Ordinal Ranking

- Ordinal ranking compares all of the bus routes based on two productivity measures and assigns each route a rank from best to worst
- In terms of passenger productivity, the most productive route appears to be Route 37
- The least productive route is Route 60 (this route has been terminated by GRTC since the time of the analysis)

These findings provide another input into service planning for the GRTC system. It is one tool that should be used in evaluating the system, but it is not a means to determine which routes are good or bad. Instead, through evaluating each individual route on different performance measures, the route diagnostic analysis can help identify both deficiencies and opportunities within the entire system.

Household Survey

A regional household survey was conducted in January 2007 with 1,034 randomly selected households in Richmond, Henrico, Chesterfield, and Hanover. The survey addressed respondents' transit use, transportation behaviors, and demographic characteristics. An equal number of surveys were collected from each of the four jurisdictions, and then all responses were factored to account for the population sizes of each jurisdiction. The key survey findings identified below offer insights into a largely untapped market of potential GRTC users:

Transit Use

- 7 percent of respondents commute by bus
- 25 percent of households have used transit in the last 3 years
- General transit use is significantly higher than daily transit commuting

Unmet demand

- 38 percent of respondents would consider using transit for commuting
- 52 percent of respondents would consider using transit for non-commuting trips
- 23 percent of respondents who do not have transit access near their home want better access

Opportunities

- 47 percent of respondents do not have GRTC service where they live
- Hours of service do not meet the needs of 20 percent of respondents
- 46 percent of respondents' commute destinations are not accessible by GRTC

Fares

- 30 percent of respondents are willing to pay the current cost or more for local and express trips

Funding

- 75 percent believe the city/county government should provide financial support for transit

The vast majority of the regional population does not use transit on a daily basis. But a significant share of survey respondents ride buses infrequently and have an interest in increasing their use of the GRTC system. These respondents largely represent the views of choice riders—potential bus riders who have access to other modes of transportation. Choice riders often require the highest quality bus service to get them on board. Improving bus service—especially outside of Richmond—with the needs of choice riders in mind, will help fulfill a relatively unmet demand for regional transit service.

Load Factor Analysis

The Load Factor Analysis compares the existing bus fleet with transit demand to determine the appropriate fleet mix and vehicle sizes for the GRTC system. Based on the vehicle inventory, the ridership on each route is compared with the capacity made available on that route. Essentially, this analysis results in a load factor that represents the percentage of filled seats on each route. This analysis calculates load factors for each of five time periods throughout the day. It also analyzes each direction of travel, with the understanding that one direction will often experience much heavier loads than another, especially during peak periods.

As a result of this analysis, it is recommended that all routes that experience load factors of less than 50% during any time period be examined for the feasibility of using smaller buses. Many routes were observed to have high load factors in the peak direction and low load factors in the opposite direction, however there were many cases of routes operating with very low load factors in both directions. These routes would be the best candidates for smaller vehicles. This analysis also highlights time periods throughout the day with extremely low ridership, allowing service planners to consider removing trips from the schedule.

Throughout the day, GRTC buses operate with an average load factor around 30%, indicating that a fleet comprising a mix of large and small vehicles would be ideal. Other key findings from this analysis include:

- There is a substantial surplus capacity in the bus system for most routes and during all five time periods, including the morning and afternoon peak periods.

- These results would suggest that GRTC's continued reliance on full-sized coaches 40 feet in length is not warranted and that a mix including smaller buses would be more appropriate.
- Purchase of low floor buses typically result in fewer seats for the same length vehicles than standard buses. In view of the maximum load volumes, this minor loss in seating capacity should not be a concern.
- Greater reliance on smaller vehicles seems an appropriate strategy.

As GRTC continues to grow and evolve, the results of this analysis should be incorporated into the GRTC fleet replacement and expansion program to allow for the proper mix of vehicles to accommodate the expected demand.

Service Standards Recommendations

GRTC's existing service standards were updated to ensure that they adhere to the most recent industry standards. As a new method of assessing transit service, the standards utilized a level-of-service based approach developed in the Transit Capacity and Quality of Service Manual that allows service to be "graded" on a scale of "A" through "F". This methodology, while accompanied by a more traditional set of guidelines, can be used to assess service throughout a region and allows for greater flexibility when conditions warrant. The standards and guidelines deal with many aspects of service including:

- Service Coverage
  - Availability
  - Frequency
  - Span
  - Directness
- Patron Convenience
  - Speed
  - Loading
  - Bus Stop Spacing
  - Dependability
- Fiscal Condition
  - Fare Structure
  - Farebox Recovery
  - Productivity
- Passenger Comfort
  - Waiting Shelters/Benches
  - Bus Stop Signs
  - Revenue Equipment
  - Public Information

The standards can be used to assess existing service on an on-going basis to ensure the continued efficiency and performance of the system into the future. They can

also be used to analyze new proposed service; proposals that cannot meet the service standards may not be warranted.

Adequacy Analysis

The existing service was analyzed based on the proposed service standards and guidelines developed in the previous section. The performance of each route was compared to the appropriate standard in each of the four categories to identify inadequacies in the existing service that provide opportunities for major improvements. In general it was found that most routes in the GRTC system meet the majority of the proposed standards. Wherever instances of inadequate performance are identified, the individual circumstances must be examined to determine what, if any changes should be made.

In the Service Coverage category most GRTC routes met the proposed standards providing service when and where passengers want it. Only a limited number of instances were found that did not meet the availability, span or frequency standards. Only directness was found to be an issue, with twelve routes not meeting the service standard. This may be due in some part to the structure of Richmond's street network, but each of these routes should be examined for potential re-routings that would provide a more direct, and therefore faster, trip for passengers.

In the category of Patron Convenience, the GRTC system meets most of the proposed standards, with a few instances of inadequate service found in each subarea. Speed and Loading are generally within the standards, although a few instances of overcrowding were found during some of the peak periods. The system currently exceeds the standard for bus stop spacing, which has both positive and negative consequences as increased convenience in accessing the system may be offset by slower speeds.

The Fiscal Condition category analyzes the financial performance of individual routes and highlights the poorly performing routes. There are many routes (mostly local routes) that fall into the "problem" category for both Farebox Recovery and Productivity. Improved performance in these areas is important in order to maintain the fiscal success of the GRTC system.

From the perspective of Passenger Comfort, there are several areas of concern where inadequacies were found. Passenger shelters need to be installed at more than 40 bus stops that meet the proposed threshold. In addition, passenger information is a major concern as no route information is available at bus stops, no system-wide map is available to passengers and the Ride Guide is complex and can be overwhelming to read. Addressing these deficiencies is recommended to improve the customer experience and attract new riders.

Phase I: Route Recommendations

Based on all of the analyses conducted to date, discussions with GRTC staff and management and field visits throughout the service area, a series of recommendations have been developed that help meet a variety of goals, including:

- Simplify the route structure to make it more understandable
- Increase service frequencies to the neighborhoods
- Provide service to new destinations with passenger demand
- Increase efficiency and productivity of each route
- Eliminate redundant/unnecessary service

In addition to these generalized recommendations, each route was analyzed based on its performance in all of the previously completed data collection and analysis efforts to provide specific recommendations about routing, frequency and service span for each route.

Phase II: Transfer Center Plans

As part of the analysis, transfer patterns were analyzed across the service area, with a particular focus on removing unnecessary transfers from Broad Street in the downtown core. Based on an analysis of the route structure, the land use patterns and available parcels of land, five potential sites for transfer centers were identified:

- Downtown Transit Centers
    - Broad Street Transfer Center in the vicinity of 2nd and Broad Streets
    - Main Street Station Transit Center near Grace/Franklin/Ambler/17th St
- Neighborhood Transit Centers
    - Willow Lawn Transit Center
    - Southside – Downtown Transit Center near Hull St & Commerce Rd
    - South Side Plaza Transit Center near Hull St & Belt Blvd

Conceptual designs for these Transit Centers were developed in addition to some basic programmatic requirements. Two options were considered in this phase: Option A, which includes both downtown transfer centers and Option B which includes only the Broad Street Transfer Center. For both options, plans were developed for modifications to each of the routes from Phase I to ensure that they connect with the appropriate Transfer Centers.

Phase III: Bus Rapid Transit

As transit service in the Richmond area continues to evolve, an opportunity exists to implement Bus Rapid Transit (BRT) along the Broad Street corridor between Willow Lawn and Rocketts Landing, with a possible extension in the future to Short Pump in Henrico County. BRT is a new system that combines unique transit vehicles, special

transit stations and features like dedicated bus lanes and priority signals to speed passengers along existing roadways. A BRT line would offer a high-quality high-capacity transportation solution for one of the busiest corridors in the Richmond area. It would move more people at higher speeds with less congestion than traditional bus service. BRT in the Broad Street Corridor would connect the transit centers developed as part of Phase II of this report. Other advantages of a BRT system include:

- Supports revitalization of downtown areas;
- Improves commutes and quality of life for users;
- Lowers green house gas emissions;
- Improves land use opportunities; and
- Reallocates vehicle resources to better serve Richmond's neighborhoods and important destinations.

Specific routing, headway and stop recommendations are made for this potential addition to the GRTC system.

Implementation Plans

General implementation plans were developed for each phase of recommendations that outline the basic steps that will be necessary to enact the recommended changes. For phase I, the routing changes were grouped according to priority and ease of transition to outline in what order the changes should be implemented. For phase II, an outline of the steps that will be necessary for GRTC to select, design and construct a new transfer center (or multiple transfer centers) and to implement the necessary routing changes. The Phase III implementation plan outlines the basic steps that will be necessary to design, fund, construct and operate a Bus Rapid Transit line in a short time frame.

Conclusion

The observations presented in this executive summary offer a glimpse at some of the most important findings revealed through the analyses of the GRTC system. These findings, along with the complete evaluation, identify aspects of the bus network that require consideration of service changes when planning future service. The operation of any transit system requires balancing the needs of riders, the taxpaying public, the transit operator, local governments, and funding sources. It can be a challenging task to build stakeholder consensus within the funding constraints imposed on transit systems. GRTC has managed to find success in this difficult situation and continuously increase its ridership by refining and improving service within its budget. Sustaining this success in the future will require constant reevaluation of the service offered compared to the ridership demand. Undertaking a COA is an important step in evaluating all aspects of the system to ensure that GRTC is operating the most efficient system possible that is capable of meeting the transportation needs of as many regional residents as possible.

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GRTC System

Introduction

Transportation plays an essential role in allowing residents to access the myriad goods, services, and opportunities available throughout the greater Richmond region. At one time, communities were small enough or dense enough that residents could walk or take public transportation to the places they needed to go. The general availability of personal automobiles helped drastically change the development patterns of most communities, including metropolitan Richmond. Owning a car provided people with the flexibility to travel farther distances in shorter amounts of time. Families and businesses began to spread out as they relocated to cheaper land outside of the old urban core where they could build larger homes and stores with abundant parking. As development spread out, having access to a reliable mode of transportation became all the more important. As the country has grown, even more goods, services, and opportunities exist, but only for those with the ability to travel to and from the places where they are available. For those who do not own or have access to a car, public transportation is often the only means to take advantage of this multitude of opportunities.

The Richmond region's public transportation history spans stretches back to 1860, when the Richmond Railway was first organized. Over the next 140 years, transit has grown and adjusted to meet the evolving transportation needs of the region. In 1888, the Richmond Union Passenger Railway Company began operating its first electric streetcar line. Although ownership of the streetcar system changed hands on multiple occasions, they operated continuously until 1949 when buses replaced the last electric streetcars. Since 1949, buses have served as the primary transit mode in Richmond and the surrounding counties. Control of the bus system shifted hands several times before the Greater Richmond Transit Company was incorporated and assumed control of the bus system in 1973.[1] Under GRTC's guidance, the bus system has become more robust than ever, covering more of the region and providing programs accommodating a greater share of the population. Over the course of

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1 Greater Richmond Transit Company at http://www.ridegrtc.com/FrontEnd/HTML/index.html. Accessed on January 23, 2007.

Richmond's public transportation history the operators have changed, the routes have changed, and even the service delivery mechanism has changed, but one thing has remained the same: Richmond-area residents have always been able to rely on public transportation to access destinations throughout the region.

The region's consistent commitment to public transportation is one of the many things that contribute to the high quality of life that has made Richmond Metropolitan Area one of the fastest growing regions in Virginia.[2] Maintaining this valuable community resource requires constant evaluation of the GRTC bus system. To ensure that the bus system is providing the best and most appropriate service possible, GRTC has undertaken a comprehensive operations analysis (COA). A COA critically evaluates all aspects of a transit agency's service and reconsiders how best to provide transit service to a community. GRTC has proven that its bus system is successful, especially over the past three years as it has attracted more and more riders each year. While this consistent ridership growth is a sign of success, it is also an important reminder that there are always more transit trips to serve if the conditions are correct. This COA looks to identify GRTC's successes while highlighting new and innovative ways to align bus service with residents' transportation needs.

At the core of a COA is information regarding how well a transit system performs in its own eyes, the eyes of its riders, and the eyes of all residents living in its service area. This process entails collecting data on ridership and the characteristics of current riders, the performance of each of the routes, and the opinions of non-users regarding GRTC service. The findings of these evaluations highlight what the service is doing right and what it could be doing better. From these findings a series of recommendations has been developed to place GRTC on an even stronger footing as it faces increasing regional demands for providing residents with transportation options.

System Overview

The Greater Richmond Transit Company (GRTC) incorporated in 1973, took control of Richmond's existing bus system from American Transportation Enterprises Incorporated. GRTC is a public service company owned equally by the City of Richmond and Chesterfield County.

GRTC operates an urban-suburban bus system serving the City of Richmond, Chesterfield County, and Henrico County. Additionally, GRTC operates several routes serving Virginia Commonwealth University (VCU) located in downtown Richmond. Both Henrico County and VCU purchase services from GRTC. In total,

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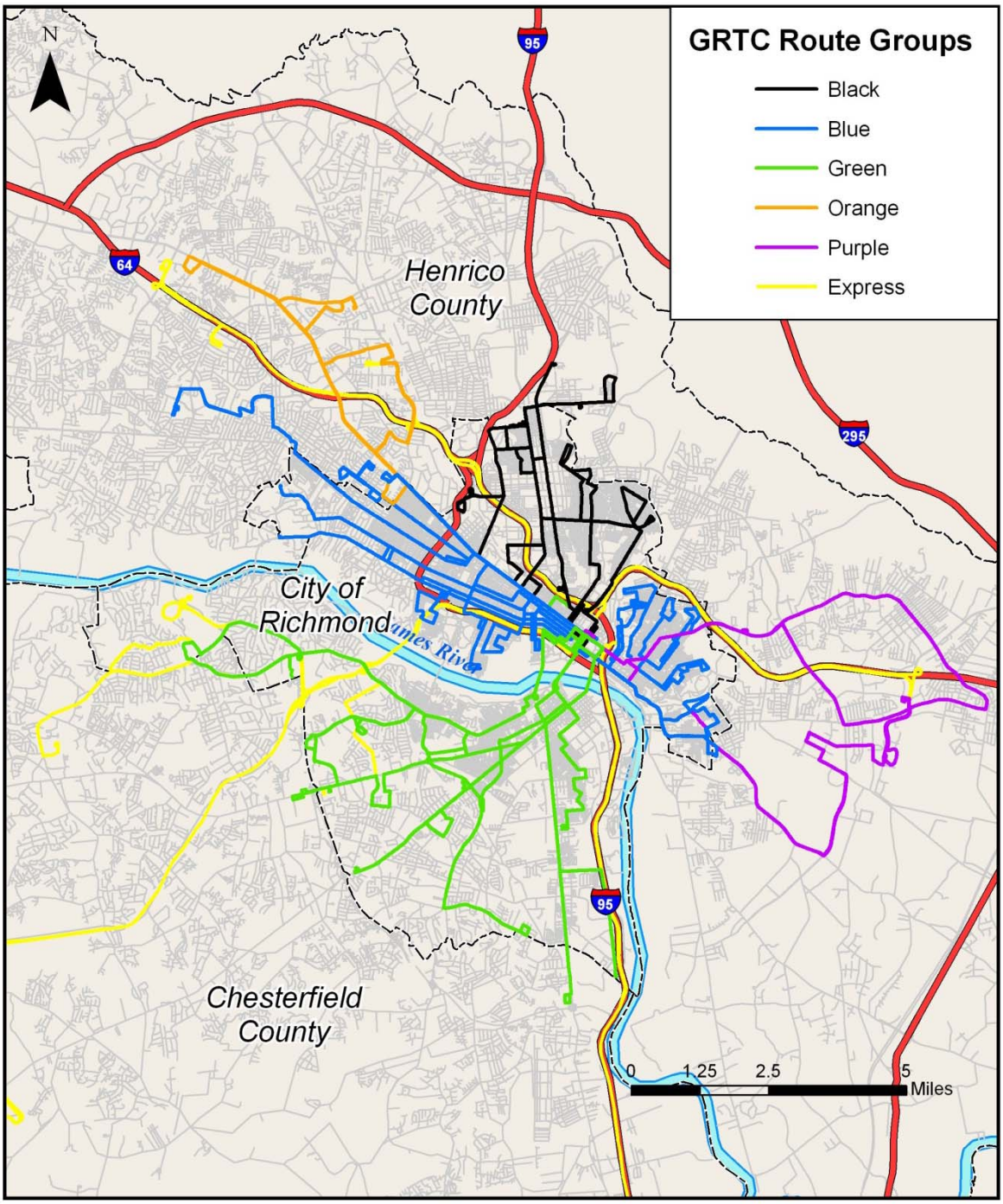
2 Weldon Cooper Center for Public Service, Demographics & Workforce Section. "Estimates of Population for Virginia & its Localities, Final 2005 & Provisional 2006," January 22, 2007. http://www3.ccps.virginia.edu/demographics/estimates/2006/0-main.html. Accessed on January 24, 2007.

GRTC uses a bus fleet of 169 buses to operate 34 regular local and express routes, a lunchtime express loop, an express route to Fredericksburg and 3 VCU routes.

Figure 1: GRTC Bus System



GRTC Bus Route Groups

Source: Greater Richmond Transit Company and 2000 Census.

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GRTC's bus route structure can largely be classified as a hub-and-spoke system, where service converges on a central downtown area—near Richmond City Hall and the VCU medical campus—and then fans out into the surrounding neighborhoods. This service pattern is especially useful in traditional mono-centric cities like Richmond, where much of the activity is still focused in a downtown core. Based on the areas each route serves, GRTC has coded each local bus route into five color groups. As of August 27, 2006, GRTC operated routes:

- **Blue**: Routes 1, 2, 3, 4, 6, 10, 11, 13, and 16 – serving downtown, the Fan district, Church Hill, and portions of the West End south of Broad Street
- **Purple**: Routes 7 and 56 – serving the East End including Richmond International Airport
- **Orange**: Routes 18 and 19 – serving portions of the West End north of Broad Street
- **Black**: Routes 20, 22, 24, 32, 34, 37, and 93 – serving the North Side and portions of the West End north of Broad Street
- **Green**: Routes 61, 62, 63, 67, 70, 71, 72, 73, and 74 – serving the Southside

Additionally, GRTC operates 10 express bus routes to Henrico and Chesterfield counties. These express routes provide direct service from the surrounding residential areas in the outlying counties to downtown Richmond with few stops in between. These routes are especially geared towards commuters. Four of these routes have dedicated park-and-ride facilities that offer commuters the ability to drive to a parking lot directly served by a GRTC bus. GRTC also operates a longer distance express route serving Fredericksburg. Finally, there are three GRTC bus routes that serve the VCU campus. Although these buses are open to the general public, their routes are specifically tailored to the needs of the VCU community.

All buses operated by GRTC are equipped with wheelchair lifts. GRTC is also in the process of increasing the number of low-floor buses in its fleet. These accommodations in combination with drivers' specifically trained to help disabled and senior riders make the GRTC system widely accessible. For riders who are unable to use fixed-route service, GRTC offers paratransit service through the CARE program. CARE provides curb-to-curb service for eligible riders in the City of Richmond, Henrico County, and portions of Chesterfield County. Eligibility for the program is dictated by the Americans with Disabilities Act (ADA).

GRTC also offers transportation assistance for Virginia Initiative for Employment not Welfare (VIEW) participants through the Central Virginia Assistance Network system (C-VAN). This program was designed in conjunction with the Department of Social Services (DSS) to remove transportation as a barrier to employment. C-VAN services include curb-to-curb service through public transit and shared-ride services to work and daycare facilities. Eligible participants must be referred to C-VAN by their local DSS.

Each of these services provided by GRTC charges a different fare to riders. Local bus routes cost $1.25 per one-way trip. Riders age 65 or older, who have certain disabilities, and registered CARE customers are eligible for a reduced fare of $0.50 on local routes. Express routes and Route 19 cost $1.75 per one-way trips. One-way trips provided through the CARE program cost riders $2.25 per trip. Transfers may be purchased at the time a rider's fare is paid for $0.15 to transfer to a local route and $0.50 to transfer to an express route. Payment is limited to exact cash fare, prepaid Go Cards, or CARE tickets available in books of six.

For the purpose of this analysis, evaluation will be focused on the core of the fixed-route system in operation at the initiation of this study: the 24 local and 10 express bus routes published in the August 27, 2006, GRTC schedules and the long-distance express route to Fredericksburg (Route 96). Focusing on these routes will provide a critical assessment of the bus service available to the general population to travel within the greater Richmond region. This analysis will also help identify opportunities for expanding core local and express service within the region.

Service Characteristics

GRTC operates a robust transit system through the provision of both local and express bus routes. The local service routes operate up to 20 hours a day, 7 days a week and provide service within the Richmond urban core and adjacent dense residential areas in Henrico County. The suburban express routes operate much less frequently—often only providing weekday peak period service—supporting commuters that live in the outer suburbs and work in the central businesses district (CBD). As the two route types have been developed to service different transit markets, the service spans associated with these route types differ. In general, the local routes operate much longer during the day and have weekend service except in Henrico County, while the express routes do not provide weekend service and offer a truncated service span.

In addition to the service span differences between the two route types, bus frequency within each route type vary as well. For example, Route 1-2 Monument-Patterson-Church Hill is a local route that operates approximately 20 hours a day and has approximately 70 buses in the eastbound direction. Similarly, Route 10 Riverview-Jefferson is a local route that operates approximately 20 hours a day but only provides 55 buses in the eastbound direction.

While a route's average headway is a function of bus frequency and service span, headways for both the local and express service vary by time of day. Therefore, the average headway for each route was stratified into six different time periods. The early morning time period is from start of service until 7 a.m., the AM peak time period is from 7 a.m. to 9:30 a.m., the Base is from 9:30a.m. until 4 p.m., the PM peak from 4pm-6pm, the Evening from 6 p.m. until 9 p.m., and the Night from 9 p.m. until close.

In order to provide as much information as possible to understand route capacities and boarding/alighting data, Table 1 was developed to show the service span for each route (i.e., 5 a.m. to 12:30 a.m.), the total hours operations are in service (i.e., 20 hours), and the total buses in the east and westbound directions. Table 2 shows the average headways for the six time periods by route.

Table 1: Service Span

	Weekday				Saturday				Sunday			
Route	**Time Frame**	**Total Hours**	**East Buses**	**West Buses**	**Time Frame**	**Total Hours**	**East Buses**	**West Buses**	**Time Frame**	**Total Hours**	**East Buses**	**West Buses**
1-2	5am-12:45am	19.75	70	73	5am-12:30am	19.5	52	52	5:30am-12:45am	19.25	40	39
3-4	5:15am-1am	20.25	85	86	5:15am-1am	20.25	68	64	5:45am-1am	19.75	49	50
6	5am-11:30pm	18.5	80	84	5am-11:30pm	18.5	54	52	6am-11:30pm	17.5	34	34
7	6:15am-7:30pm	13.25	22	25	no service				no service			
10	5:15am-1am	20.25	55	55	5:30am-1am	19.5	41	41	6am-1am	19	42	42
11	6:30am-6pm	11.5	16	16	9am-4:15pm	7.25	5	4	no service			
13	5:15am-7:30pm	14.25	20	20	5:15am-7:30pm	14.25	19	19	no service			
16	5:30am-10:30pm	17	44	39	5:30am-10:30pm	17	16	15	6:24am-10:30pm	16	15	15
18	6:45am-7pm	12.25	13	13	no service				no service			
19	6am-7:15pm	9	10	7	no service				no service			
20	6:30am-4:30pm	3	4	3	6:30am-4:30pm	3	4	3	no service			
22	5:30am-11:15pm	18	24	24	6am-11:15pm	17.25	13	13	6am-11:15pm	17.25	13	13
24	5:45am-10:45pm	17	26	26	6am-10:15pm	16.25	17	17	6am-9:15pm	15.25	15	15
32	5:15am-12:45am	19.5	74	77	5:15am-12:45am	19.5	69	70	5:15am-12:45am	19.5	40	41
34	5am-12:00am	19	68	69	5:15am-12:00am	18.75	53	52	5:30am-12:am	18.5	47	47
37	5:45am-12:30am	18.75	45	45	5:45am-12:30am	18.75	32	32	6:30am-1am	18.5	22	20
61	no service				5:45am-6:45pm	9.5	11	11	6am-6pm	8.5	7	7
62-63	5am-12:30pm	19.5	94	92	5am-12:30am	19.5	68	70	5:15am-12:45am	19.5	38	38
70-71	5:30am-11:30pm	18	45	42	6am-11:30pm	17.5	30	31	6:15am-11:45pm	17.5	30	32
72-73	5:30am-1am	19.5	50	49	6am-1am	19	19	18	6am-1am	19	19	18
74	5:15am-12:30am	19.25	38	38	5:15am-12:30am	19.25	29	29	6:15am-12:30am	18.25	18	18
64	6:15am-6:30pm	5.5	See "Headways"	See "Headways"	no service				no service			
65	6:00am-10pm	12	See "Headways"	See "Headways"	9:15am-9:30pm	12	See "Headways"	See "Headways"	11:15am-6:30pm	7.25	See "Headways"	See "Headways"
66	6:45am-6:15pm	4	See "Headways"	See "Headways"	no service				no service			
67	7am-6:30pm	4	See "Headways"	See "Headways"	no service				no service			
69	6:45am-6:30pm	3.5	See "Headways"	See "Headways"	no service				no service			
26	6:30am-6:15pm	8	See "Headways"	See "Headways"	no service				no service			
27	7am-6:15pm	7	See "Headways"	See "Headways"	no service				no service			
28	7am-6:15pm	4.25	See "Headways"	See "Headways"	no service				no service			
29	6:30am-6:15pm	7.5	See "Headways"	See "Headways"	no service				no service			
82	5:45am-6:15pm	4.5	See "Headways"	See "Headways"	no service				no service			
95	5:30am-7:15pm	7.5	See "Headways"	See "Headways"	no service				no service			
56	6:15am-5:45pm	4.25	6	7	no service				no service			
93	6:45am-7pm	8.5	17	17	no service				no service			

Table 2: Service Frequency in minutes

	Early Mornings			AM Peak			Base		
Route	**Weekday**	**Saturday**	**Sunday**	**Weekday**	**Saturday**	**Sunday**	**Weekday**	**Saturday**	**Sunday**
1-2	16	17	23	12	20	25	15	20	26
3-4	9	15	22	10	15	23	14	15	22
6	15	18	27.5	10	18	30	12	18	30
7	23			35			37		
10	17	27.5	30	18	27	25	21	27	25
11				60	1 trip		30	4 trips	
13	40	40		45	45		45	45	
16	28	60	60	20	70	65	24	65	65
18				55			60		
19				3 Trips			3 trips		
20				2 trips	2 trips				
22	33	60	60	33	67	67	33	62	62
24	34	60	60	36	60	60	40	60	70
32	9	20	25	10	19	30	20	20	30
34	18	17	22	11	17	23	18	25	23
37	16	32	56	17	33	40	28	33	60
61		2 trips	1 trip		3 trips	2 trips		4 trips	2 trips
62-63	12	20	30	9	15	30	15	15	30
70-71	18	40	60	22	32	40	20	45	30
72-73	20	60	60	20	60	30	30	60	45
74	18	33	60	18	35	60	36	35	60
64	2 trips			3 trips			1 trip		
65	3 trips			1 trip			3 trips	60	6 trips
66	1 trip			2 trips					
67				5 trips					
68							10		
69	1 trip			2 trips					
26	2 trips			8 trips			2 trips		
27	1 trip			5 trips			2 trips		
28	1 trip			3 Trips					
29	2 trips			6 trips			3 trips		
82	3 trips			2 trips					
95	2 trips			4 trips			2 trip		
56	30			35					
93	30			30			30		

Table 2: Service Frequency in minutes (Continued)

	PM Peak			Evenings			Night		
Route #	**Weekday**	**Saturday**	**Sunday**	**Weekday**	**Saturday**	**Sunday**	**Weekday**	**Saturday**	**Sunday**
1-2	11	20	32	14	27	32	30	30	34
3-4	9	15	22	16.5	17.5	26	22	21.5	22
6	10	18	30	18	25	35	36	40	38
7	24			25					
10	17	27	25	20	29	25	25	25.5	29
11	2 trips								
13	30	45		50					
16	18	70	70	30	60	65	60	75	75
18	60								
19	2 trips			2 trips					
20	1 trip	1 trip							
22	33	62	62	31.5			1 trip	1 trip	1 trip
24	30	60	60	47	60	60	60	70	
32	10	12	30	16	18	28	18	20	26
34	11	17	23	23	23	25	25	25	23
37	17	33	60	29	32	60	33	43	60
61		2 trips	2 trips						
62-63	8	15	30	16	20	30	25	32	30
70-71	20	30	30	40	45	45	40	60	60
72-73	20	36	30	20	41	36	25	65	39
74	22	35	60	30	40	60	60	60	60
64	5 trips			2 trips					
65	1 trip	60	2 trips	2 trips	60	1 trip		1 trip	
66	3 trips								
67	5 trips								
68									
69	3 trips								
26	10 trips								
27	9 trips								
28	4 trips								
29	7 trips								
82	4 trips								
95	3 trips			1 trip					
56	35								
93	30			30					

Paratransit Service

For those customers who are unable to use fixed-route transit service, GRTC provides demand responsive paratransit service through the Community Assisted Ride Enterprise (CARE) program. CARE provides shared-ride, curb-to-curb service to ADA eligible riders within the City of Richmond, Henrico County and portions of Chesterfield County. Care operates seven days per week in the City of Richmond, but only between the hours of 6 am and 7 pm on weekdays in Henrico and

Chesterfield Counties. Each one-way trip costs $2.25 and must be reserved at least one day in advance. The service also accepts standing reservations for commuters.

CARE operates a fleet of 60 vehicles with seating capacities of 8 to 12 people. All of the vehicles can accommodate a wide range of mobility aids including wheelchairs, walkers, crutches, canes and guide dogs. Two-thirds of the vans were purchased in 2006, while the remainder is from 2000.

Ridership and Trips

CARE receives almost 20,000 reservations during an average month of which 17% are cancelled and less than 4% are "no-shows" where the passenger did appear within 5-minutes of the vehicle arrival.

The majority of CARE's ridership occurs within the City of Richmond, with just over 30% occurring in Henrico County. An average month since July, 2004 had a total of 17,000 riders: over 5,000 in Henrico County and over 11,500 in the City of Richmond. In addition to the 17,000 ADA eligible passengers, an additional 86 people are transported as guests and caregivers. The majority of trips occur during the week, with less than 5% occurring on the weekend when service is only available in the City of Richmond. Most of the passengers transported by the CARE service are ambulatory; only 17% are identified as non-ambulatory.

The CARE system runs approximately 150,000 miles during an average month; over 85% of the miles traveled are providing revenue service. An average of three vehicle accidents occurred each month, the majority of which are minor. On average there are 2 passengers per revenue hour on the CARE system and 0.12 passengers per revenue mile. The average trip length per passenger is over nine miles.

System Performance

On-time arrivals and departures are elements of extreme importance to riders of any paratransit system. With the type of shared-ride service provided by CARE timeliness is difficult to ensure as the needs, timing and destinations of multiple passengers must be accommodated at once. Because of the nature of the service, departures from scheduled pick-up locations are given a thirty-minute window to qualify as on-time (the scheduled pick-up time plus or minus fifteen minutes). This requires the passenger to be ready to leave fifteen minutes before the scheduled time, and can require them to wait up to 30-minutes for the vehicle to arrive. With this generous window, 87% of trips are on-time in an average month. Of these late trips, almost 20% are more than 30-minutes late (more than 45-minutes after the scheduled pick-up time).

Trip lengths are even harder to dictate on this type of shared-ride service because other customers may be picked up and dropped off along the way. A predictable, short trip is desirable and CARE uses the cutoff of one-hour to determine when a trip has been excessively long. (The cutoff point was 90 minutes before additional vans were added to the fleet.) In an average month, 3.5% of passenger-trips were on-board the vehicle for longer than one-hour.

Customer Service

Since December of 2005, CARE has received an average of over 13,000 calls per month. On average, each month, approximately 10%, or 1,300 calls, are abandoned and not answered.

Data regarding customer complaints and commendations is available for most of Fiscal Year 2006 (October through July). More than 25 complaints were received during every month in this time period, with almost 100 in the month of March. On average, 50 complaints are received every month although less than half of those are "valid complaints." In only two months did the number of commendations outnumber the valid complaints, with the system receiving eleven commendations in an average month. While customers are more likely to communicate their complaints instead of their praise, these statistics do indicate a relatively high incidence of complaints.

Regional Demographics

An examination of the region's spatial distribution of population and households in relation to the GRTC bus network provides a foundation for evaluating how existing transit service matches the regional population's transportation needs. In particular, a regional demographic analysis of persons and households with transit-dependent characteristics will help identify the areas within the region with high potential demand for transit service and if they are currently covered by bus routes. Although demographic analysis cannot determine the exact need for GRTC buses, it provides important evidence for locations that could support new or more extensive bus service.

Demographic data from the 2000 US Census reveal a number of transit-dependent persons in the greater Richmond area. The ridership demand for a transit system is typically correlated to several demographic characteristics. High densities of persons demonstrating these demographic characteristics indicate areas with potentially high demand for transit service. There are five indicators of transit dependence collected through the US Census long form: living below the poverty line, having a mobility limitation, being age 65 or older, and living in a household with either no or one vehicle. Persons falling into one or more of these categories may have difficulty

accessing major destinations—medical facilities, government offices, employment centers, shopping areas, etc.—without adequate transit service.

Assessing GRTC's current network of bus routes requires examining how effectively the existing routes cover locations in the region with concentrations of citizens most likely to rely on the service. Through the use of geographic information systems (GIS) software, the GRTC bus routes were overlaid on regional demographic maps (Figure 2 through Figure 8). This spatial evaluation reveals common service gaps that should be considered for service improvements.

Regional Density

In general, the regional population and the GRTC bus system are concentrated in and around downtown Richmond, especially in the West End areas of the Fan District and Carytown and the northside neighborhoods near the border with Henrico County (see Figure 2). As the regional locus, these areas have the highest population densities (seven persons or more per acre) and extensive bus service. The downtown core has a slightly lower population density, complemented by a very high concentration of jobs. In the downtown core, the outskirts of Richmond and the proximate portions of Henrico and Chesterfield counties, the population density tapers off but remains above average for the region (three to six persons per acre). The areas outside of downtown with the highest densities generally fall into one of two broad corridors radiating from downtown: one to the northwest and one to the southwest. Both of these corridors are served by GRTC bus routes, although the route network is less extensive than in downtown and is focused primarily on transporting riders to and from the urban core. The majority of the remainder of the region has a low population density (less than one person per acre) and almost no transit service corresponding to the rural nature of the outlying counties.

This population-density pattern resembles a bull's eye, with a high-density center encircled by a (mostly) medium-density ring and finally enclosed by a low-density ring consisting of most of the outlying counties. This is a traditional pattern of population density for a monocentric region. Activity is centered in one urban core and decreases the farther one moves from that center to medium-density inner-ring suburbs, low-density outer-ring suburbs, and rural landscape with very low densities.

Household density follows a similar, but less pronounced, pattern as population density (Figure 3). The highest household density is centered downtown in the Fan District and Carytown, with density tapering off from there. The same two broad corridors—northwest and southwest of downtown—have higher densities than the rest of the region. The areas in these corridors generally have access to bus service, but the bus system is not extensive and some portions are unserved.

A recent trend, not apparent in the seven year old Census data, is the increase in density occurring just east of downtown Richmond and extending into Henrico

County along the James River, as abandoned industrial buildings are converted for residential use and new units are constructed.

Demographic Indicators of Transit Dependence

The five indicators of transit dependence—living below the poverty line, having a mobility limitation, being age 65 or older, and living in a household with either no or one vehicle—available through the US Census identify areas within the region that will likely have the highest demands for GRTC bus service. These characteristics are not determinants of transit use, but they are prevalent characteristics for transit users without other transportation options. Many people possessing one or more of these characteristics will not use transit, and many people without any of these traits will use transit. Ultimately, an individual's use of transit service will depend on personal circumstances and choices. Nonetheless, the indicators of transit dependence identify persons and households whose personal circumstances and choices correspond to an above average rate of transit use.

Five maps (Figure 4 through Figure 8) show the spatial distribution of each population with one of the indicators of transit dependence in relation to the GRTC bus network. Viewing these maps makes it evident that some areas with high concentrations of populations expressing one or more of the transit dependent characteristics are better served than others. Although areas identified as having service gaps should be considered for service improvements, not all of the identified areas will be appropriate candidates for service expansions or increases. But taken together, these maps can reveal common areas with high concentrations of populations that generally rely on and benefit from transit service. This analysis helps fill in part of a larger puzzle of where and how GRTC should deliver service. Only once the entire puzzle is pieced together can fully informed service decisions be made.

Persons Living below the Poverty Line

Persons living below the poverty line are primarily concentrated in and around downtown Richmond (see Figure 4). The highest densities of persons living below the poverty line are in downtown and across the river in the southwest portion of the city. These areas have the best transit service in the region. There are also other areas in the southwest and bordering the city in Henrico and, to a lesser extent, Chesterfield counties with relatively high densities of persons in poverty that receive limited or no transit service. In the northwest and southwest corridors, bus routes radiating out from the city leave large tracts of land unserved, especially at the perimeter of the bus network. Areas to the south and northeast of the city boundaries are unserved altogether.

Persons with a Mobility Limitation

The 2000 US Census long form collected information on persons with mobility limitations. The questionnaire asked respondents to identify if they had "a physical, mental, or emotional condition lasting 6 months or more that made it difficult to perform certain activities" including "going outside the home alone to shop or visit a doctor's office (going outside the home disability)."[3] This inclusive definition results in a larger number of people identifying themselves as having a mobility limitation than as having a disability under the Americans with Disabilities Act. This Census measure provides a means for identifying people who would likely need transit or other specialized services to travel on their own.[4]

Densities of persons with a mobility limitation are highest in downtown and just south of the James River in the southwest portion of the city (see Figure 5). These areas have the most extensive transit coverage in the region. There are also multiple areas with relatively high concentrations of persons with mobility limitations on the outskirts of the GRTC system, which have minimal access to routes or lie just beyond the bus system. The areas to the northwest and southwest of the city have broad swaths of uncovered land between bus routes. Land identified with relatively high densities bordering the city on the northeast and the south does not have any transit service.

Persons Age 65 or Older

Persons age 65 or over are primarily concentrated in downtown Richmond, but there are also significant concentrations of this population outside of downtown and even outside of the city. Besides high densities of the elderly population in the southwest of the city, there is also a high elderly population density northwest of the city in Henrico County. This concentration largely falls outside of the current GRTC service area. Also in Henrico County, there is a high concentration of the elderly population just north of the city, which is also outside of the bus network. There are also several other areas ringing the border of the city in Henrico and Chesterfield counties that have above average concentrations of elderly persons and do not receive bus service.

Households with No Vehicle

Areas with above average densities of households with no vehicle are more tightly concentrated within the city and along existing transit routes than some of the other indicators. It follows that people without personal automobiles will likely depend on public transportation at least some of the time. Therefore, these people will often self select to live near existing transit routes. The areas within the city that have the

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3 US Census Bureau, *Housing and Household Economic Statistics Division* "Definition of Disability Differs by Survey," at http://www.census.gov/hhes/www/disability/disab_defn.html#00census. Accessed December 7, 2006.

4 Monmouth County, New Jersey at http://www.shore.co.monmouth.nj.us/06612trans/mon_co.htm. Accessed December 7, 2006.

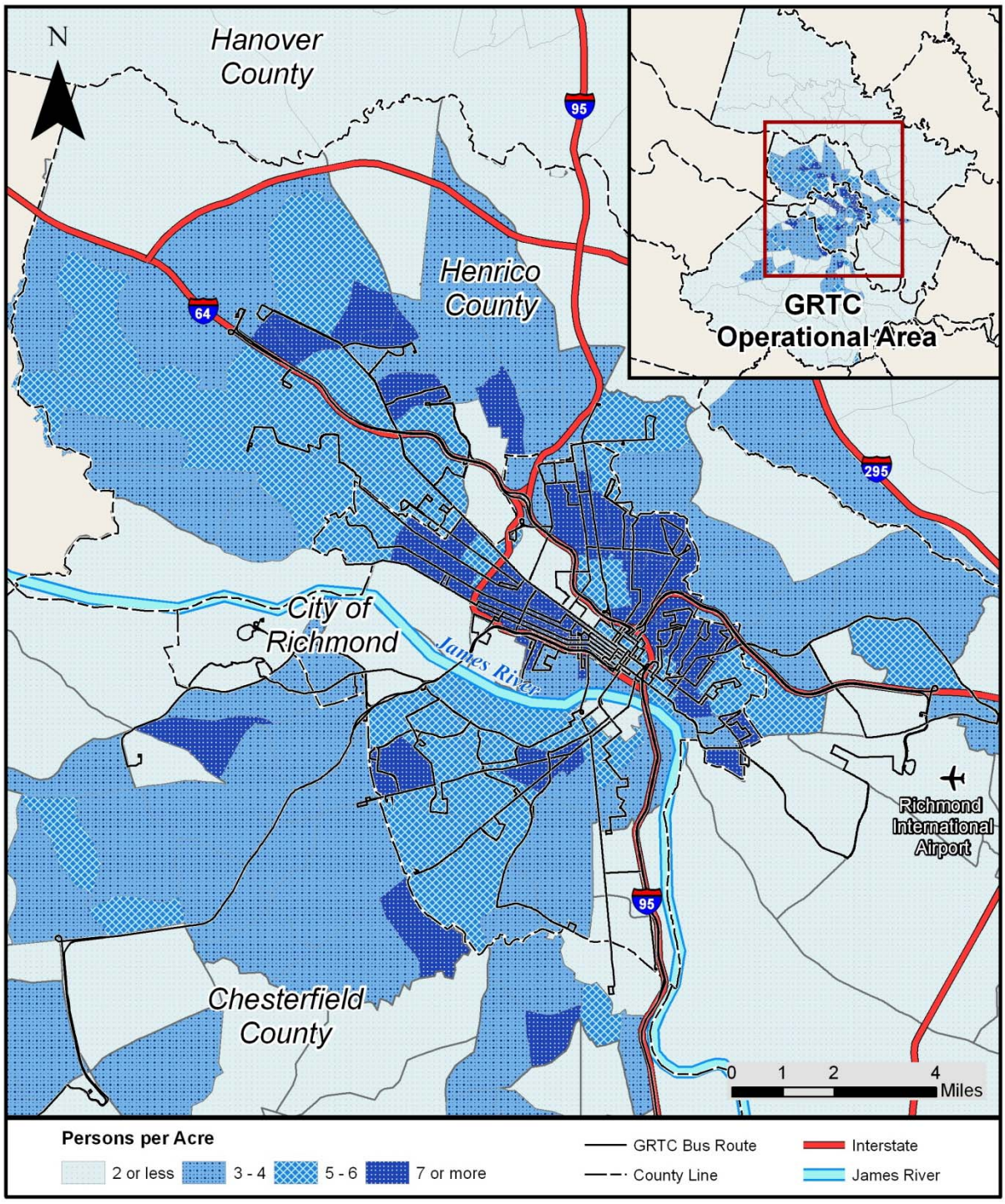
highest concentrations of households without a vehicle also have the most extensive bus route coverage. There is only one small area with a relatively high concentration of households without a private vehicle—just northeast of the city—that does not have any transit service and there are a few portions of the city in the southwest that have limited transit coverage.

Households with One Vehicle

The areas with high densities of households with one vehicle are more dispersed around the metropolitan region than the other indicators, but are still focused in the general vicinity of the city. In addition to the downtown, the highest concentrations are in the two broad corridors radiating northwest and southwest from downtown. There are also several areas in Henrico and Chesterfield counties encircling the city that have above average densities of households with one vehicle that do not have access to GRTC bus service.

Although densities of households with one vehicle can be an indicator for transit dependency, it is a weaker indicator than the others. The mobility needs for average families are growing on a daily basis. Therefore, if more than one person lives in a household with one car, members of the household without access to the car will need to find other ways to get around. In some cases, this transportation demand will translate to transit use. But, this indicator does not take into account two important factors. One, households with one car may only comprise a single individual, who would not be more likely to use transit than a household with multiple vehicles. And two, households with one car still have access to a personal vehicle and can potentially address their transportation needs without relying on transit. With these considerations in mind, this indicator still helps identify areas where at least some people have limited access to personal transportation.

Figure 2: Population Density by Census Tract

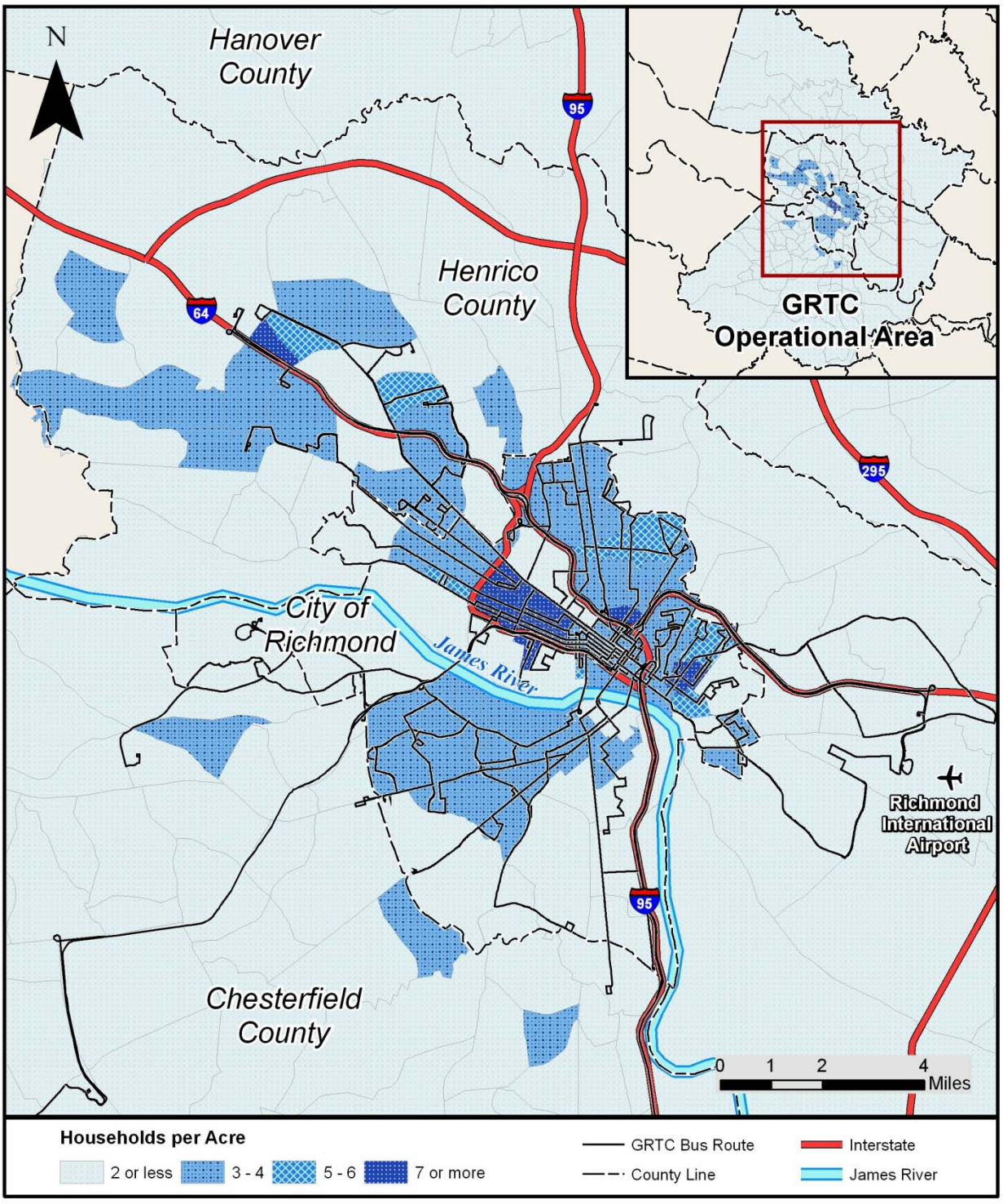


Population Density

Source: Greater Richmond Transit Company and 2000 Census.

Vanasse Hangen Brustlin, Inc.

Figure 3: Household Density by Census Tract

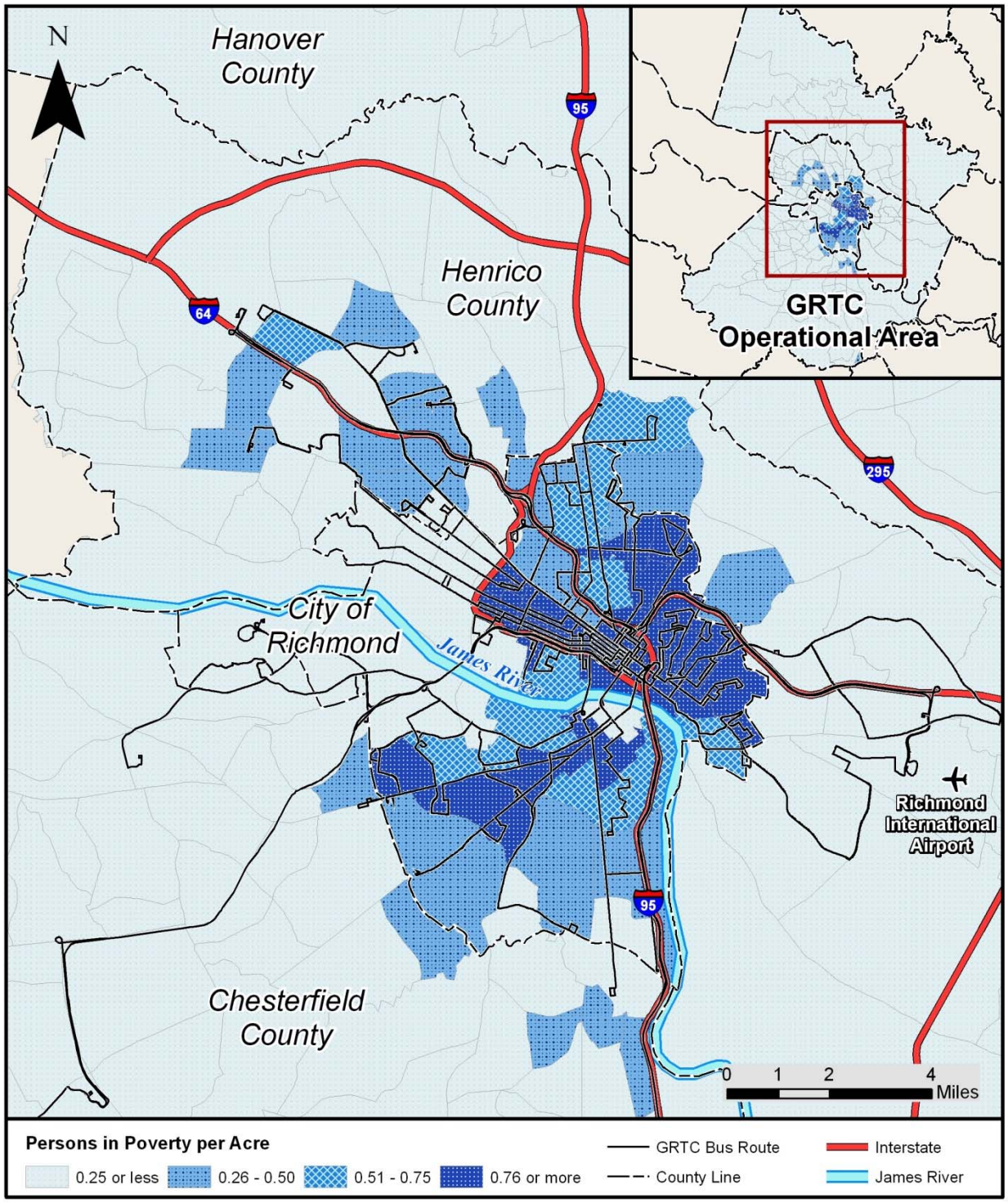


Household Density

Source: Greater Richmond Transit Company and 2000 Census.

Vanasse Hangen Brustlin, Inc.

Figure 4: Density of Persons below the Poverty Line by Census Tract

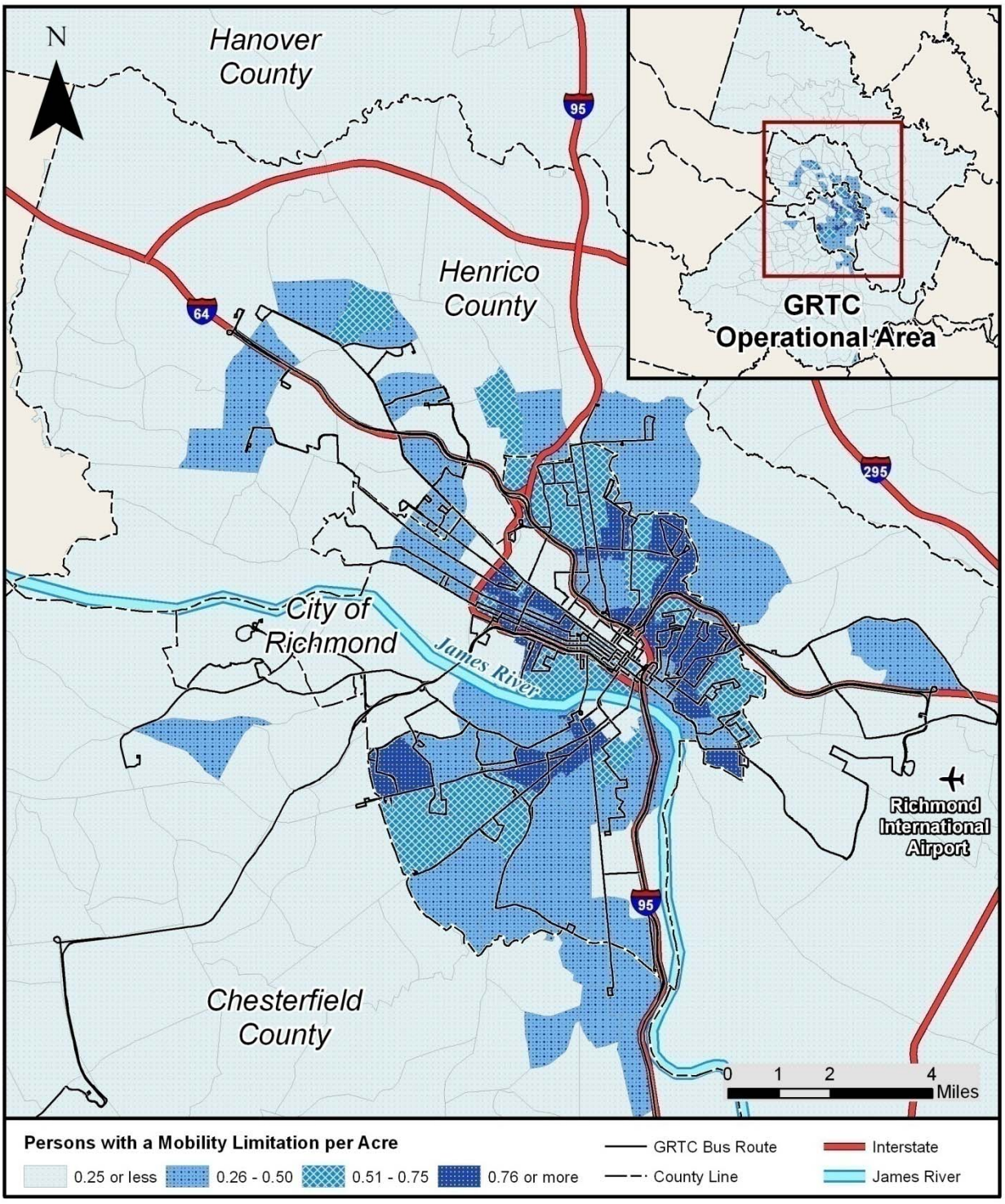


Density of Persons in Poverty

Source: Greater Richmond Transit Company and 2000 Census.

Vanasse Hangen Brustlin, Inc.

Figure 5: Density of Persons with Mobility Limitations by Census Tract

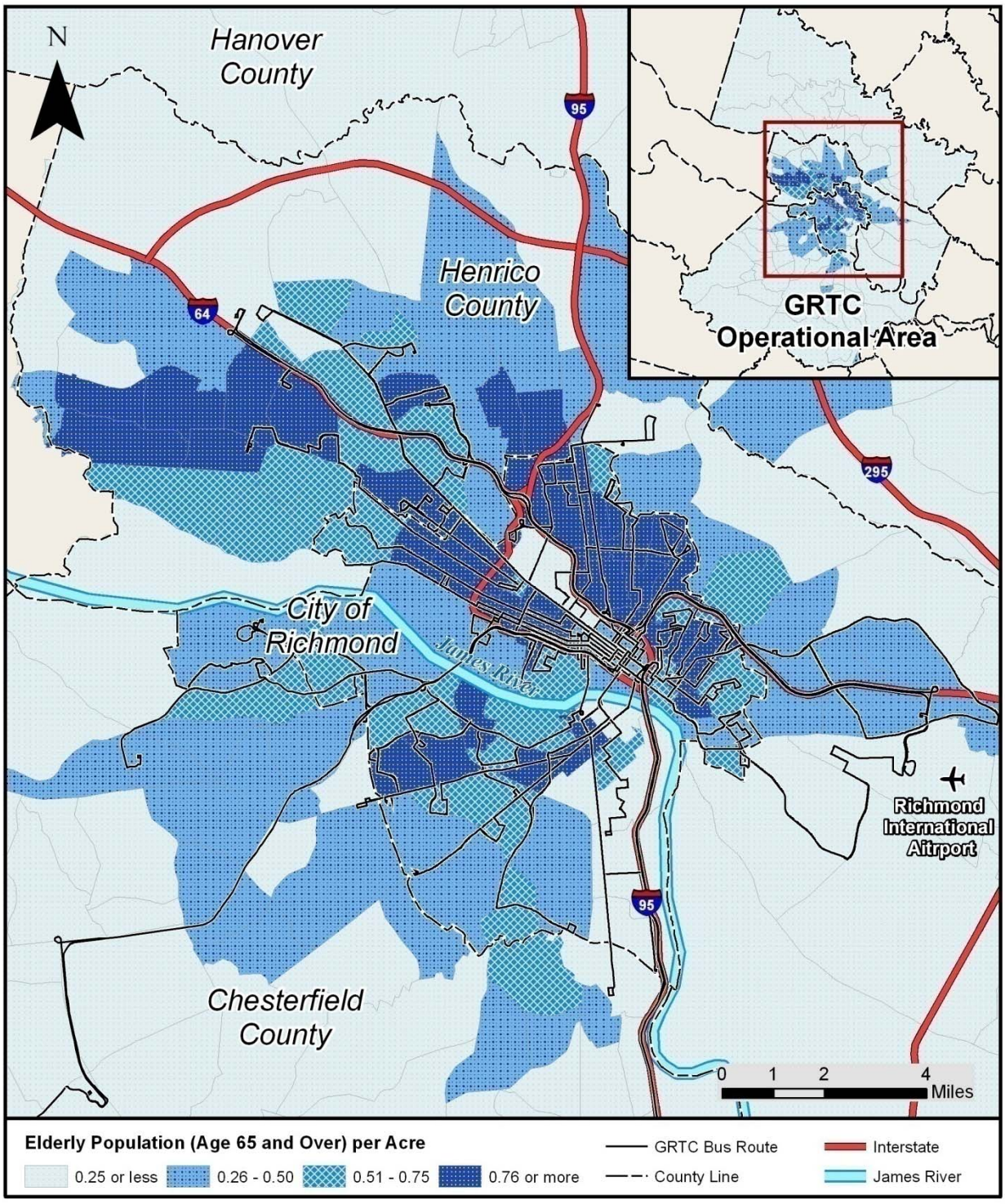


Density of Persons with a Mobility Limitation

Source: Greater Richmond Transit Company and 2000 Census.

Vanasse Hangen Brustlin, Inc.

Figure 6: Density of Elderly Persons (Age 65 and over)

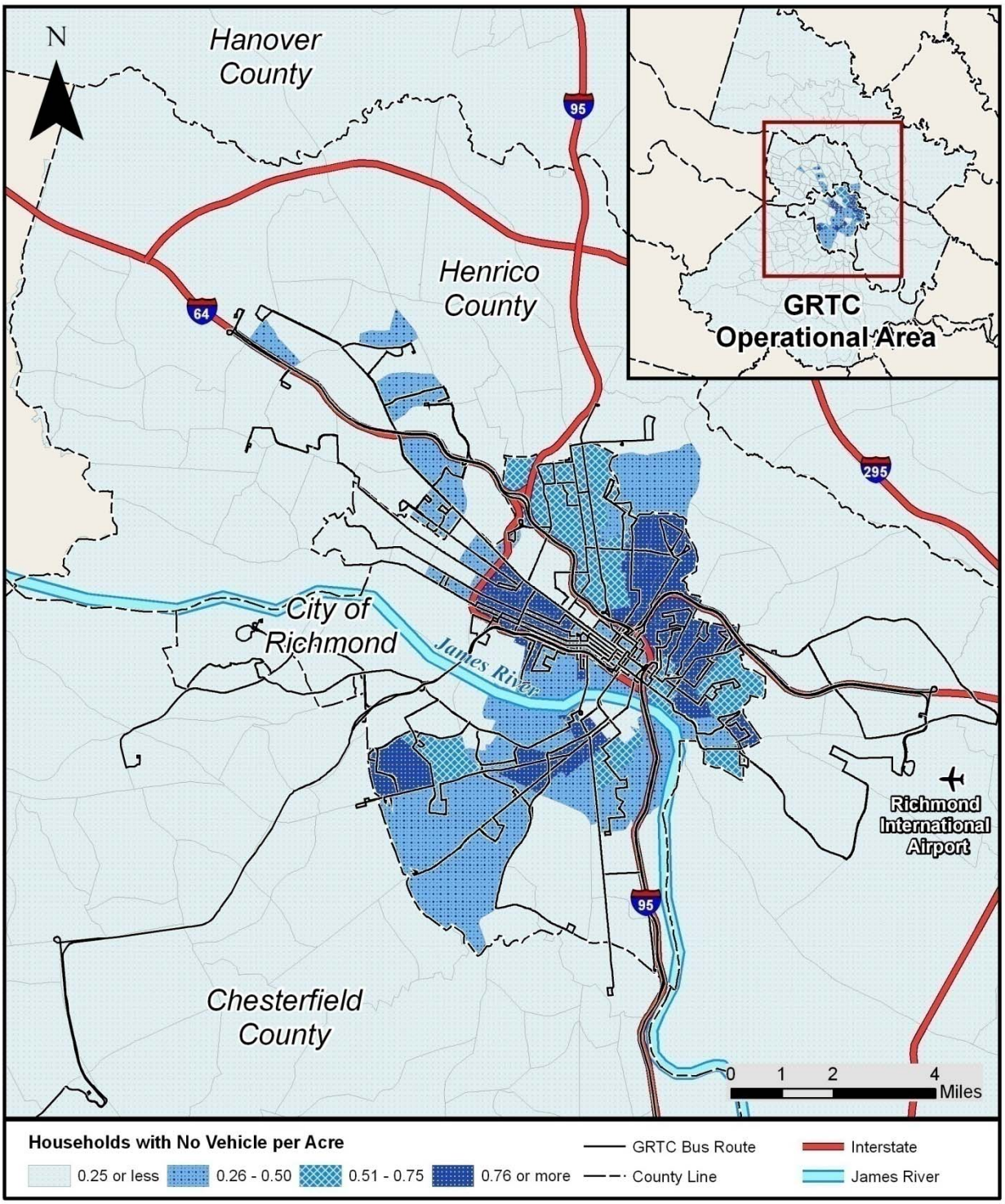


Elderly Population Density

Source: Greater Richmond Transit Company and 2000 Census.

Vanasse Hangen Brustlin, Inc.

Figure 7: Density of Households with No Vehicle by Census Tract

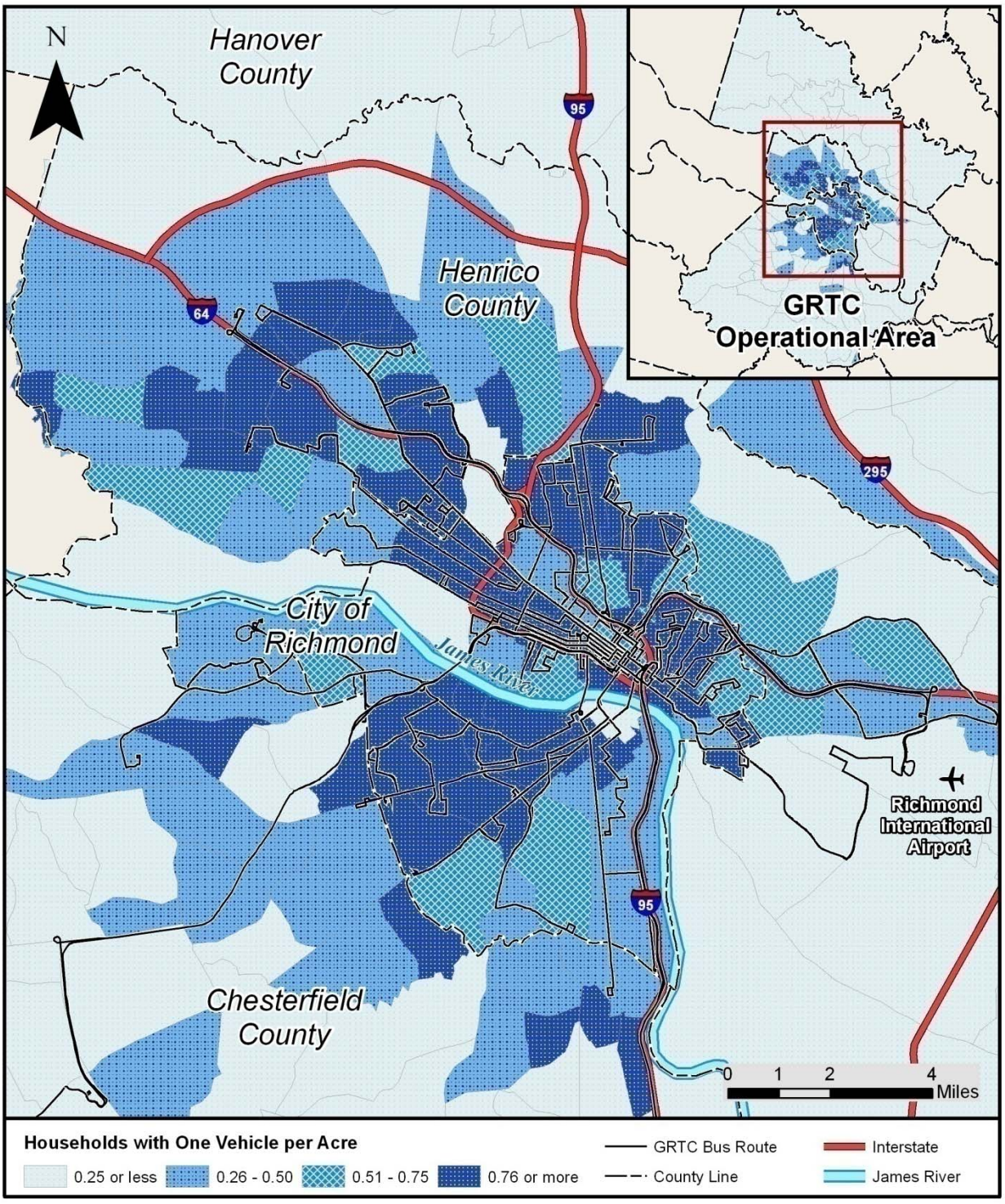


No-Vehicle Household Density

Source: Greater Richmond Transit Company and 2000 Census.

Vanasse Hangen Brustlin, Inc.

Figure 8: Density of Households with One Vehicle by Census Tract



One-Vehicle Household Density

Source: Greater Richmond Transit Company and 2000 Census.

Vanasse Hangen Brustlin, Inc.

Summary Demographic Indicators of Transit Dependence

Spatial analysis using the indicators of transit dependence provides very important information regarding locations with high population densities of people likely in need of transit service. Areas identified as having high concentrations of transit-dependent populations are good contenders for expanded or new fixed-route transit service. For this region, the City of Richmond and the adjacent portions of Henrico and Chesterfield counties have the highest general population and housing densities, which corresponds to the areas with the highest concentrations of population and households with transit-dependent characteristics. But focusing on the spatial distribution of these populations may result in the exclusion of large numbers of people with these characteristics who live more dispersed throughout the region. Therefore, considering the transportation needs of residents in the outlying counties is also an important part in evaluating the existing GRTC service.

Table 3 shows the total number of persons in each transit-dependent category by jurisdiction. In the majority of cases, the City of Richmond has the highest total population in each category, specifically for persons with mobility limitations, persons below the poverty line, and households with no vehicle, which are the strongest indicators of transit dependence. These summary demographics suggest a similar result as the spatial analysis: transit need is greatest in Richmond and expanding services there will benefit transit-dependent residents.

The remainder of the information in the table further clarifies the regional picture in a way the spatial analysis could not. Although demand for transit service is likely focused on the city, there are substantial portions of the population that live outside of the city and display one of these five characteristics. Outside of the city, considerable numbers of people with at least one of these characteristics are located in Henrico and Chesterfield counties, which also show up in the spatial analysis, but to a lesser extent. But thousands of residents with these traits live outside of the metropolitan area in outlying Henrico, Chesterfield, and Hanover counties and were not highlighted in the spatial analysis.

For primarily rural, low-density areas of the region, fixed-route buses are not the most appropriate method of service delivery. Other transit agencies in rural communities have relied on demand-response service to provide residents with an additional transportation option in these types of areas. Demand-response service enables residents to call and request a ride, similar to a shared-ride taxi service. This type of service efficiently matches service demand with availability, making it operationally and cost effective. Providing demand-response transit service in the outlying counties would be one means for serving the transit-dependent population outside of GRTC's fixed-route network.

Table 3: Summary Demographics for Metropolitan Richmond Area[5]

	Total Population	Total Households	Area (Square Miles)	Persons Age 65 or Over	Persons with Mobility Limitations	Persons below the Poverty Lin	Households with No Vehicle	Households with One Vehicle
Chesterfield County	259,903	97,707	437	20,968	10,802	7,234	3,106	22,972
Hanover County	86,320	31,103	474	9,220	3,518	2,117	1,105	6,347
Henrico County	262,300	112,570	245	32,706	12,711	10,539	6,067	38,974
Richmond City	197,790	92,282	63	26,491	17,788	26,145	18,284	35,713
Regional Total	*806,313*	*333,662*	*1,219*	*89,385*	*44,819*	*46,035*	*28,562*	*104,006*

Population Growth Trend

The most detailed demographic data available for the Richmond region comes from the 2000 US Census. These data provide the best picture of the potential need for transit service and where populations with characteristics of transit dependence are located within the region. Although this information is essential to effective transit planning, it is important to remember that the population of such a vibrant region has certainly fluctuated since 2000. In fact, the Richmond Metropolitan Area—as defined by the US Census consisting of the four study jurisdictions as well as several other smaller jurisdictions surrounding Richmond—reported one of the largest population increases in all of Virginia between 2000 and 2006, approximately 86,150 (8 percent). This positive growth trend suggests that as the general population increases, so will the population depending on transit service.

As Table 4 shows, although the growth trend is positive for the region it is more complicated when broken down by jurisdiction. Chesterfield, Henrico, and Hanover counties all increased their population, whereas Richmond City experienced a slight population loss. Since the population increases fall primarily outside of the city, serving transit trips in the outlying counties will be more important for GRTC. As density and destinations increase in the outlying counties, GRTC will need to consider expanding its bus system to serve both trips from these areas to the city as well as to other locations outside of the city.

Table 4: Population Change 2000 to 2006[6]

Area	2006 Population Estimate	2000 Census	Difference	Percentage Change
Chesterfield	292,491	259,903	32,588	12.5
Hanover	96,309	86,320	9,989	11.6
Henrico	286,842	262,300	24,542	9.4
Richmond City	192,032	197,790	-5,758	-2.9
Richmond Metropolitan Area	*1,183,123*	*1,096,957*	*86,166*	*7.9*

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5 Source: US 2000 Census

6 Weldon Cooper Center for Public Service, Demographics & Workforce Section. "Estimates of Population for Virginia & its Localities, Final 2005 & Provisional 2006," January 22, 2007. http://www3.ccps.virginia.edu/demographics/estimates/2006/0-main.html. Accessed on January 24, 2007.

Conclusion

Examining demographic indicators of transit dependence along with the GRTC bus network in a spatial analysis helps reveal potential service gaps in the transit system. Mapping each of these indicators—living below the poverty line, having a mobility limitation, being age 65 or over, and having either no or one vehicle—revealed several areas within the metropolitan Richmond area that currently have high densities of at least one of these populations but limited or nonexistent bus service (Figure 4 through Figure 8). Several of these populations are concentrated in similar parts of the metropolitan region and likely comprise many of the same individuals. Areas that are repeatedly identified as locations for potential service expansion and introduction will be able to better serve many of these populations as well as the people falling into multiple categories, who are likely most in need of transit service.

A comparison of the spatial evaluation of these demographics suggests four areas that could benefit from improved transit service: the northwest corridor extending from downtown, the southwest corridor extending from downtown, the northeastern border of the city in Henrico County, and the southern border of the city in Chesterfield County. Although the intensity of each indicator varies by location, these areas frequently have above average densities for most if not all of the indicators.

The areas lying on the northeastern and southern boundaries of the city generally do not have any transit service. Expanding or introducing new routes into Henrico and Chesterfield counties will improve the transportation choices for residents living in these locations. The other two areas—the northwest and southwest corridors—already have at least some bus service. In these corridors, the bus service is designed to bring people back and forth from downtown. This service design is referred to as a hub-and-spoke system, where routes radiate out from a central downtown area. This type of route design has the effect of leaving areas between the spokes unserved, especially at the perimeter of the system. While there is an operational logic to this style of system, the demographic findings suggest that more extensive service outside of downtown may be necessary to meet the needs of the transit-dependent population. Furthermore, the increase in destinations outside of the city may mean people need to access locations other than downtown, which is difficult under the current route structure.

It is also important to remember that in all cases, downtown Richmond had among the highest population densities for each indicator. Although downtown has the most extensive existing bus service, additional bus service will always benefit downtown residents.

Finally, augmenting the spatial analysis with a summary of demographics by jurisdiction will help provide a more comprehensive look at the region. The spatial analysis of the indicators of transit dependence focused on areas with high densities of these populations. These are the areas most amenable to fixed-route bus service. There are also thousands of residents living in the rural, low-density portions of the

region who may need transit service. Although these people may currently not have access to transit service, they may benefit from the expanded opportunity afforded through transit service just as much as someone living within the fixed-route service area. Since fixed-route service is not viable in rural areas, demand-response service might offer an alternative form of service delivery in the outlying counties.

GRTC Historic Trends

The performance and operation of GRTC over the past three fiscal years (FY 2004, 2005, and 2006) provides an understanding of the general direction of the system. Delving into this historic data offers a broader context for understanding the current condition of the system: have the levels of service been increasing, decreasing, or stable? A historic overview also provides insight into the performance of the system in terms of ridership and operating costs. The trends identified through this review will be an important consideration in planning for the future of the GRTC system.

Based on data GRTC has reported to the National Transit Database (NTD), several performance and operational variables were readily available at the system level for the past three years. In general, GRTC appears to have remained relatively stable over its recent history. FY 2005 represents the largest aberration from the other two years, when the amount of service slightly declined as a result of several route cancellations. Service then increased in FY 2006 above its FY 2004 levels as GRTC added new service: both new routes and increased frequency on existing routes.[7] Although there have been modest changes in service, the trends of the system appear to be positive. In the last year, FY 2006, ridership increased at a faster rate than the amount of service and the operating cost of the system.

Operating Statistics

The historic operating statistics of GRTC are measured in revenue and platform hours and miles. Revenue hours and miles measure the time and distance the system provides service to customers. Whereas, platform hours and miles measure the total time and distance that operators are in a bus, including both revenue and deadhead (when the bus is not in service for customers) operation.

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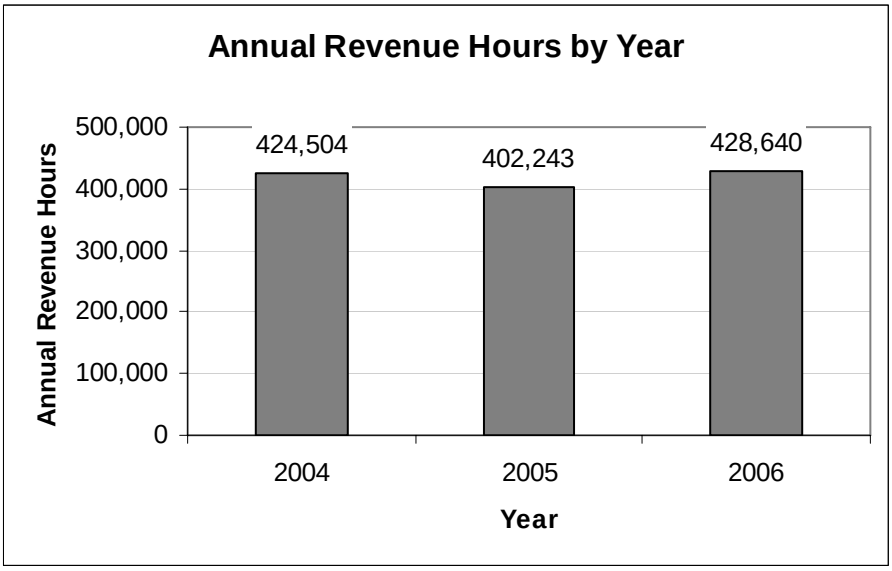
7 On June 3, 2004, GRTC discontinued two express routes in Chesterfield County and three local routes in Henrico County after a loss of funding. The express Chesterfield routes covered a large distance, contributing many platform and revenue miles and hours to the system. In FY 2006, GRTC reinstated one of the Chesterfield express routes and extended a city express route into Chesterfield. Additionally, GRTC increased the service frequency of its Henrico and Petersburg express routes. These operational changes in part explain the service decline in FY 2005 and subsequent increase in FY 2006.

Revenue Hours

Over the past three years, the number of annual revenue hours has not changed significantly. Figure 9 below shows that the primary change in revenue hours was a one-year decline in service provided during FY 2005. From FY 2004, revenue hours decreased by approximately five percent, but in FY 2006 revenue hours had increased by approximately seven percent over FY 2005 to the highest level in the three-year period. These changes were the result of several route cancellations in 2004 and route additions and other service increases in FY 2006. As of FY 2006, GRTC provided 428,640 revenue hours of service to customers.

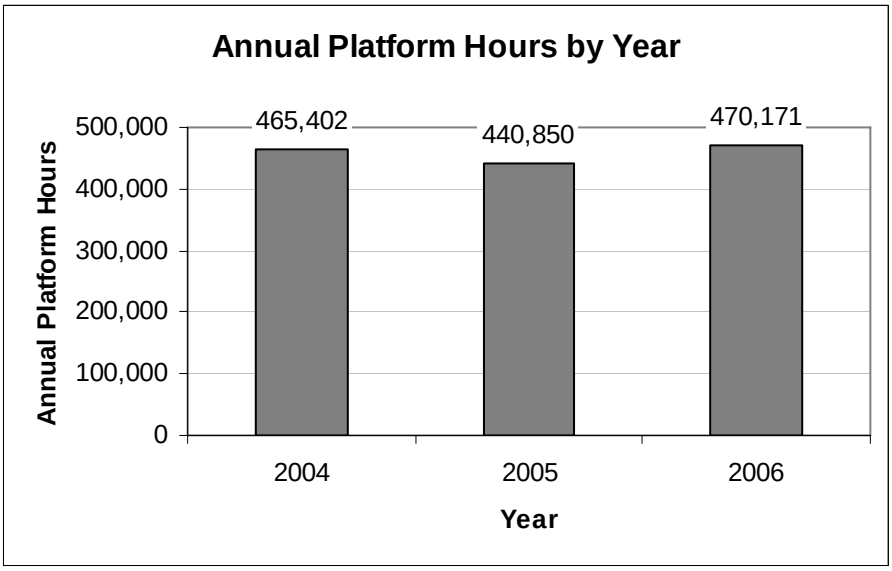
Figure 9: Annual Revenue Hours by Year



Platform Hours

As shown in Figure 10, the annual platform hours reflect the same pattern found for revenue hours: FY 2005 represents a temporary decline in the total hours operators drove the buses. The amount of platform hours is directly correlated to the amount of revenue hours. The more revenue hours a system operates, the more associated deadhead hours a system will experience transporting buses to and from revenue operation. For each year, the revenue hours represent approximately 91 percent of the total platform hours. This high percentage of revenue hours indicates GRTC uses its vehicles efficiently and limits the amount of time vehicles are on the road but out of service.

Figure 10: Annual Platform Hours by Year

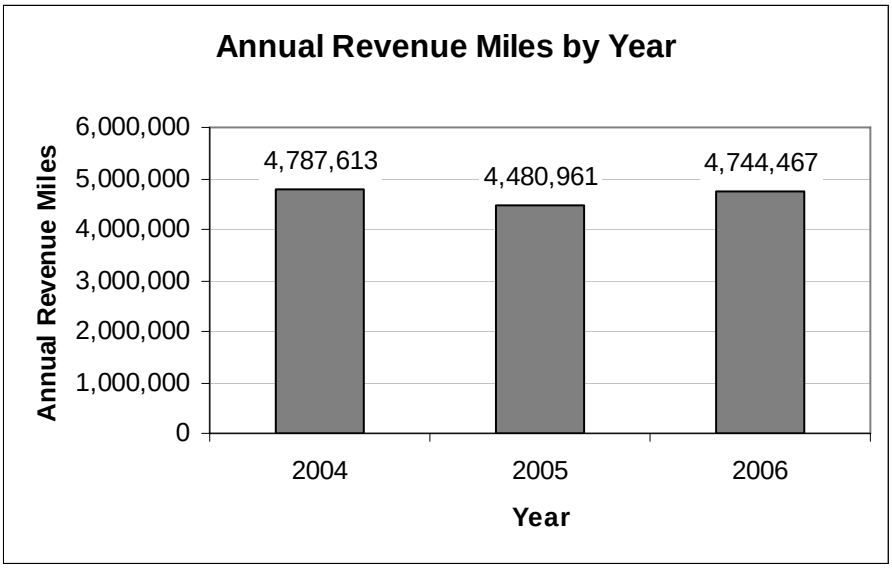


Revenue Miles

The number of revenue miles is also generally correlated to the number of revenue hours. The longer a distance a route covers, the more time it will take to operate that route. In general, the number of annual revenue miles follows the same trend as revenue hours; a temporary decline of revenue miles in FY 2005. But the revenue hours and revenue miles are not perfectly correlated. From FY 2004 to FY 2005, the annual revenue miles decreased by approximately six percent and then increased in FY 2006 by approximately five percent. Once again, the decline and subsequent increase in revenue miles for the system is a result of the cancellation of several routes in 2004 and route additions and service increase in FY 2006.

Figure 11 shows that in FY 2006, GRTC provided 4,744,467 miles of revenue service. Compared to FY 2004, as of FY 2006, GRTC was operating more service hours over fewer service miles. The decrease in service miles compared to service hours between FY 2004 and FY 2006 can in part be explained by the cancellation of two express routes covering large distances. When service was increased in FY 2006, new routes and service requiring fewer revenue miles replaced the routes canceled in 2004.

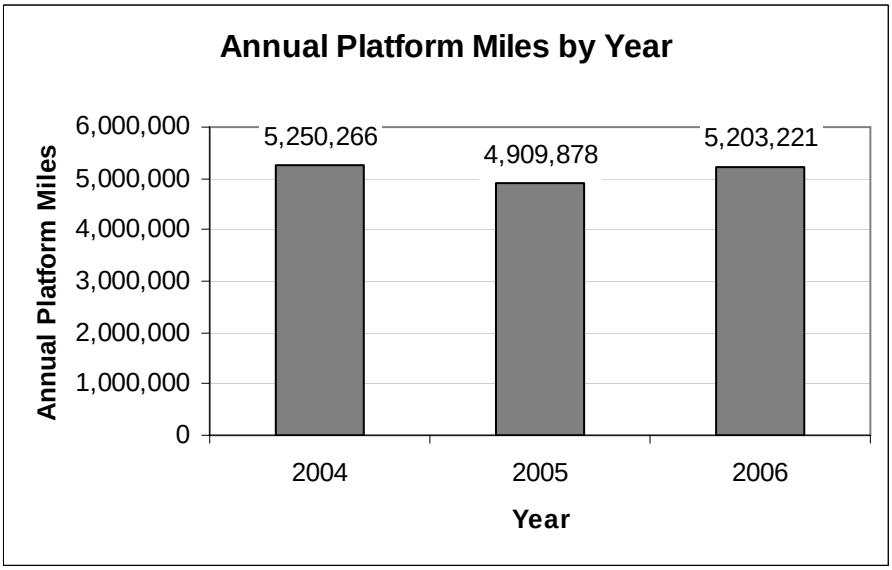
Figure 11: Annual Revenue Miles



Platform Miles

The number of platform miles follows the same trend as the revenue miles: FY 2005 represents the largest difference (approximately 300,000 miles) from the other two years. Similar to revenue and platform hours, revenue and platform miles are highly correlated to one another. As seen in Figure 12, 5,203,221 platform miles were required in FY 2006, just under the number of platform miles operated in FY 2005.

Figure 12: Annual Platform Miles

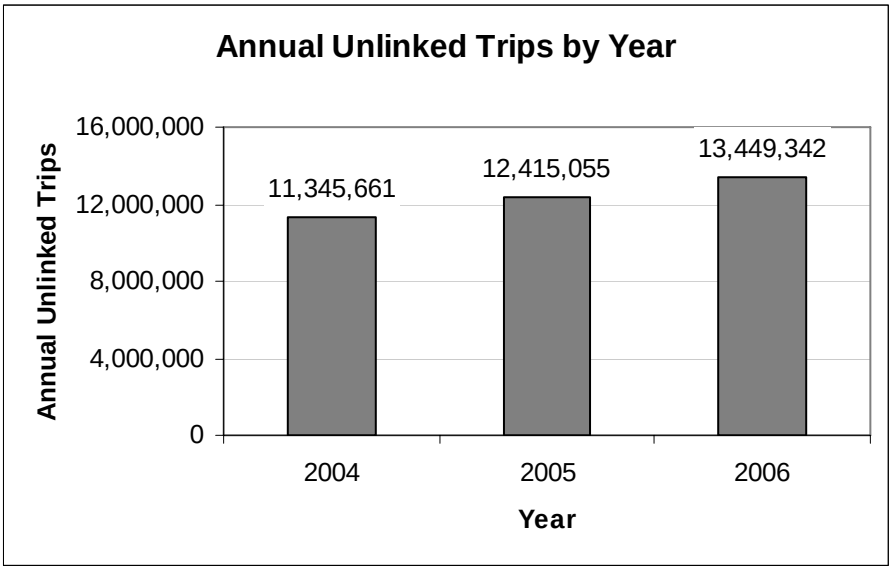


Trip statistics focus on the amount of GRTC service consumed over the three-year period. The two most relevant measures of service consumption reported to the NTD are unlinked trips and passenger miles. Unlinked trips measures ridership and accounts for each time a rider boards a bus. Therefore, a trip that requires one transfer counts as two unlinked trips. This should not be confused with the number of passengers. Passenger miles represent the total distance riders travel throughout the system.

Unlinked Trips

Despite the fluctuations in the amount of service provided over the past three years, the number of annual unlinked trips has steadily increased. From FY 2004 to FY 2005, unlinked trips increased by approximately nine percent. This strong growth trend continued the following year; unlinked passenger trips increased by eight percent in FY 2006 to a three year high of 13,449,342 (see Figure 13).

Figure 13: Annual Unlinked Trips

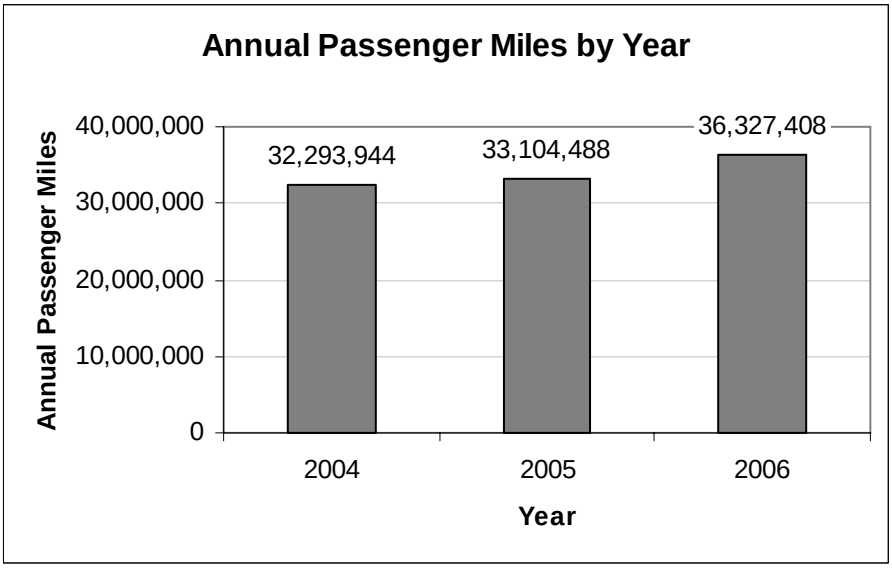


Passenger Miles

The number of passenger miles traveled on the GRTC system has also experienced consistent growth over the three-year period. The amount of passenger miles is related to unlinked passenger trips (the more trips made the more miles accrued), but it also indicates how far people are traveling on the service. Although unlinked trips increased in a fairly consistent manner, passenger miles experienced the largest increase between FY 2005 and FY 2006, approximately a ten percent increase. In FY

2006, passengers rode GRTC service for 36,327,408 miles (see Figure 14). This increase likely relates to the increase in revenue miles during this same time period.

Figure 14: Annual Passenger Miles



Ridership by Route

Table 5 shows that although ridership increased each year between 2004 and 2006, there was considerable variation in the performance of individual routes. Between 2004 and 2005, the average monthly ridership of several local routes declined, but those declines were more than offset by ridership growth on other routes (average monthly ridership for local routes increased by 1.4 percent in 2005). Between 2005 and 2006, almost all local routes experienced increases in their average monthly ridership (total increase for local routes of 6.2 percent). Similar to the local routes, ridership growth on express routes was more pronounced in 2006 than in 2005 (total increase for express routes of 28.1 percent). The changes in express route ridership can in part be explained by route changes: one express route was canceled in 2004 and a different express route was added in 2005. Additionally, service was increased on Henrico and Petersburg express routes during 2005 and 2006. This analysis at the route level demonstrates that although the total ridership trend was positive from year to year, it is important to monitor the performance of each individual route to continue the success of the entire system.

Table 5: Average Monthly Ridership by Route

	Average Monthly Ridership				
Route	**2004**	**2005**	**Percent Change from 2004**	**2006**	**Percent Change from 2005**
Local					
1	46,066	42,510	-7.7%	45,062	6.0%
2	18,932	19,510	3.1%	20,034	2.7%
3	51,239	50,815	-0.8%	56,079	10.4%
4	49,425	49,885	0.9%	52,173	4.6%
6	92,182	96,033	4.2%	101,270	5.5%
7	11,868	14,185	19.5%	16,174	14.0%
10	56,340	53,929	-4.3%	55,695	3.3%
11	3,128	2,867	-8.4%	3,120	8.8%
13	10,109	7,826	-22.6%	7,383	-5.7%
16	13,904	14,664	5.5%	14,760	0.7%
18	4,577	5,163	12.8%	5,788	12.1%
19	4,932	5,019	1.8%	5,178	3.2%
20	984	1,056	7.4%	1,063	0.7%
22	6,743	6,323	-6.2%	6,837	8.1%
24	12,348	13,851	12.2%	14,256	2.9%
32	64,740	64,280	-0.7%	66,939	4.1%
34	42,753	43,434	1.6%	45,766	5.4%
37	48,323	50,546	4.6%	54,115	7.1%
56	557	919	65.1%	1,413	53.7%
60	-	90	-	141	56.0%
61	379	399	5.3%	473	18.6%
62	45,900	47,182	2.8%	51,675	9.5%
63	30,290	31,968	5.5%	33,619	5.2%
67	2,591	3,097	19.5%	3,156	1.9%
68	-	230	-	213	-7.4%
70	15,003	16,820	12.1%	18,471	9.8%
71	12,911	14,454	11.9%	15,311	5.9%
72	6,431	6,527	1.5%	6,500	-0.4%
73	27,127	28,250	4.1%	30,685	8.6%
74	24,282	24,689	1.7%	27,375	10.9%
90	2,006	-	-	-	-
91	2,141	-	-	-	-
92	981	-	-	-	-
93	696	908	30.5%	1,247	37.3%
Total	*707,533*	*717,451*	*1.4%*	*762,104*	*6.2%*

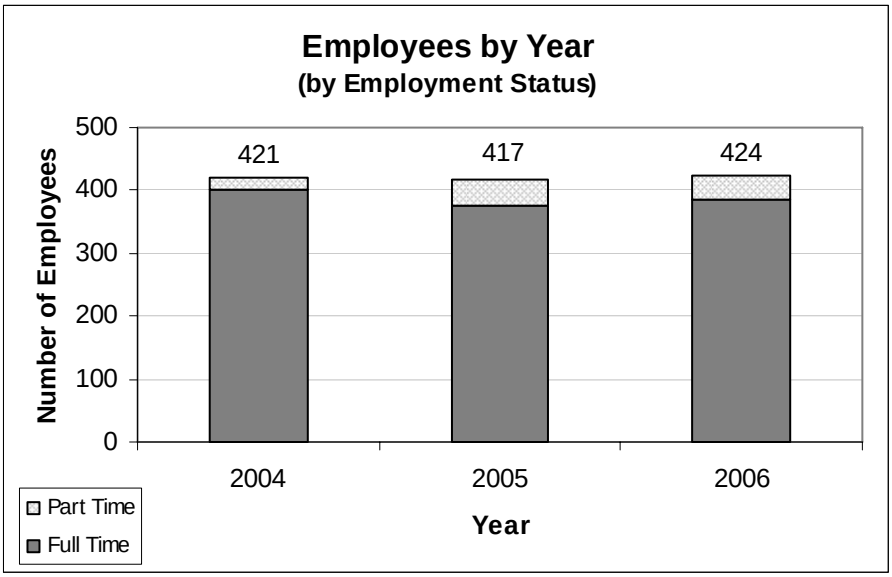
Table 5: Average Monthly Ridership by Route (Continued)

Route	Average Monthly Ridership 2004	2005	Percent Change from 2004	2006	Percent Change from 2005
Express					
26	7,257	6,614	-8.9%	6,011	-9.1%
27	3,740	4,068	8.8%	4,312	6.0%
28	1,876	1,990	6.1%	1,863	-6.4%
29	3,753	5,354	42.6%	7,027	31.2%
64	3,407	2,588	-24.1%	2,889	11.6%
65	1,342	1,900	41.5%	1,948	2.6%
66	1,046	1,451	38.7%	1,553	7.0%
69	-	2,256	-	2,683	18.9%
81	4,219	-	-	-	-
82	1,780	1,639	-8.0%	4,429	170.3%
95	2,478	3,187	28.6%	5,292	66.1%
Total	*27,901*	*29,679*	*6.4%*	*38,006*	*28.1%*
Other					
84	36,771	41,199	12.0%	41,420	0.5%
85	2,882	2,902	0.7%	2,052	-29.3%
86	13,869	13,425	-3.2%	9,558	-28.8%
87	-	-	-	8,537	-
88	2,486	3,216	29.4%	6,522	102.8%
Others	2,216	2,105	-5.0%	859	-59.2%
Total	*33,578*	*62,605*	*86.4%*	*61,602*	*-1.6%*
Grand Total	***769,011***	***809,735***	***5.3%***	***861,712***	***6.4%***

Employment

The number of GRTC employees has remained relatively constant over the three-year period. Generally, the largest portion of a transit system's workforce is vehicle operators, a position that is responsive to changes in levels of service provision. The total number of employees changed very little over the three-year period, ranging from 417 to 424 (see Figure 15). The primary change in employment was the growth of part-time employees and decline of full-time employees. The brunt of this workforce change took effect between FY 2004 and FY 2005. In FY 2005, the number of part-time employees doubled from 21 to 40, with a corresponding decline in full-time employees. This suggests that although the number of employees has slightly increased, the total employment hours may have decreased because more employees work part time than did so in FY 2004.

Figure 15: Annual Employment



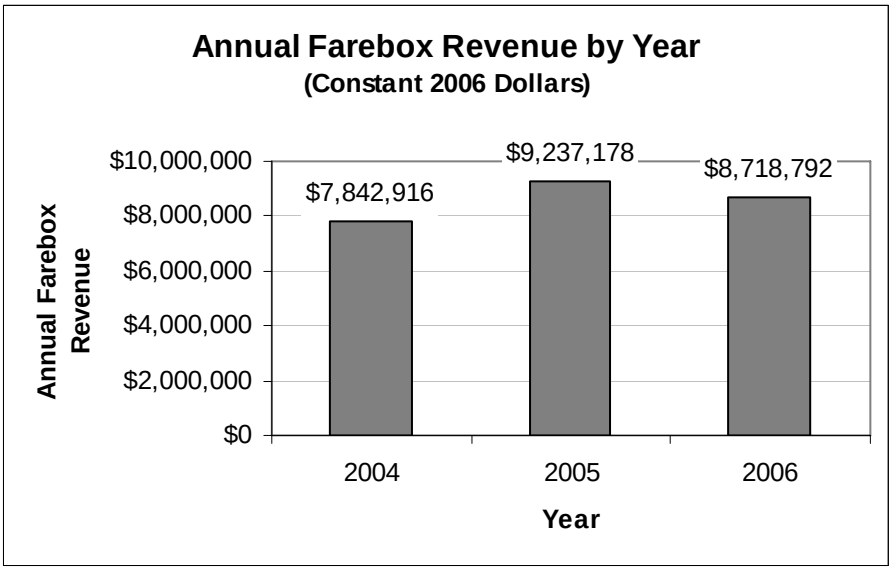
Farebox

Revenue generated from the farebox of a transit system is an important source of funding to offset operating costs. No public transit system generates enough farebox funding to completely cover operating costs. It is important to look not only at the total farebox revenue collected, but at the recovery ratio. The recovery ratio measures how much of the operating cost is covered by farebox revenue.

Revenue

Accounting for inflation, FY 2005 generated the most farebox revenue, $9,237,178 (see Figure 16). In a reverse trend than identified for the other historic data, FY 2005 had a temporary spike in farebox revenue. Although there is no precise trend during this period, it appears that in general, GRTC is collecting more farebox revenue as the number of unlinked trips increase.

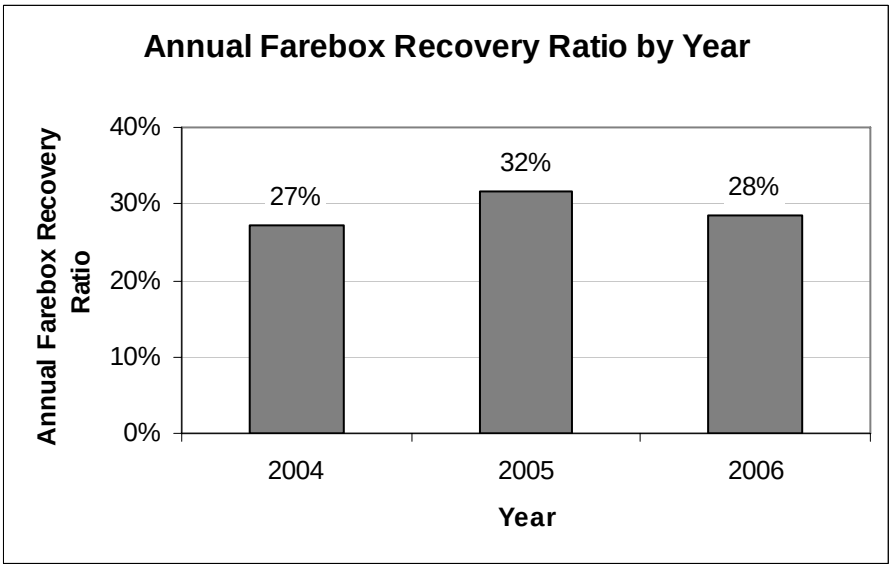
Figure 16: Annual Farebox Revenue



Farebox Recovery Ratio

The trend in farebox recovery ratio is similar to the farebox revenue trend: FY 2005 represents a temporary spike during the three-year period. As seen in Figure 17, the annual farebox recovery ratio hit a high of 32 percent in FY 2005. The farebox-recovery ratio was highest in FY 2005 since ridership and farebox revenues increased while service and operating costs remained relatively stable or declined. The decline in the recovery ratio in FY 2006 represents the increase in operating cost and the decrease in farebox revenue, despite continued ridership gains.

Figure 17: Annual Farebox Recovery Ratio

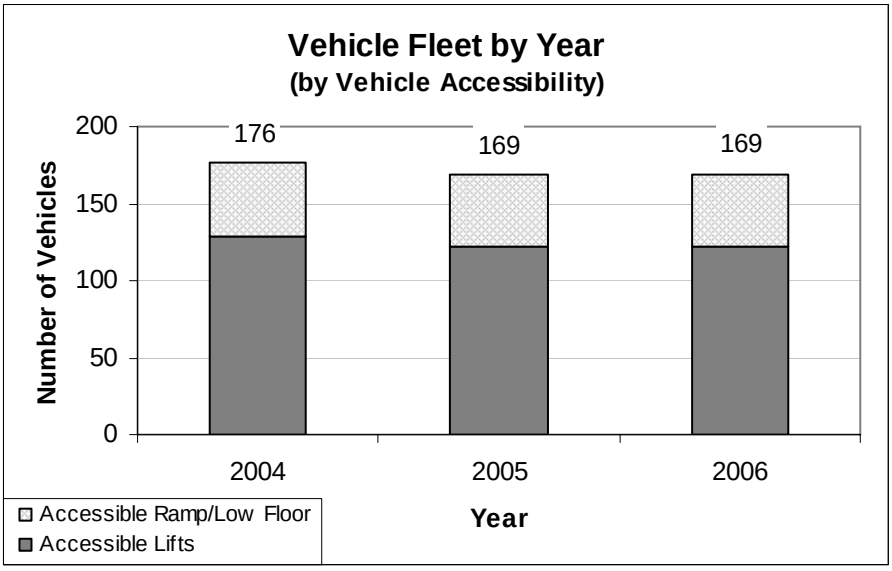


GRTC's fixed-route vehicle fleet consists of a variety of buses representing a range of purchase years and models. For the purpose of this overview, the primary distinctive feature of each vehicle is its type of accessibility for people with disabilities, either ramp/low floor or accessible lifts. Another important measure of a transit system's vehicle fleet is the number of vehicles required to operate the annual maximum service. In other words, what is the most vehicles that will be required at any one time during the year to operate all service. This measure is important because the Federal Transit Administration uses it in part to measure if it will provide a system with capital funding for additional vehicles.

Vehicle Fleet Size

As shown in Figure 18, GRTC's vehicle fleet has not changed substantially over the past three years. In fact, the fleet has remained identical between FY 2005 and FY 2006. In those two years, the fleet consisted of a total of 169 vehicles: 122 accessible-lift buses and 47 accessible-ramp/low-floor buses.

Figure 18: Vehicle Fleet Accessibility

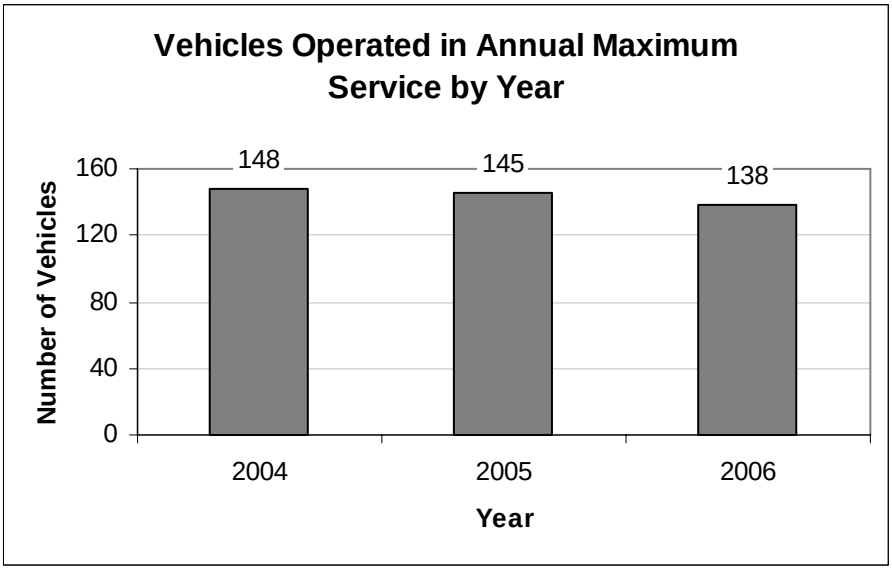


Vehicles Operated in Annual Maximum Service

The number of vehicles required for operating the annual maximum service has consistently declined during the three-year period from 148 to 138 buses (see Figure 19). The need for fewer buses to cover annual maximum service reflects the changes in service GRTC has experienced during this period, such as the cancellation of three

Henrico County routes in 2004. As the number of vehicles required for annual maximum service declines, GRTC will need to adjust its vehicle fleet accordingly to ensure it does not have too many spare buses. Currently, approximately 18 percent of its fleet is defined as spare buses by the FTA. If that percentage rises to over 20 percent, GRTC may have trouble accessing federal capital funding for new vehicles.

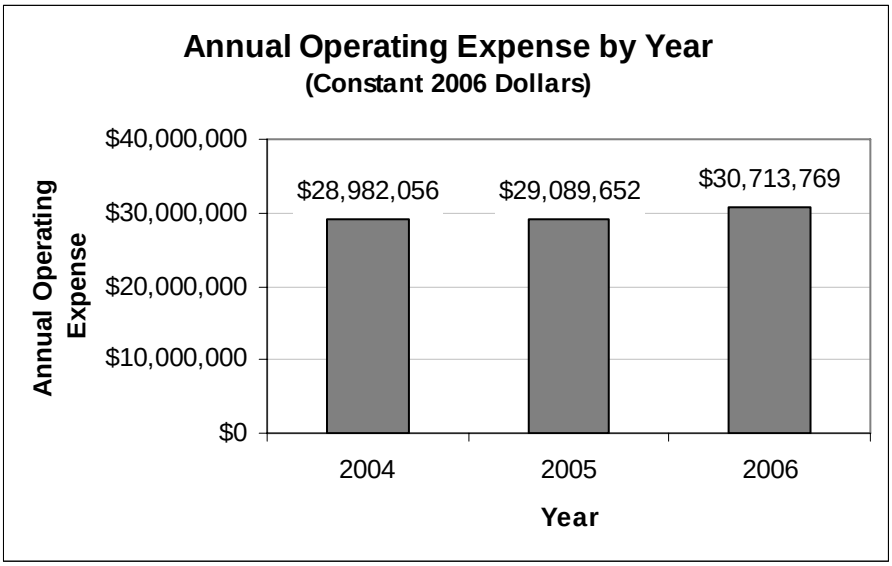
Figure 19: Vehicles Operated in Annual Maximum Service



Annual Operating Expense

Accounting for inflation, the total operating expense of the GRTC fixed-route system has increased each year during the three-year period. Between 2004 and 2005, the operating cost of the system remained relatively stable in part because the cancellation of several routes offset the increasing cost of operating service. The largest increase in operating cost was between FY 2005 and FY 2006, a ten percent increase to a total operating cost of $30,713,769 (see Figure 20). The increase in the number of revenue hours likely contributes to the increase in operating cost in FY 2006. Providing more hours of service requires paying additional hourly wages to operators, one of the most significant costs associated with operating buses.

Figure 20: Annual Operating Expense



Conclusion

The historic NTD data for the three-year period starting in FY 2004 reveals that GRTC has managed to consistently attract more trips as it has fine-tuned its service. As of FY 2006, the GRTC system had hit a point that it was operating its highest level of service at its highest operating cost, but enabling higher levels of use both in terms of the number of unlinked trips and passenger miles. The success of these changes in service of attracting more riders without disproportionately increasing costs or decreasing fares demonstrates how the system has grown and changed over the past three years. Understanding these changes helps to provide a fuller context of where GRTC stands today.

GRTC Vehicle Fleet Condition

As part of the COA, the bus fleet was examined to ascertain its overall condition. The current bus fleet is assessed in terms of both the condition of the fleet and the mileage accumulated by each vehicle type. This section looks at the composition of the fleet as a whole, the age of the vehicles, their state of repair, vehicle cleanliness and the mileage of each vehicle type. The fleet was generally found to be in very good condition.

Existing Fleet

The majority of the bus fleet is comprised of heavy duty coaches either 35 or 40 feet in length, with most of the fleet manufactured by Gillig. While the Gillig buses differ by length and features, this reliance on one manufacturer reduces parts inventory requirements. Recent bus purchases have included low floor vehicles, which expedite

passenger loading and unloading. Further, the lift for wheelchair access is replaced with a far simpler ramp design. GRTC also has smaller buses (i.e., Ford E-450) which account for about seven percent of the fleet. Key fleet characteristics and composition are shown in Table 6.

Table 6: GRTC Active Fleet

Vehicle Type	Number of Vehicles	Length (Feet)	Seats
1996 Gillig Phantom	19	35	37
1997 Gillig Phantom	13	35	37
1998 Gillig Phantom	32	35	37
2000 Gillig Phantom	25	40	44
2000 Gillig Low Floor	16	35	38
2001 Ford E-450	9	24	21
2001 Gillig Low Floor	14	35	38
2002 Ford E-450	3	24	21
2003 Gillig Phantom	16	40	43
2003 Gillig Low Floor	17	40	38
2003 Bluebird	3	35	36
Total Active Fleet	***167***		

Vehicle Inspection

As noted above, GRTC has five basic vehicle types in its bus fleet. However, when the year of manufacture is considered, eleven different types of vehicles comprise the fixed route fleet. As can be seen in Table 7, sampling rates were typically one-quarter to one-third, with some categories having higher sampling rates. Overall, about one-third of the entire fleet was inspected, which is more than adequate to draw conclusions on the fleet condition.

Table 7: Inspections by Vehicle Type

Vehicle Type	Active Number in Fleet	Number Inspected	Percent Inspected
1996 Gillig Phantom	19	7	36.8
1997 Gillig Phantom	13	3	23.1
1998 Gillig Phantom	32	9	28.1
2000 Gillig Phantom	25	6	24.0
2000 Gillig Low Floor	16	7	43.8
2001 Ford E-450	9	2	22.2
2001 Gillig Low Floor	14	5	35.7
2002 Ford E-450	3	1	33.3
2003 Gillig Phantom	16	7	43.8
2003 Gillig Low Floor	17	6	35.3
2003 Bluebird	3	3	100.0
Total Active Fleet	***167***	***56***	***33.5***

Visual inspections of a sample of GRTC buses were performed at the Operating and Maintenance Facility on South Davis Avenue during November of 2006. A total of 56 buses, or more than one-third of the fixed route service's active fleet of 167 buses, were inspected for attributes affecting the passenger's riding experience and the public's perception of the vehicles. This includes the cleanliness of the exterior and interior of the bus, the condition of the seats and floor as well as unaddressed body damage, exterior paint and glass condition. As shown in Table 8, each of these attributes was rated on a scale of 1 to 5, which represent the following:

Table 8: Rating Scheme

Rating	Significance
5	Excellent Condition
4	Good Condition
3	Poor Condition, but fit for use in revenue service
2	Unacceptable Condition - Immediate attention is needed before return to revenue service
1	Deplorable Condition - Vehicle should no longer be used in revenue service

Table 9 provides the average results for all of the buses that were inspected. The condition of the GRTC fixed-route bus fleet is rated between good and excellent for most of the inspected attributes.

Table 9: Summary of Fleet Condition

Exterior Condition				Interior Condition		
Body	**Paint**	**Clean**	**Glass**	**Floor**	**Seats**	**Clean**
4.9	4.4	3.9	5.0	4.1	4.8	3.9

On average, only two attributes rated less than "good". These were the overall cleanliness of both the exteriors and the interiors. It should be noted that neither regular graffiti, nor scratch graffiti (i.e., "scratchiti") was noted on any of the inspected buses. The condition of the glass on GRTC's buses was—quite simply—superb, and was rated a perfect "5". The vehicle inspections discovered essentially no cracks or scratches in the glass, nor was there any "crazing" which makes it difficult to see out of a window. Other attributes of the GRTC fixed-route fleet which were observed include:

The condition of the vehicle bodies was also superb. Very few – if any – dents were observed, and no body rust was seen. Some vehicles had scratches along their roof line. These types of scratches are caused by contact with trees and are common for buses operating on local roads.

The condition of the vehicle paint jobs was very good. The GRTC paint scheme is striking, with a base white bus that has a "purple swoosh" which starts along the side of the vehicle and covers the rear of the bus. Some buses were completely

covered in advertising wraps, which were all maintained in excellent condition. The only drawbacks noticed is that sometimes the paint appeared "splotchy" – possibly due to repainting after body work or sun fading – and some buses had the paint at the rear corners faded away. Another issue is that sometimes the paint comprising part of the GRTC logo appeared faded.

The condition of the floors was also good. The vehicle floors were not rated higher because sometimes it seemed they could be a little cleaner (e.g., gum stuck on, etc.) and perhaps even waxed. However, the "shiny" appearance provided by such waxing is likely not possible on some of the buses in the fleet (i.e., the 2003 Gillig Low Floors and the 2003 Bluebirds) as they have a type of "abrasive" non-slip flooring.

GRTC should also especially be commended on the condition of its passenger seats. Almost all of the seats that were observed were clean and comfortable, with none damaged, torn or vandalized in any significant manner. In fact, one typical problem area where graffiti is typically observed is on the back of seats in the rear portion of a bus; at GRTC, no seatback graffiti was observed on any bus.

As previously mentioned, the cleanliness of bus exteriors and interiors, while satisfactory, were the lowest rated attributes. The cause of these lower ratings are discussed further in the section below.

In terms of interior cleanliness, the inspections were performed in the middle of the service day and therefore the vehicles had not yet been serviced or swept. Because of insufficient light in the bus storage yard, it was not possible to inspect the buses for cleanliness at the end of the day after the buses had been serviced. Due to this sampling, the random coffee cup or newspaper on buses were noted. However, it should be kept in mind that the average rating of 3.9 is almost a "good" (i.e., "4") rating and that – in the aggregate – the interior cleanliness of the fleet was far superior to that observed at other transit systems. One interesting note is that every driver's station which was observed was exceptionally clean, and all of the system notices or passenger advisories placed on the bus were current and in well-kept condition.

In terms of the exterior cleanliness of the buses, the area that most often appeared to require some more cleaning was the front of the bus near the destination sign. It is possible that the shape of the Gillig buses (which comprise the majority of the fleet) contributes to the problem when the buses go through the bus washer. Also, the cleanliness of the wheel hubs varied greatly, with some buses having very clean wheel hubs and others being quite dirty. Sometimes, smudges and hand marks could also be observed near service doors on the vehicle's exterior. However, it should be kept in mind that these imperfections are somewhat minor and that they are especially easy to spot when a fleet looks as good overall as GRTC's fleet does.

The results of the inspections found the GRTC bus fleet to be, in the aggregate, in very good to excellent condition. The bodies of the buses inspected had very few defects and corrosion due to rust was not observed on any bus. GRTC seems to maintain the quality of the paint job on the revenue fleet in good condition. Very few major scratches or chips were observed. Overall, GRTC should be commended for the fantastic shape in which its bus fleet is maintained.

The overall superior condition of the GRTC fleet creates an impression of professionalism and cleanliness that is a large positive attribute from the standpoint of the passengers as well as the general public.

As noted previously, when the year of manufacture is considered, there are eleven different types of vehicles that comprise the GRTC fixed-route fleet. The inspection results for each vehicle type are presented in Table 10.

Table 10: Condition by Vehicle Type

Exterior Condition				Interior Condition		
Body	**Paint**	**Clean**	**Glass**	**Floor**	**Seats**	**Clean**
Fleet-wide Results						
4.9	4.4	3.9	5.0	4.1	4.8	3.9
1996 Gillig Phantom						
5.0	4.7	4.1	5.0	4.1	4.4	4.1
1997 Gillig Phantom						
4.7	3.7	3.7	5.0	4.0	4.3	3.3
1998 Gillig Phantom						
5.0	4.4	3.9	4.9	3.9	4.8	3.9
2000 Gillig Phantom						
4.8	3.8	3.3	4.8	3.8	5.0	3.9
2000 Gillig Low Floor						
5.0	4.0	3.9	5.0	4.1	4.9	3.8
2001 Ford E-450						
4.5	4.5	3.5	5.0	4.0	5.0	4.0
2001 Gillig Low Floor						
5.0	4.6	3.9	5.0	4.2	5.0	4.0
2002 Ford E-450						
4.0	5.0	4.0	5.0	4.5	5.0	5.0
2003 Gillig Phantom						
4.9	4.7	4.3	5.0	4.1	5.0	3.7
2003 Gillig Low Floor						
5.0	4.5	3.8	5.0	4.2	5.0	4.0
2003 Bluebird						
5.0	4.7	4.7	5.0	4.5	5.0	4.3

As shown in the exhibit, the results for each vehicle type in the active fleet do not differ too greatly from the fleet-wide results. One expected result is that both exterior and interior vehicle cleanliness were rated less than "good" (i.e., less than a "4") for several fleet types. However, one interesting result is that both the condition of the paint job and the condition of the floor were rated less than "good" in two different fleet types. The paint job was less than "good" on the 1997 Gillig Phantoms and on the 2000 Gillig Phantoms; the condition of the floor was rated less than "good" on the on the 1998 Gillig Phantoms and on the 2000 Gillig Phantoms.

Finally, three vehicle types had more than two attributes rated as being less than "good". The 1997 Gillig Phantoms saw less than "good" ratings for their paint jobs, their exterior cleanliness and their interior cleanliness. The 1998 Gillig Phantoms saw less than "good" ratings for their exterior cleanliness, the condition of their floors and their interior cleanliness. The 2000 Gillig Phantoms saw less than "good" ratings for their paint jobs, their exterior cleanliness, the condition of their floors and for their interior cleanliness.

Overall, as was previously mentioned, GRTC maintains their fixed route fleet in excellent condition. One suggestion is to make certain the vehicles are kept as clean as possible. On the exterior of the vehicles, this is because their basic white color scheme shows dirt and smudges easily. As noted previously, the cleanliness rating was influenced by the conduct of the inspections during the day and not after the servicing in the evening.

Vehicle Mileage

Finally, an analysis of vehicle mileage was conducted in two ways. First, the average number of miles operated by each vehicle type was examined for the last fiscal year. Next, accumulated mileage for the life of the vehicle was reviewed since it, along with vehicle age, is a good indicator of remaining economic life.

As shown in Table 11, the newer vehicles in the GRTC fleet tend to be utilized most frequently and had the highest average mileage during the last fiscal year. This is logical, since it allows the most riders to experience the newest and most reliable vehicles in the transit system's inventory. These results are also confirmed in terms of accumulated life time mileage. The Ford E-450 buses are used to a lesser extent than the full-sized, heavy duty coaches.

None of the GRTC vehicles are past their useful life in terms of either age or mileage. A typical useful life for buses is 12 years, which would suggest replacement of the 1996 and 1997 Gilligs in the next few years. Useful life in terms of mileage is typically 500,000 miles. The mileage of these older buses is somewhat low, which may reflect a reduction in the peak vehicle requirements during the last five years and a corresponding increase in the spare ratio. The published values presented in the 2006 National Transit Database indicated a peak vehicle requirement of 138, buses with a

spares ratio of about 21 percent. The peak vehicle requirements were reduced by ten buses since 2002, when the maximum number of vehicles in service was 148.

Table 11: Average Mileage by Vehicle Type

Vehicle Type	Last Year	Life Time
1996 Gillig Phantom	28,753	270,816
1997 Gillig Phantom	28,646	298,803
1998 Gillig Phantom	26,894	276,432
2000 Gillig Phantom	39,259	220,200
2000 Gillig Low Floor	26,124	161,638
2001 Ford E-450	17,166	127,990
2001 Gillig Low Floor	28,436	146,412
2002 Ford E-450	21,817	96,132
2003 Gillig Phantom	40,000	122,926
2003 Gillig Low Floor	37,808	112,046
2003 Bluebird	13,173	39,790

GRTC Peer Comparison

To place its bus system in a larger transit context, GRTC performed a peer comparison, which it provided to VHB for consideration in this Comprehensive Operational Analysis.[8] For this peer analysis, the peer group of 11 transit agencies came from a pool chosen because of similar regional qualities (population, area, climate, state capital, presence of a major university) and similar system size (peak vehicles, revenue hours, revenue miles). Each agency provided data from their 2005 and 2006 National Transit Database (NTD) reports. Because 2006 data from some agencies was either unavailable or not finalized, only 2005 data was used in this analysis. All data in this analysis are based on calculations using this raw data. The raw data supplied by the agencies and the formulas used in this analysis can be found in Appendix A.

System Size

Within this group, GRTC is generally below the average in the measures for system size (Table 12). While GRTC's population and area of service are 28 percent and 48 percent below the average, the density is near average. Other measures that relate to the size of the service (Hours per Square Mile, Miles per Square Mile, and Peak Vehicles per Square Mile) show GRTC to be also near but below the average.

♦

8 The GRTC peer comparison was conducted exclusively by GRTC staff.

Table 12: System Size

Location	Population of Service Area	Area of Service Area	Density of Service Area	Max Vehicles	Hours per Square Mile	Miles per Square Mile	Peak Vehicles per Square Mile
Albany, NY	794,293	1,760	451	198	315	3,552	0.098
Austin, TX	727,000	572	1,271	228	1,441	17,739	0.399
Charlotte, NC	681,310	445	1,531	247	1,663	23,842	0.555
Dayton, OH	559,062	247	2,263	161	2,083	29,490	0.610
Hartford, CT	851,535	664	1,282	186	709	9,387	0.280
Indianapolis, IN	791,926	373	2,123	120	1,111	15,638	0.322
Lansing, MI	380,073	136	2,795	85	1,640	22,138	0.559
Madison, WI	234,294	60	3,898	167	6,065	77,793	2.779
Memphis, TN	888,627	288	3,086	149	1,674	24,318	0.510
GRTC	449,572	227	1,980	145	1,772	19,740	0.639
Tampa, FL	578,252	254	2,277	151	2,134	26,442	0.594
Tucson, AZ	535,732	227	2,364	155	2,389	30,502	0.684
Average	622,640	438	2,110	166	1,916	25,049	0.67
GRTC	449,572	227	1,980	145	1,772	19,740	0.64
Percent Difference	-28%	-48%	-6%	-13%	-8%	-21%	-5%
Rank	3 of 12	4 of 12	4 of 12	3 of 12	8 of 12	5 of 12	10 of 12

Economic and Social Need

For the purpose of evaluating Economic and Social Need the United States 2000 Decennial Census provided data on Percent of Population with Income below Poverty Level and Percent of Transit Dependent Households. This data is for the Metropolitan Statistical Area (MSA) in which the transit agency is located, not the service area and population reported for NTD, but can give a general overview for comparison. GRTC's MSA had the third lowest Percent of Population with Income Below Poverty Level, which was 13.1 percent below the peer average. The Percent of Transit Dependent Households for the Richmond MSA was, however, 6.8 percent higher than the average with a rank of 8 out of 12. These numbers show that, although there are fewer people below poverty level in the area, a greater number are dependent on public transit for transportation (Table 13).

Table 13: Economic and Social Need

Metropolitan Statistical Area	Percent of Population with Income Below Poverty Level	Metropolitan Statistical Area	Percent of Transit Dependent Households
Hartford, CT MSA	8.4%	Austin--San Marcos, TX MSA	5.9%
Indianapolis, IN MSA	8.6%	Lansing--East Lansing, MI MSA	6.5%
Richmond--Petersburg, VA MSA	9.3%	Charlotte--Gastonia--Rock Hill, NC--SC MSA	6.6%
Charlotte--Gastonia--Rock Hill, NC--SC MSA	9.3%	Indianapolis, IN MSA	7.1%
Madison, WI MSA	9.4%	Madison, WI MSA	8.0%
Albany--Schenectady--Troy, NY MSA	9.4%	Tampa--St. Petersburg--Clearwater, FL MSA	8.1%
Dayton--Springfield, OH MSA	10.3%	Dayton--Springfield, OH MSA	8.4%
Lansing--East Lansing, MI MSA	11.0%	Richmond--Petersburg, VA MSA	8.9%
Austin--San Marcos, TX MSA	11.1%	Tucson, AZ MSA	9.0%
Tampa--St. Petersburg--Clearwater, FL MSA	11.2%	Hartford, CT MSA	9.8%
Tucson, AZ MSA	14.7%	Memphis, TN--AR--MS MSA	10.4%
Memphis, TN--AR--MS MSA	15.3%	Albany--Schenectady--Troy, NY MSA	11.2%
Average	10.7%	Average	8.3%
Richmond--Petersburg, VA MSA	9.3%	Richmond--Petersburg, VA MSA	8.9%
Percent Difference	-13.1%	Percent Difference	6.8%
Rank	3 of 12	Rank	8 of 12

Social Effectiveness

Measures for Social Effectives were Boardings Per Capita and Boardings per Square Mile. Analysis of Social Effectiveness measures provides an indication of the level of overall transit use for each area. Given that GRTC had a nearly average density within the group, its Boardings per Capita were 19 percent above the average, indicating significantly greater use of transit by the population. Boardings per Square Mile were near the average for the group (Table 14). Boardings per Capita and per Square mile are the ratios of trips to population and trips to service area.

Table 14: Social Effectiveness

Boardings per Capita		Boardings per Square Mile	
Madison, WI	48.98	Madison, WI	190,942
Austin, TX	31.63	Tucson, AZ	71,636
Tucson, AZ	30.31	Lansing, MI	65,683
GRTC	27.62	GRTC	54,692
Charlotte, NC	24.63	Dayton, OH	47,692
Lansing, MI	23.50	Tampa, FL	43,472
Dayton, OH	21.07	Austin, TX	40,201
Tampa, FL	19.10	Memphis, TN	37,788
Hartford, CT	14.69	Charlotte, NC	37,705
Albany, NY	14.34	Indianapolis, IN	22,751
Memphis, TN	12.25	Hartford, CT	18,838
Indianapolis, IN	10.72	Albany, NY	6,473
Average	23.24	Average	53,156
GRTC	27.62	GRTC	54,692
Percent Difference	19%	Percent Difference	3%
Rank	4 of 12	Rank	4 of 12

Transportation and Vehicle Efficiency

General Transportation Efficiency can be measured by the average speed of buses (Mile per Hour). The average speed of buses is the ratio of revenue hours to revenue miles. This indicator shows the relationship between revenue miles and revenue hours. In this study GRTC ranked last among the peers and was 15 percent below the average. This number indicates that GRTC buses spend more time in areas of congestion and have more boardings and alightings per stop than those of the peer group.

Measures for Vehicle Efficiency demonstrate the level of use of vehicles by the agency. Peak to Base Ratio is the number of buses in service at peak times divided by the number of buses in service at mid-day. This ratio shows the relative number of buses that are idle at non-peak times. Hours per Peak Vehicle and Miles per Peak Vehicle are calculated by dividing total revenue hours and total revenue miles by total peak vehicles. These numbers show the degree of use of the vehicles in the fleet. Miles per Direction Route Miles is the ratio of revenue miles to the non-duplicated miles of road along which routes pass. This measure indicates the relative amount of miles that are traveled over routes.

Building upon the observation that GRTC's buses have the lowest average speed, GRTC's rankings in the vehicle efficiency measures show that buses are used more in peak service and less in non-peak service. The Peak to Base Ratio of 2.13 for GRTC tells us that over two vehicles operate at peak times for every one vehicle at non-peak times. This translates into fewer hours and miles per each vehicle. Compared to other agencies, GRTC is well below the average for Peak to Base Ratio, Miles per Peak Vehicle and Hours per Peak Vehicle. On the other hand GRTC's vehicles put more

miles on their routes than eight other agencies, which is 26 percent above the average (Table 15).

Table 15: Transportation and Vehicle Efficiency

Miles per Hour (Speed)		Peak to Base Ratio		Miles per Peak Vehicle	
Memphis, TN	14.53	Lansing, MI	0.89	Indianapolis, IN	48,608
Charlotte, NC	14.33	Austin, TX	1.23	Dayton, OH	48,239
Dayton, OH	14.16	Tucson, AZ	1.30	Memphis, TN	47,644
Indianapolis, IN	14.08	Tampa, FL	1.34	Tucson, AZ	44,601
Lansing, MI	13.50	Indianapolis, IN	1.54	Austin, TX	44,504
Hartford, CT	13.24	Albany, NY	1.85	Tampa, FL	44,479
Madison, WI	12.83	Dayton, OH	1.94	Charlotte, NC	42,955
Tucson, AZ	12.77	Memphis, TN	1.99	Lansing, MI	39,615
Tampa, FL	12.39	Charlotte, NC	1.99	Albany, NY	36,351
Austin, TX	12.31	Hartford, CT	2.09	Hartford, CT	33,512
Albany, NY	11.29	GRTC	2.13	GRTC	30,903
GRTC	11.14	Madison, WI	2.83	Madison, WI	27,996
Average	13.05	Average	1.76	Average	40,784
GRTC	11.14	GRTC	2.13	GRTC	30,903
Percent Difference	-15%	Percent Difference	21%	Percent Difference	-24%
Rank	12 of 12	Rank	11 of 12	Rank	11 of 12

Hours per Peak Vehicle		Miles per Direction Route Mile	
Austin, TX	3,615	Tucson, AZ	11,878
Tampa, FL	3,589	Madison, WI	11,518
Tucson, AZ	3,494	Austin, TX	11,454
Indianapolis, IN	3,453	GRTC	10,070
Dayton, OH	3,408	Lansing, MI	8,115
Memphis, TN	3,280	Indianapolis, IN	7,910
Albany, NY	3,219	Dayton, OH	7,678
Charlotte, NC	2,997	Tampa, FL	7,514
Lansing, MI	2,935	Charlotte, NC	6,585
GRTC	2,774	Hartford, CT	6,434
Hartford, CT	2,532	Memphis, TN	3,761
Madison, WI	2,183	Albany, NY	3,299
Average	3,123	Average	8,018
GRTC	2,774	GRTC	10,070
Percent Difference	-11%	Percent Difference	26%
Rank	10 of 12	Rank	4 of 12

Service Effectiveness

Service Effectiveness measures show the levels at which passengers are filling the buses. Passengers per Mile, per Revenue Hour and per Peak Vehicle are the number of trips divided my revenue miles, revenue hours, and peak vehicles respectively. In all three of the Service Effectiveness measures GRTC ranks near the top of the list. In Passengers per Mile GRTC ranks number two with a value 36 percent above the average. In Passengers per Revenue hour the rank is third and 17 percent above the average. Passengers per Peak Vehicle is 5 percent above average with a rank of four among the peers (Table 16). These measures together show that GRTC's buses carry more than the average number of passengers and further help to explain the relatively low average speed of GRTC buses as already observed under Transportation Efficiency.

Table 16: Service Effectiveness

Passengers per Mile		Passengers per Revenue Hour		Passengers per Peak Vehicle	
Lansing, MI	2.97	Lansing, MI	40.05	Lansing, MI	117,539
GRTC	2.77	Madison, WI	31.48	Tucson, AZ	104,750
Madison, WI	2.45	GRTC	30.86	Austin, TX	100,854
Tucson, AZ	2.35	Tucson, AZ	29.98	GRTC	85,621
Austin, TX	2.27	Austin, TX	27.90	Dayton, OH	78,013
Hartford, CT	2.01	Hartford, CT	26.57	Memphis, TN	74,033
Albany, NY	1.82	Dayton, OH	22.89	Tampa, FL	73,125
Tampa, FL	1.64	Charlotte, NC	22.67	Indianapolis, IN	70,717
Dayton, OH	1.62	Memphis, TN	22.57	Madison, WI	68,716
Charlotte, NC	1.58	Albany, NY	20.58	Charlotte, NC	67,930
Memphis, TN	1.55	Indianapolis, IN	20.48	Hartford, CT	67,251
Indianapolis, IN	1.45	Tampa, FL	20.37	Albany, NY	66,237
Average	2.04	Average	26.37	Average	81,232
GRTC	2.77	GRTC	30.86	GRTC	85,621
Percent Difference	36%	Percent Difference	17%	Percent Difference	5%
Rank	2 of 12	Rank	3 of 12	Rank	4 of 12

Service Provided per Capita

Measures that were used to evaluate Service Provided per Capita are Revenue, Revenue Hours per Capita, and Peak Vehicles per 10,000 People. All these methods use the population of the service area as the denominator with revenue miles, revenue hours, and peak vehicles as the numerator. These numbers show the relative amount of service provided to the population. A higher number indicates higher amounts of service provided. In both Revenue Miles per Capita and Revenue Hours per Capita GRTC ranked in the middle of the peer group while in Peak Vehicles per 10,000 people, GRTC ranked third (Table 17). The amount of service provided by GRTC as compared to the population of the service area is average among the peers.

Table 17: Service Provided per Capita

Revenue Miles per Capita		Revenue Hours per Capita		Peak Vehicles per 10,000 People	
Madison, WI	19.96	Madison, WI	1.56	Madison, WI	7.13
Charlotte, NC	15.57	Austin, TX	1.13	Charlotte, NC	3.63
Austin, TX	13.96	Charlotte, NC	1.09	GRTC	3.23
Dayton, OH	13.03	Tucson, AZ	1.01	Austin, TX	3.14
Tucson, AZ	12.90	Tampa, FL	0.94	Tucson, AZ	2.89
Tampa, FL	11.61	Dayton, OH	0.92	Dayton, OH	2.70
GRTC	9.97	GRTC	0.89	Tampa, FL	2.61
Lansing, MI	7.92	Albany, NY	0.70	Hartford, CT	2.18
Memphis, TN	7.88	Lansing, MI	0.59	Albany, NY	2.17
Albany, NY	7.87	Hartford, CT	0.55	Lansing, MI	2.00
Indianapolis, IN	7.37	Memphis, TN	0.54	Memphis, TN	1.65
Hartford, CT	7.32	Indianapolis, IN	0.52	Indianapolis, IN	1.52
Average	11.28	Average	0.87	Average	2.90
GRTC	9.97	GRTC	0.89	GRTC	3.23
Percent Difference	-12%	Percent Difference	3%	Percent Difference	11%
Rank	7 of 12	Rank	7 of 12	Rank	3 of 12

Service Span

Service Span shows the number of hours that the buses operate for weekdays, Saturdays, and Sundays. Service Span figures for Weekday and Saturday service show GRTC providing a span of service close to the average of the peer group. On Sundays, however, GRTC had the fourth greatest service span which was 19 percent higher than the average (Table 18).These measures show that, while GRTC, while smaller in size than most peers, provides an average service span on weekdays and Saturdays, and above average on Sundays.

Table 18: Service Span

Weekday Service Span		Saturday Service Span		Sunday Service Span	
Austin, TX	24.00	Austin, TX	23.45	Hartford, CT	21.08
Albany, NY	22.17	Albany, NY	23.17	Charlotte, NC	21.00
Charlotte, NC	21.82	Charlotte, NC	21.25	Dayton, OH	20.70
Hartford, CT	21.57	Dayton, OH	21.20	GRTC	20.53
Dayton, OH	21.30	Hartford, CT	21.08	Albany, NY	19.50
Madison, WI	20.77	Madison, WI	21.02	Madison, WI	18.78
GRTC	20.53	GRTC	20.15	Austin, TX	18.47
Indianapolis, IN	20.47	Indianapolis, IN	18.92	Indianapolis, IN	15.57
Lansing, MI	20.42	Memphis, TN	18.03	Tampa, FL	14.48
Memphis, TN	20.32	Tampa, FL	16.07	Memphis, TN	13.05
Tampa, FL	19.00	Tucson, AZ	13.67	Tucson, AZ	12.75
Tucson, AZ	16.00	Lansing, MI	7.00	Lansing, MI	10.33
Average	20.70	Average	18.75	Average	17.19
GRTC	20.53	GRTC	20.15	GRTC	20.53
Percent Difference	-1%	Percent Difference	7%	Percent Difference	19%
Rank	7 of 12	Rank	7 of 12	Rank	4 of 12

Financial Efficiency

The measures for Financial Efficiency were Cost per Revenue Mile, Cost per Revenue Hour, and Cost per Peak Vehicle. All measures were calculated using operating expenses as the numerator with the denominator being revenue miles, revenue hours, and peak vehicles respectively. Cost per Revenue Mile and cost per Revenue Hour shows the cost of operating a bus per mile or per hour in revenue service. Cost per Peak Vehicle divides the total operating costs by number of peak vehicles to show the average cost of operating a vehicle.

In the measures for Financial Efficiency GRTC ranked either average or better than average. In Cost per Revenue Mile GRTC was right at the average of $6.22. Cost per Revenue Hour was 14 percent better than average and at the number two rank among the peers. Cost per Peak Vehicle also ranked at number two and was 23 percent below the average (Table 19).

Regarded as a whole, GRTC showed better than average return on funds expended on operating costs.

Table 19: Financial Efficiency

Cost per Revenue Mile		Cost per Revenue Hour		Cost per Peak Vehicle	
Tucson, AZ	$4.19	Tucson, AZ	$53.48	Tucson, AZ	$186,833.24
Memphis, TN	$5.35	GRTC	$69.32	GRTC	$192,310.48
Charlotte, NC	$5.47	Memphis, TN	$77.79	Madison, WI	$197,450.57
Indianapolis, IN	$5.58	Tampa, FL	$78.14	Hartford, CT	$209,810.92
Dayton, OH	$6.02	Charlotte, NC	$78.47	Charlotte, NC	$235,175.01
GRTC	$6.22	Indianapolis, IN	$78.50	Memphis, TN	$255,127.36
Hartford, CT	$6.26	Albany, NY	$80.52	Albany, NY	$259,190.59
Tampa, FL	$6.31	Hartford, CT	$82.88	Indianapolis, IN	$271,085.58
Madison, WI	$7.05	Dayton, OH	$85.29	Tampa, FL	$280,461.75
Albany, NY	$7.13	Madison, WI	$90.47	Lansing, MI	$285,381.71
Lansing, MI	$7.20	Austin, TX	$96.97	Dayton, OH	$290,628.95
Austin, TX	$7.88	Lansing, MI	$97.23	Austin, TX	$350,523.49
Average	$6.22	Average	$80.75	Average	$251,164.97
GRTC	$6.22	GRTC	$69.32	GRTC	$192,310.48
Percent Difference	0%	Percent Difference	-14%	Percent Difference	-23%
Rank	4 of 12	Rank	2 of 12	Rank	2 of 12

Cost Effectiveness

Cost Effectiveness measures used for this analysis were Cost per Passenger, Farebox Recovery, Subsidy per Trip, Subsidy per Capita, and Cost per Capita. All measures use total operating expenses in the formula. Cost per passenger is the ratio of operating expenses to trips and shows the cost of a single trip. Farebox recovery is the percentage of operating expenses that are recovered through fares received and is calculated by dividing revenue by trips. Subsidy per trip is the part of the cost of a trip that is not covered by the fare and is calculated by subtracting revenue from

operating expenses and dividing the difference by total trips. Subsidy per capita shows the cost to each person in the service area for the bus service for a year and is calculated by subtracting revenue from operating expenses and dividing the difference by the population of the service area. Cost per Capita is the total operating expenses divided by the service area population.

In the Cost Effectiveness measures GRTC placed at or near the top in most of the rankings. Its first position for the traditional Farebox Recovery measure was 63 percent better than the average. It shows that GRTC is able to recover the greatest percentage of its cost through the farebox of all peers. Cost per Passenger and Subsidy per trip showed GRTC to be in second place and 29 percent and 41 percent better than the average respectively showing that GRTC provides cost effective service. Subsidy per capita was 26 percent better than average and in 5th position. Cost per capita topped the bottom half of the peers but was still 12 percent less than the average (Table 20). While the Cost per Capita was a little better than average, the Subsidy per Capita showed that GRTC requires less funding to subsidize operations than most peers.

Table 20: Cost Effectiveness

Cost per Passenger		Farebox Recovery	
Tucson, AZ	$1.78	GRTC	31.8%
GRTC	$2.25	Hartford, CT	27.4%
Lansing, MI	$2.43	Tucson, AZ	26.4%
Madison, WI	$2.87	Madison, WI	22.3%
Hartford, CT	$3.12	Indianapolis, IN	22.2%
Memphis, TN	$3.45	Tampa, FL	20.0%
Charlotte, NC	$3.46	Memphis, TN	19.5%
Austin, TX	$3.48	Charlotte, NC	17.3%
Dayton, OH	$3.73	Dayton, OH	15.6%
Indianapolis, IN	$3.83	Lansing, MI	14.2%
Tampa, FL	$3.84	Albany, NY	12.0%
Albany, NY	$3.91	Austin, TX	5.2%
Average	$3.18	Average	19.5%
GRTC	$2.25	GRTC	31.8%
Percent Difference	-29%	Percent Difference	63%
Rank	2 of 12	Rank	1 of 12

Subsidy per Trip		Subsidy per Capita		Cost per Capita	
Tucson, AZ	$1.31	Indianapolis, IN	$31.96	Indianapolis, IN	$41.08
GRTC	$1.53	Hartford, CT	$33.28	Memphis, TN	$42.20
Lansing, MI	$2.08	Memphis, TN	$33.98	Hartford, CT	$45.83
Madison, WI	$2.23	Tucson, AZ	$39.79	Tucson, AZ	$54.06
Hartford, CT	$2.27	GRTC	$42.33	Albany, NY	$56.13
Memphis, TN	$2.77	Lansing, MI	$48.96	Lansing, MI	$57.07
Charlotte, NC	$2.86	Albany, NY	$49.41	GRTC	$62.03
Indianapolis, IN	$2.98	Tampa, FL	$58.62	Tampa, FL	$73.24
Tampa, FL	$3.07	Dayton, OH	$66.27	Dayton, OH	$78.50
Dayton, OH	$3.15	Charlotte, NC	$70.54	Charlotte, NC	$85.26
Austin, TX	$3.30	Austin, TX	$104.26	Austin, TX	$109.93
Albany, NY	$3.44	Madison, WI	$109.37	Madison, WI	$140.74
Average	$2.58	Average	$57.40	Average	$ 70.50
GRTC	$1.53	GRTC	$42.33	GRTC	$62.03
Percent Difference	-41%	Percent Difference	-26%	Percent Difference	-12%
Rank	2 of 12	Rank	5 of 12	Rank	7 of 12

Revenue Generation

The measures for Revenue Generation divide total revenue by total revenue hours, total revenue miles, peak vehicles, and total trips. All of these measures are indicators of the relationship between revenue and other factors. GRTC's rankings for all of the Revenue Generation measures were high. Revenue per Hour, Mile and Peak Vehicle were in the second, and first places and had values that were 45 percent, 68 percent, and 32 percent above average respectively. Revenue per Boarding was also high with a rank of four and a value 20 percent above average (Table 21). These measures and rankings show that GRTC's service is structured to optimize revenue received.

Table 21: Revenue Generation

Revenue per Revenue Hour		Revenue per Revenue Mile		Revenue per Peak Vehicle		Revenue per Trip (Average Fare)	
Hartford, CT	$22.69	GRTC	$1.98	GRTC	$61,066.60	Hartford, CT	$0.85
GRTC	$22.01	Hartford, CT	$1.71	Indianapolis, IN	$60,173.33	Indianapolis, IN	$0.85
Madison, WI	$20.16	Madison, WI	$1.57	Hartford, CT	$57,438.12	Tampa, FL	$0.77
Indianapolis, IN	$17.42	Tampa, FL	$1.26	Tampa, FL	$55,984.09	GRTC	$0.71
Tampa, FL	$15.60	Indianapolis, IN	$1.24	Memphis, TN	$49,724.18	Memphis, TN	$0.67
Memphis, TN	$15.16	Tucson, AZ	$1.11	Tucson, AZ	$49,317.19	Madison, WI	$0.64
Tucson, AZ	$14.12	Memphis, TN	$1.04	Dayton, OH	$45,275.24	Charlotte, NC	$0.60
Lansing, MI	$13.82	Lansing, MI	$1.02	Madison, WI	$44,002.41	Dayton, OH	$0.58
Charlotte, NC	$13.55	Charlotte, NC	$0.95	Charlotte, NC	$40,611.42	Tucson, AZ	$0.47
Dayton, OH	$13.29	Dayton, OH	$0.94	Lansing, MI	$40,551.09	Albany, NY	$0.47
Albany, NY	$9.64	Albany, NY	$0.85	Albany, NY	$31,021.98	Lansing, MI	$0.35
Austin, TX	$5.00	Austin, TX	$0.41	Austin, TX	$18,085.34	Austin, TX	$0.18
Average	$15.20	Average	$1.17	Average	$46,104.25	Average	$0.59
GRTC	$22.01	GRTC	$1.98	GRTC	$61,066.60	GRTC	$0.71
Percent Difference	45%	Percent Difference	68%	Percent Difference	32%	Percent Difference	20%
Rank	2 of 12	Rank	1 of 12	Rank	1 of 12	Rank	4 of 12

Fare Structure

This fare structure analysis addresses two groups: the peer group used in the rest of this study and a group of agencies in the Mid-Atlantic region.

Peer Group

A comparison of fare structures shows the level at which an agency chooses or needs to have the customer contribute to operating costs. In this comparison, GRTC, with a base fare of $1.25, falls in the middle of the peer group whose average fare is $1.21. Likewise GRTC's $2.25 base fare for ADA service ranks near the $2.15 average. (Table 22)

For other types of fares and transfers the agencies differed considerably in their structures. Only six had express fares. Among these GRTC's $1.75 fare is 9% greater than the average of $1.60. Only two agencies have fares resembling GRTC's $2.50 extended express fare. GRTC's fare is lower than both Charlotte's and Memphis' similar fares.

It is noteworthy that only GRTC and Memphis charge for a transfer. Six of the agencies give free transfers. Three agencies charge full fare. Two of the agencies charging full fare for transfers are at the low end of fare costs. Another charges $1.50 for a fare. The three agencies that charge full fare, however, give their customers the opportunity to buy a day pass at a cost of $1.00 to $3.50.

To compare transfer costs, consider a GRTC customer making a daily round-trip with one transfer each way. Assuming the use of a base fare, the cost would be $2.80. A customer in Indianapolis with a similar situation would spend $3.50 on a day pass but $6.00 without. In Austin, where all fares are very low, the cost would be $1.00 with a day pass and $2.00 without. GRTC does not offer a day pass, but more than half of the peer agencies do.

Unlimited monthly and weekly passes are other fare payment methods used by many of the peers. Nine of the twelve peers offer monthly passes. GRTC is among the three that do not.

Table 22: Peer Group Fare Structure

Peer Group							
	Fixed Route						ADA
Location	Base Fare	Transfer	Express Fare	Extended Express	Day Pass	Month Pass	Base Fare
Austin, TX	$0.50	Full Fare or Day Pass	$1.00	N/A	$1.00	$10.00	$0.60
Albany, NY	$1.00	Full Fare or Day Pass	$1.00	Varies	$3.00	N/A	$2.00
Lansing, MI	$1.00	Free	N/A	N/A	N/A	$30.00	$2.00
Tucson, AZ	$1.00	Free	N/A	N/A	$2.00	$28.00	$2.00
Dayton, OH	$1.25	Free	N/A	N/A	N/A	$35.00	$2.00
Hartford, CT	$1.25	Free	N/A	N/A	$3.25	$45.00	Varies
GRTC	$1.25	$0.15	$1.75	$2.50	N/A	N/A	$2.25
Charlotte, NC	$1.30	Free	$1.75	$2.60	N/A	$52.00	$2.00
Indianapolis, IN	$1.50	Full Fare or Day Pass	N/A	N/A	$3.50	$55.00	$3.00
Madison, WI	$1.50	Free	N/A	N/A	$3.40	$47.00	$3.00[1]
Memphis, TN	$1.50	$0.10	Additional $.75 - $1.55		N/A	N/A	$3.00
Tampa, FL	$1.50	Full Fare or Day Pass	$2.50	N/A	$3.25	$50.00	$2.60
Average	$1.21		$1.60		$2.77	$39.11	$2.15
GRTC	$1.25		$1.75				$2.25
Percent Difference	3%		9%				5%

[1]$3.00 Peak/$2.00 Off-Peak

Fare Data as of September 2007

Regional Group

GRTC's ranking falls near the average of the regional group as with the peer group. (Table 23) The base fare is much lower than fares for the large metropolitan systems with the exception of Washington, DC where they are considering a $.45 increase.

The study of regional fares yields observations similar to those for the peer group. Only two of the other regional agencies are like GRTC in charging for a transfer

(18%). Here again the transfer is handled either by being free (47%) or through the use of a day pass (24%.) One agency charges full fare for every trip.
Many (59%) of the agencies offer day passes at an average cost of $4.00. Even more (76%) offer monthly passes with the average price of $50.00. Costs for daily and monthly passes vary widely among the regional agencies.

Table 23: Regional Agency Fare Structure

Other Regional Agencies							
	Fixed Route						ADA
Location	Base Fare	Transfer	Express Fare	Extended Express	Day Pass	Month Pass	Base Fare
Jacksonville[1]	$1.00	Full Fare	$1.50	N/A	N/A	$40.00	$1.25-$3.00
Raleigh	$1.00	Full Fare or Day Pass	N/A	N/A	$2.00[2]	$36.00	$1.50
Fairfax	$1.00	Free	$3.00	N/A	$3.00	N/A	$1-$4
Alexandria	$1.00	Free	N/A	N/A	$2.00[3]	N/A	$2.00
Arlington	$1.25	Free	N/A	N/A	N/A	N/A	N/A
Washington[4]	$1.25	Free	$3.00	N/A	$3.00	$11 / Week	$1-$4
GRTC	$1.25	$0.15	$1.75	$2.50	N/A	N/A	$2.25
Nashville	$1.25	Full Fare or Day Pass	$1.75	N/A	$3.75	$60.00	$2.50
Charleston	$1.25	Free	$2.00	N/A	$4.00	$31.25	$2.50
Pittsburgh	$1.25	$0.50	$1.75-$2.75		N/A	$60-$93	$2.60
Rochester	$1.25	Full Fare or Day Pass	N/A	N/A	$ 3.00	$56.00	1-$5
Hampton Roads	$1.50	Free	N/A	N/A	N/A	$50.00	$3.00
Boston	$1.50	Free	$3.50-$5.00		$9.00[5]	$40.00	$2.00
Baltimore	$1.60	Full Fare or Day Pass	$2.00	N/A	$3.50	$64.00	$1.85
Atlanta	$1.75	Free	N/A	N/A	N/A	$52.50	$3.50
New York City	$2.00	Free	$5.00	N/A	$7.00	$38.00	$2.00
Philadelphia	$2.00	$0.60	+$.50	Zones	N/A	$78-$181	$4.00
Average	$1.36				$3.93	$49.98	$2.49
GRTC	$1.25	$0.15	$1.75	$2.50	N/A	N/A	$2.25
Percent Difference	-9%						-11%

[1] Fares Effective October 1, 2007 (Simplified Fare Structure)

[2] $4.00 Regional

[3] $3.00 Regional

[4] Fare increase of $.45 under consideration.

[5] Unlimited travel on Subway, Local Bus, Inner Harbor Ferry, and Commuter Rail Zone 1A.

Fare Data as of September 2007 except where noted

In summary, considering both the peer group and the regional group GRTC has an average fare. In both cases GRTC differs from the majority by not offering daily or monthly passes and by charging for a transfer.

Conclusions

In a group of peers that were generally larger in area and population, GRTC compared favorably in almost all major and minor categories.
In measures of financial efficiency, cost effectiveness, and revenue generation, GRTC excelled. Most measures showed GRTC at the top. This indicates that GRTC is getting a very good return on its use of funds.

The numbers show that GRTC provides a greater percentage of its service at peak times than other agencies. This may be explained by the service region's smaller size with less traffic congestion and greater use of private vehicles for transportation by the general population. In addition, GRTC receives limited funding for its services and must operate under financial constraints that necessitate efficient use of those funds. GRTC charges an average fare for its services when compared with both its peer group and another group of transit agencies in the Mid-Atlantic region. Service effectiveness was higher than average and in the top half of peers. Service per capita and service span were near average, which is good when compared to many systems of greater size serving larger populations.

Transportation and vehicle efficiency were the two major categories in which GRTC was in a lower rank. The low Peak to Base Ratio provides the reason for fewer miles and hours being put on each bus, since many buses are not used at non-peak times. The lower average speed of the buses for GRTC could indicate that buses operate through congested areas with frequent stops during peak times of day.

A conclusion may be drawn that GRTC's high rankings in cost effectiveness, financial efficiency, and revenue generation come at the sacrifice of providing more service at non-peak times.

2

GRTC Ridership

Introduction

Riders are the foundation of every transit system. In the Richmond region, transit riders rely on GRTC to get them safely to their destinations, enabling them to pursue any of the opportunities available throughout the metropolitan area. Meeting the transportation needs of these riders is the primary responsibility and obligation of GRTC. In other words, satisfying the transportation needs of riders is the very reason GRTC exists. A detailed ridership analysis will help identify if GRTC is effectively meeting the needs of its riders and potential ways to improve the service.

Ridership represents an important measure of success for a transit system as well as for each bus route in the system. The more riders a bus system serves, the more useful it is for local residents. Furthermore, as ridership increases on existing routes, the economic efficiency of the route improves. Therefore, evaluating ridership for GRTC's bus system and individual routes will add an important piece to the puzzle of how well the system and its constituent parts perform. Ridership analysis was conducted based on on-off counts collected for each GRTC bus over the course of a typical operating weekday. Evaluation of ridership by route will also serve as a check to ensure that GRTC's resources are being used efficiently throughout the system. Routes identified as popular with riders should be enhanced and emulated throughout the system. Routes that are struggling to attract riders will need to be reconsidered. Through this process, GRTC will strengthen the overall system by making each route as relevant to the transportation needs of residents as possible.

In addition to assessing the GRTC system based on its ridership numbers, it is important to gain a deeper understanding of who is using the service and for what purposes. Gathering information on current GRTC riders through an on-board survey will provide GRTC with specific details regarding the transportation needs of riders. The survey findings will help fill out the ridership analysis by including personal characteristics of the people who use the service every day. Together, information on the needs of riders and the success of routes will provide valuable tools for making decisions on how to improve and change service to make the system as appropriate as possible.

Ridership

Ridership counts were conducted for each route in the GRTC system by stop during a period from the last week in October, 2006, until the first week of December, 2006. To obtain this information, VHB's subconsultant Data Smarts staffed each route and manually counted the number of boarding and alighting passengers at each stop. The data were directly input into a handheld computer loaded with software customized for the GRTC system. From these data, the bus load—the number of passengers onboard the bus—was calculated for each trip leg between every stop on the route. These three types of data—boardings, alightings, and passenger loads—each provide a more in-depth understanding to different aspects of the system.

Studying boardings and alightings reveals which bus stops have the highest demand. The most used stops are good candidates for rider amenities, such as benches and bus shelters. Additionally, identifying the max load, the location on the route having the greatest number of riders, can help determine route segments that could benefit from additional service and higher service frequency. Evaluating route loads shows the most popular, and crowded, portion of each route. This information is important for planning service frequency and scheduling appropriate vehicles. These data also uncover the stops and route segments with the lowest demonstrated demand. Stops and route segments that are not frequently used should be considered for adjustments that will effectively serve more riders.

Below, a table is provided for each direction of GRTC regular and express routes (Table 24 through Table 69). The tables list the total daily boardings, alightings, and route loads at each stop. The route loads denote the number of riders on board the bus between the stop the bus is leaving and the next stop. In each table, the highest recorded boarding, alighting, and route load is indicated in bold. The daily counts for each of these statistics provide a means to focus in on the stops and route segments that should receive the most attention during future service planning.

Since many GRTC routes have multiple branches and other route deviations, the stops listed in the tables do not always represent sequential service. For routes with different branches, the stops from each branch are typically grouped in the tables based on the sequential order they are served along that branch. In the ridership tables presented below, each route branch is shaded a different color to indicate deviations from the common segment. The common leg of the route is unshaded.

Additionally, the passenger loads for each route direction do not start or end at zero since passengers often remain on board from the previous route direction. The route direction at the end of a route can be an imprecise designation, especially in cases where a route makes a loop. People will board at the most convenient point for their trip regardless of route direction. The following tables are best used to identify individual stops and route segments of interest.

Route 1-2

Routes 1 & 2 serve the Church Hill area and downtown along Broad Street. Route 1 service extends to St. Mary's Hospital along Monument Ave, while Route 2 provides service to Regency Square Mall along Patterson Ave. The downtown segment of eastbound Route 1-2 receives the heaviest ridership. The most popular eastbound boarding point is at the Broad & Boulevard stop and the most popular alighting point is at Broad & 9th. The segment between these two stops, which serves downtown Richmond along Broad Street, carries the heaviest volume of passengers. The northwest portions of this route have a lower ridership than the downtown segment. Between the two branches of this route, the segment operating on Patterson has a higher ridership than the Monument segment. The average observed boardings per trip for this route was 16. The 2:51 p.m. trip carries the highest load with 38 passengers.

Westbound Route 1-2 experiences ridership patterns complimentary to those observed for the eastbound trip. Ridership loads are highest downtown along the Broad segment. Broad & 6th and Broad & 4th recorded the highest number of boardings and alightings, respectively. Similar to the eastbound trip, the passenger loads along the Patterson branch are higher than on the Monument segment. On average, there are 19 boardings per trip on the westbound route. The 5:45 a.m. trip carries the highest load with 29 passengers. In the table below, the shaded cells represent stops along the common leg of the route.

Figure 21: Route 1

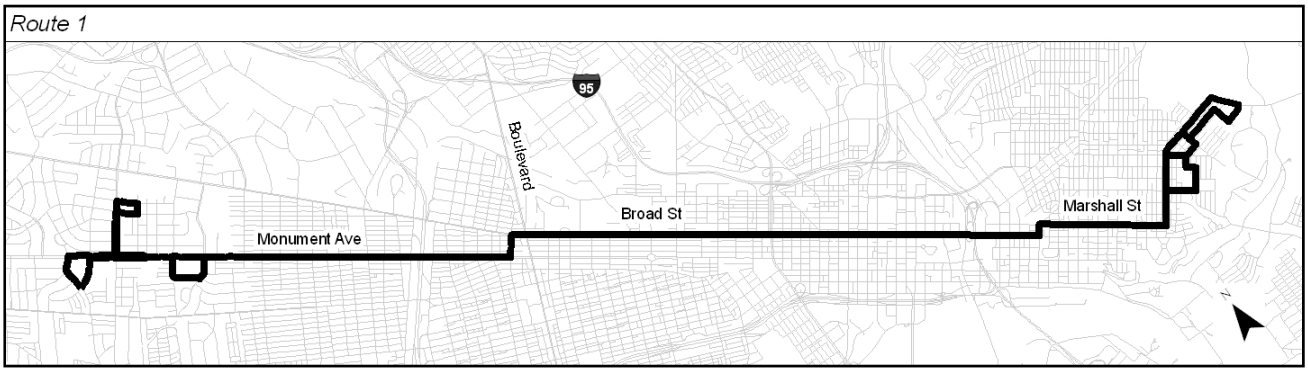


Figure 22: Route 2

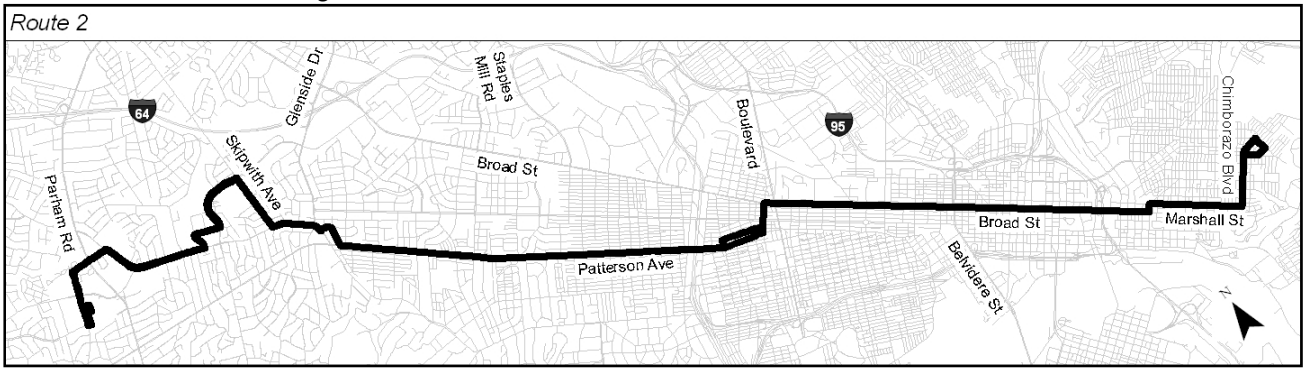


Table 24: 1-2 Eastbound Daily Ridership

Order	Description	Ons	Offs	Load
1	Starling & Farmington	16	15	92
2	Sears (Garden Center) Regency*	33	26	99
3	Starling & Quiocassin	17	14	102
4	Starling & Gateway East	9	0	111
5	Fargo & Parham	2	1	112
6	Fargo & Dena	1	0	113
7	Three Chopt & Ridgehaven	1	0	114
8	Three Chopt in front of 8907 *	9	0	123
9	Three Chopt & drive to D Free*	3	0	126
10	Three Chopt & Camden	1	0	127
11	Three Chopt & Beverly	2	0	129
12	Santa Rosa & Three Chopt	1	1	129
13	Santa Rosa & Franklin Farms	8	0	137
14	Franklin Farms & Forest	6	0	143
15	Forest & Henrico Doctors' Hos*	9	0	152
16	Skipwith & School Building	10	1	161
17	Skipwith & Parkline	1	0	162
18	Three Chopt & Skipwith	0	0	162
19	Three Chopt & Park	2	1	163
20	Patterson east of driveway to*	29	0	210
21	Patterson at Ripley	10	2	218
22	Patterson at Honaker	7	0	225
23	Patterson at Chantecler	2	0	228
24	Patterson at Pine Ridge	1	0	228
25	Patterson at Pepper	4	0	232
26	Patterson at St Christopher	0	0	232
27	Patterson at Algoma	0	0	230
28	Patterson at Maple	8	1	236
29	Patterson at Libbie	10	1	246
30	Patterson at Granite	19	2	263
31	Patterson at Westview	3	1	265
32	Patterson at Matoaka	4	0	268
33	Patterson at Willow Lawn	5	2	272
34	Patterson at Greenway Lane	1	0	273
35	Patterson at Harlan Circle	0	1	272
36	Patterson at Lexington	0	1	270
37	Patterson at Wisteria	0	0	271
38	Patterson at Bunting	2	0	273
39	Patterson at Westmoreland	1	0	274
40	Patterson at Commonwealth	3	0	279
41	Patterson at Sauer	3	2	280
42	Patterson at Malvern	1	0	281
43	Patterson at Lafayette	0	0	281
44	Patterson at Hamilton	4	6	279
45	Patterson at Thompson	7	4	282
46	Patterson at Roseneath	15	2	289
47	Patterson at Tilden	1	2	288
48	Patterson at Cleveland	3	2	295
96	Broad & 17th	5	19	390
97	Broad & 18th	14	7	397
98	Broad & 19th	4	14	386

Order	Description	Ons	Offs	Load
49	Patterson at Belmont	3	0	292
50	Sheppard & Park	7	1	298
51	Sheppard & Monument	2	2	298
52	Bremo & Monument	32	5	60
53	Monument & Libbie	3	4	59
54	Monument at Peachtree	9	0	68
55	Monument at Byrd	2	0	76
56	Monument at Willow Lawn	7	3	80
56	Monument at Willow Lawn	7	3	80
57	Monument at Staples Mill	2	1	81
58	Monument at Chantilly	1	0	82
59	Monument at Blacker	4	0	86
60	Monument at Westmoreland	3	0	89
61	Monument at Commonwealth	4	0	93
62	Monument at Shenandoah	1	0	94
63	Monument at Sauer	2	0	96
64	Monument at Antrim	0	0	96
65	Monument at Malvern	1	0	97
66	Monument at Lafayette	1	0	98
67	Monument at Kent	7	1	104
68	Monument at Thompson	0	0	104
69	Monument at Tilden	8	1	111
70	Monument at Cleveland	2	1	112
71	Monument at Belmont	0	0	112
72	Sheppard & Grace	4	1	365
73	Broad & Sheppard	26	12	373
74	Broad & Boulevard	79	10	443
75	Broad & Robinson	30	23	449
76	Broad & Davis	25	5	469
77	Broad & Strawberry	19	7	481
78	Broad & Allison	16	8	489
79	Broad & Meadow	21	19	491
80	Broad & Allen	11	8	494
81	Broad & Lombardy	41	9	526
82	Broad & Ryland	15	18	529
83	Broad & Harrison	35	20	545
84	Broad & Laurel	17	11	551
85	Broad & Henry	24	7	566
86	Broad & Monroe	11	6	573
87	Broad & Jefferson	25	12	584
88	Broad & Adams	7	6	585
89	Broad & 1st	12	25	574
90	Broad & 2nd	34	98	510
91	Broad & 4th	41	74	471
92	Broad Street at 9th Street	78	159	394
93	Broad & 10th	35	29	400
94	Broad & 12th	26	37	390
95	Broad & Old 14th	36	22	404
106	Marshall & 33rd	0	15	235
107	Chimborazo Boulevard & Marsha*	1	20	216
108	Chimborazo Boulevard & Leigh	3	43	176

Order	Description	Ons	Offs	Load
99	21st & Broad	8	15	372
100	Marshall & 22nd	1	25	350
101	Marshall & 24th	3	24	329
102	Marshall & 25th	0	13	316
103	Marshall & 27th	0	12	304
104	Marshall & 29th	1	38	267
105	Marshall & 31st	4	21	250

Order	Description	Ons	Offs	Load
109	Chimborazo Boulevard & M	0	19	157
110	Chimborazo Boulevard & N	0	21	136
111	Chimborazo Boulevard & O	0	21	120
112	P & Chimborazo Boulevard	1	22	99
113	P & 35th	1	14	88
114	R & 36th	10	26	81
115	R & Oakwood	29	21	59
Daily Totals		1128	1143	

Table 25: 1-2 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
116	R & Oakwood	44	8	149
117	Oakwood & R	20	0	164
118	Oakwood & Q	19	3	180
119	Chimborazo Boulevard & P	18	1	197
120	Chimborazo Boulevard & N	19	0	216
121	Chimborazo Boulevard & M St.	20	1	235
122	Chimborazo Boulevard & Leigh	41	1	264
123	Marshall & Chimborazo Bouleva*	20	1	283
124	Marshall & 33rd	14	0	297
125	Marshall & 31st	19	2	314
126	Marshall & 29th	32	0	346
127	Marshall & 27th	14	3	357
128	Marshall & 25th	35	8	384
129	Marshall & 23rd	7	0	391
130	21st & Marshall	29	12	414
131	Broad & 19th	20	4	430
132	Broad & 18th	17	7	440
133	Broad & 17th	27	4	463
134	Broad between 14th and 12th	19	32	450
135	Broad & 12th	60	39	463
136	Broad Street at 10th Street	47	27	486
137	Broad & 9th	88	50	524
138	Broad & 8th	1	0	9
139	Broad & 6th	167	61	628
140	Broad at 4th	79	86	621
141	Broad & 3rd	45	41	625
142	Broad & 1st	102	28	692
143	Broad & Jefferson	38	17	714
144	Broad & Madison	12	14	712
145	Broad & Monroe	9	10	711
146	Broad & Henry	15	19	707
147	Broad & Gilmer	6	10	703
148	Broad & Hancock	9	19	693
149	Broad & Harrison	37	29	701
150	Broad & Ryland	17	16	702
186	Patterson at Pepper	5	10	263
187	Patterson at Pine Ridge	1	0	264
188	Patterson at Chantecler	0	3	261
189	Patterson at Honaker	2	14	249
190	Patterson at Ripley	4	12	241
191	Three Chopt at Park	3	7	206

Order	Description	Ons	Offs	oads
151	Broad & Bowe	5	53	654
152	Broad & Allen	9	26	637
153	Broad & Meadow	6	17	625
154	Broad & Allison	6	20	611
155	Broad & Strawberry	4	23	595
156	Broad & Davis	6	10	586
157	Broad & Robinson	17	19	584
158	Broad & Terminal Place	2	22	479
159	Broad & Boulevard	14	42	451
160	Sheppard & Broad	7	12	446
161	Sheppard & Monument	4	23	512
162	Park & Sheppard	7	10	349
163	Park & Cleveland	3	8	344
164	Park & Tilden	1	5	340
165	Roseneath & Park	1	2	339
166	Patterson & Nansemond	3	16	326
167	Patterson & Thompson	5	2	322
168	Patterson at Hamilton	0	2	320
169	Patterson at Lafayette	0	2	318
170	Patterson at Malvern	2	0	320
171	Patterson at Sauer	1	0	321
172	Patterson at Commonwealth	3	4	320
173	Patterson at Westmoreland	0	3	317
174	Patterson at Chantilly	1	0	318
175	Patterson at Spokane	1	0	319
176	Patterson at Harlan Circle	1	4	316
177	Patterson at Greenway Lane	0	2	314
178	Patterson & Willow Lawn	1	7	308
179	Patterson at Matoaka	1	2	307
180	Patterson at Glenbernie	0	7	300
181	Patterson at Granite	2	12	290
182	Patterson at Libbie	3	14	279
183	Patterson at Maple	2	10	271
184	Patterson at Algoma	0	2	269
185	Patterson & Hampstead	0	1	268
229	Libbie & Old Richmond	0	6	76
230	Libbie Ave. Convalescent Cent*	4	9	71
231	Libbie & Fitzhugh	2	3	70
232	Libbie & Crestwood	1	1	70
233	Libbie & Morningside	1	2	69
234	Bremo & Monument	10	39	44

Order	Description	Ons	Offs	Loads
192	Three Chopt & Park	0	3	203
193	7402 Three Chopt	0	1	202
194	Skipwith & Parkline	0	2	200
195	1619 Skipwith	1	31	170
196	Franklin Farms & Forest	2	7	165
197	Santa Rosa & Franklin Farms	0	7	158
198	Three Chopt & Santa Rosa	0	3	155
199	Three Chopt & Westberry	0	9	146
200	Three Chopt & Ridge	0	10	136
201	Three Chopt in front of 8907 *	0	1	135
202	Three Chopt & Ridgehaven	0	2	133
203	Three Chopt & Fargo	0	7	125
204	Fargo & Dena	2	3	125
205	Fargo & Parham	0	8	116
206	Starling & Starling Ct	3	24	95
207	Starling & Farmington	4	28	61
208	Monument & Belmont	0	3	157
209	Monument & Cleveland	0	0	157
210	Monument & Tilden	1	1	157
211	Monument & Thompson	1	5	153
212	Monument & Hamilton	0	2	151
213	Monument & Lafayette	0	1	150
214	Monument & Malvern	1	20	136
215	Monument & Antrim	0	0	136
216	Monument & Sauer	0	0	136
217	Monument & Shenandoah	0	2	134
218	Monument & Commonwealth	0	0	134
219	Monument & Westmoreland	0	0	134
220	Monument & Blacker	2	1	135
221	Monument & Chantilly	1	2	134
222	Monument & Staples Mill	0	6	128
223	Monument & Westlyn ave	0	11	117
224	Monument & Byrd	0	5	105
225	Monument & Treboy	0	4	101
226	Libbie & Monument	0	10	91
227	Libbie & Crestwood	1	5	87
228	Libbie & Fitzhugh	1	6	82

Order	Description	Ons	Offs	oads
235	Willow Lawn south of Monument	0	1	6
236	Wythe between Willow Lawn and*	0	0	6
237	Monument at Byrd	0	0	6
238	Sheppard & Monument	4	23	512
239	Park & Sheppard	7	10	349
240	Park & Cleveland	3	8	344
241	Park & Tilden	1	5	340
242	Roseneath & Park	1	2	339
243	Patterson & Nansemond	3	16	326
244	Patterson & Thompson	5	2	322
245	Patterson at Hamilton	0	2	320
246	Patterson at Lafayette	0	2	318
247	Patterson at Malvern	2	0	320
248	Patterson at Sauer	1	0	321
249	Patterson at Commonwealth	3	4	320
250	Patterson at Westmoreland	0	3	317
251	Patterson at Chantilly	1	0	318
252	Patterson at Spokane	1	0	319
253	Patterson at Harlan Circle	1	4	316
254	Patterson at Greenway Lane	0	2	314
255	Patterson & Willow Lawn	1	7	308
256	Patterson at Matoaka	1	2	307
257	Patterson at Glenbernie	0	7	300
258	Patterson at Granite	2	12	290
259	Patterson at Libbie	3	14	279
260	Patterson at Maple	2	10	271
261	Patterson at Algoma	0	2	269
262	Patterson & Hampstead	0	1	268
263	Patterson at Pepper	5	10	263
264	Patterson at Pine Ridge	1	0	264
265	Patterson at Chantecler	0	3	261
266	Patterson at Honaker	2	14	249
267	Patterson at Ripley	4	12	241
268	Register Pkwy at Patterson Av*	0	15	16
269	Park & Stafford Pl.	3	1	18
270	Park & Three Chopt	6	4	20
271	Patterson east of driveway to*	1	2	19
Daily Totals		1401	1471	

Route 3-4

Routes 3 & 4 provide service between the downtown area and the West End. Route 3 serves the area near Marymont Park, with connections to Fairfield Court and the Science Museum of Virginia via Route 3PP. Route 4 serves the University of Richmond Stadium with connections to the City Jail and the Science Museum of Virginia via Route 4P. For the eastbound direction of Route 3-4, the downtown segment traveling along Broad Street serves the most riders. This route segment is common to the two east and two west branches of the route. The west branches serve fewer riders than the branches operating northeast of downtown, but the Mechanicsville segment receives the highest ridership outside of downtown. The stop located at Broad & 9th sees both the highest number of boardings and alightings

of all stops. There was an average of 31 boardings per trip in the eastbound direction. The 4:53 p.m. trip carries the highest load with 52 passengers.

The westbound Route 3-4 trip has the same general ridership patterns as the eastbound trip. Ridership is heaviest downtown along the Broad Street segment, followed by the northeast segments, particularly the portion of the route operated along Mechanicsville. The westbound stop with the most boardings is located along the Mechanicsville segment, Ford & Mechanicsville. The most popular alighting stop is located at Broad & 4th. The westbound route had an average of 19 boardings per trip. The 6:25 a.m. trip carries the highest load with 60 passengers. In the ridership table below, each route branch is shaded a different color to indicate deviations from the common segment. The common leg is left unshaded.

Figure 23: Route 3

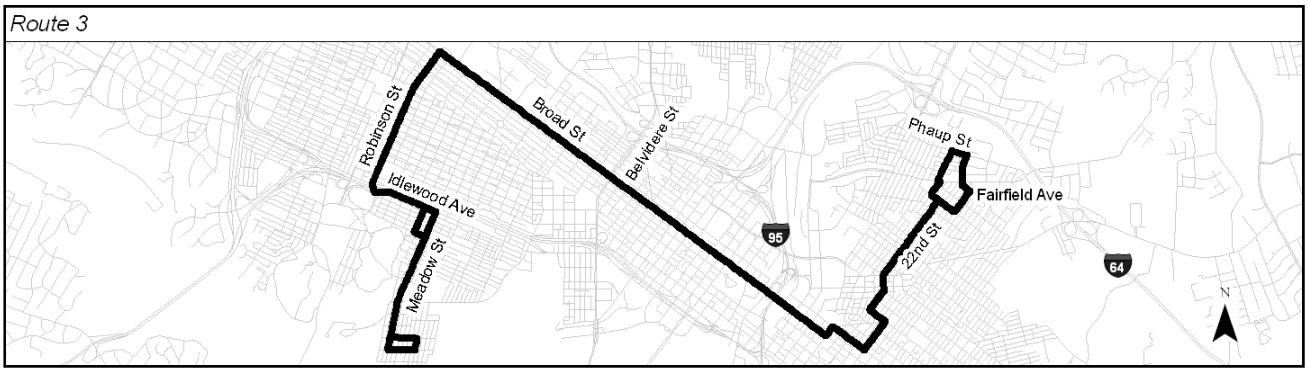


Figure 24: Route 4

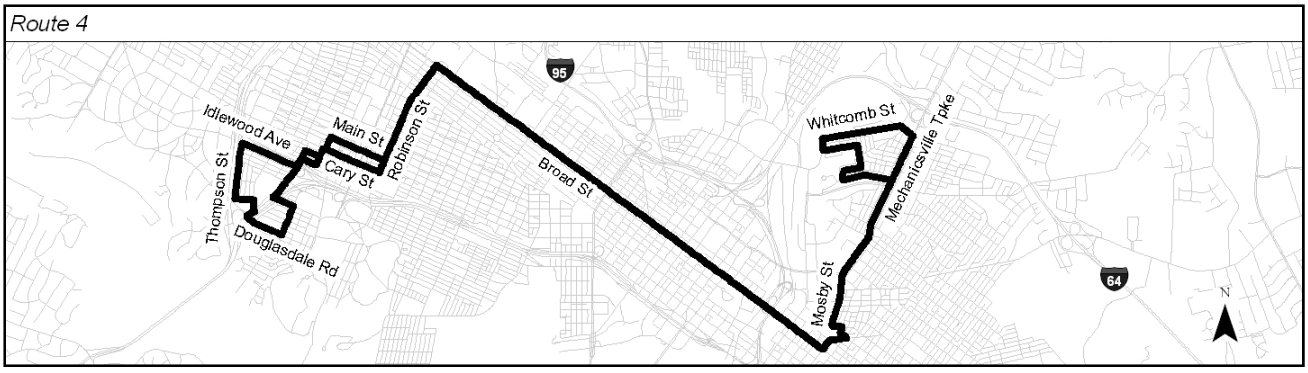


Table 26: 3-4 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	New York & Carter	14	16	37
2	New York & Georgia	10	1	46
3	Meadow & Pennsylvania	2	0	48
4	Meadow & Nevada	5	0	53
5	Meadow & Dakota	10	0	62
6	Meadow & Colorado	3	3	64
7	Meadow & Amelia	4	0	68
8	Meadow & Winder	6	1	73

Order	Description	Ons	Offs	Loads
51	Broad & 1st	78	21	817
52	Broad & 2nd	123	74	864
53	Broad & 4th	170	75	955
54	Broad Street at 9th Street	245	131	1080
55	Broad & 10th	104	65	1119
56	Broad & 11th	60	50	1129
57	Broad & 12th	63	23	1170
58	Broad & Old 14th	35	20	1185

Order	Description	Ons	Offs	Loads
9	Meadow & Blair	3	0	76
10	Meadow & Clairborne	3	0	79
11	Meadow & Lakeview	10	0	89
12	Meadow & Maplewood	10	0	98
13	Meadow & Rosewood	12	0	110
14	Idlewood at Rowland	24	6	128
15	Idlewood at Shields	13	0	138
16	Idlewood at Addison	7	0	146
17	Grayland & Davis	5	0	153
18	Robinson & Grayland	1	2	151
19	Douglasdale & French	1	2	36
20	Belmont & Condie	8	8	36
21	Belmont & French	2	1	37
22	Belmont & Grant	3	5	35
23	McCloy & Maplewood	1	0	36
24	McCloy & Idlewood	6	0	42
25	Grayland & McCloy	3	0	45
26	Belmont & Parkwood	3	0	48
27	Cary & Belmont	16	1	63
28	Cary & Sheppard	4	0	67
29	Cary & Boulevard	7	1	73
30	Robinson & Cary	66	7	280
31	Robinson & Main	22	3	301
32	Robinson & Grove	61	10	350
33	Robinson & Hanover	10	2	358
34	Robinson & Stuart	30	0	390
35	Robinson & Kensington	16	1	404
36	Robinson & Grace	15	10	411
37	Robinson & Broad	19	46	387
38	Broad & Davis	33	10	414
39	Broad & Strawberry	38	9	443
40	Broad & Allison	17	2	455
41	Broad & Meadow	41	4	496
42	Broad & Allen	32	6	518
43	Broad & Lombardy	82	11	594
44	Broad & Ryland	29	15	608
45	Broad & Harrison	73	22	656
46	Broad & Laurel	49	14	697
47	Broad & Henry	50	16	728
48	Broad & Monroe	26	10	745
49	Broad & Jefferson	28	9	764
50	Broad & Adams	14	17	761
Order	Description	Ons	Offs	Loads
101	21st & Fairfield	11	20	121
Daily Totals		2261	1827	

Order	Description	Ons	Offs	Loads
59	Broad & 17th	11	27	1170
60	Broad & 18th	16	9	1177
61	Broad & 19th	16	13	1180
62	21st & Broad	14	25	1169
63	Jefferson & Marshall	17	4	740
64	Clay & 21st	2	8	734
65	21st & Princess Anne	5	4	735
66	Mosby & Cedar	13	15	733
67	Mosby & Venable	2	25	710
68	Mosby & O	3	26	687
69	Mosby & P	4	23	668
70	Mosby & Q	0	22	646
71	Mosby St. at Fairmount Ave	2	35	613
72	Mosby & T	8	46	575
73	Mechanicsville Pike & Brauers*	5	38	542
74	Mechanicsville Pike & Fairfie*	3	76	469
75	Mechanicsville Pike & Carver	1	30	440
76	Mechanicsville Pike & Phaup St	24	87	377
77	Whitcomb & Mechanicsville Pike	43	41	379
78	Whitcomb & Deforest	40	68	358
79	Whitcomb & Conrad	9	25	270
80	Whitcomb & Redwood	42	38	274
81	Marshall & 22nd	4	10	437
82	Marshall & 24th	2	15	424
83	25th & Leigh	0	16	408
84	M & 24th	2	16	394
85	23 & M St	0	7	386
86	23 & Venable	7	23	373
87	22nd & Q St	3	29	349
88	22nd & R St	1	23	325
89	22nd & Fairmount	4	24	305
90	22nd & U St	1	15	292
91	22nd & W St	13	16	289
92	X & 22nd	5	27	266
93	X & 24th	4	8	263
94	24th & Y St	6	5	265
95	24th & Peter Paul Boulevard	4	8	261
96	23 & Fairfield	43	64	243
97	23 & Selden	16	17	186
98	23 & Phaup	19	48	156
99	21st & Phaup	9	11	154
100	21st & Selden	2	10	145

Table 27: 3-4 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
102	21st & Fairfield	39	1	286
103	X & 22nd	10	3	293

Order	Description	Ons	Offs	Loads
148	Broad at 4th	55	161	827
149	Broad & 3rd	55	98	785

Order	Description	Ons	Offs	Loads
104	22nd & W St	25	5	312
105	22nd & V St	18	1	329
106	22nd & U St	22	0	351
107	22nd & Fairmount	32	0	378
108	22nd & O St	27	1	409
109	22nd & Venable	15	2	422
110	23 & Jessamine	3	0	425
111	M & 25th	7	2	429
112	25th & Leigh	6	3	432
113	Marshall & 25th	0	7	425
114	Marshall & 23rd	1	2	424
115	Whitcomb & Deforest	11	60	91
116	Whitcomb & Conrad	14	3	102
117	Whitcomb & Redwood	44	6	395
118	Whitcomb & Sussex	21	8	408
119	Whitcomb & Lebanon	12	0	420
120	Mecklenburg between Whitcomb	6	11	415
121	Wood & Eastview Lane	14	9	420
122	Sussex & Hospital	13	3	430
123	Sussex & Hildreth	9	9	430
124	Hildreth St & Ford Ave	21	18	433
125	Ford Ave & Sussex	6	0	439
126	Ford Ave & Bryan St	10	6	443
127	Ford Ave & Mechanicsville Pike	103	8	538
128	Mechanicsville Pike & Richmond	8	0	546
129	Mechanicsville Pike & Redd	50	3	593
130	Mechanicsville Pike & Littlep*	62	0	652
131	Mosby & Q	26	1	661
132	Mosby & P	12	2	671
133	Mosby & Leigh St	8	4	675
134	Mosby & Venable	15	0	690
135	Mosby & Cedar	0	0	690
136	Princess Anne & N. 21st	2	2	690
137	Clay & 21st	6	10	686
138	21st & Marshall	27	21	1119
139	Broad & 19th	13	2	1131
140	Broad & 18th	20	22	1129
141	Broad & 17th	37	14	1154
142	Broad between 14th and 12th	21	29	1148
143	Broad & 12th	41	107	1077
144	Broad Street at 10th Street	53	49	1075
145	Broad & 9th	59	129	1007
146	Broad & 8th	96	139	964
147	Broad & 6th	74	101	933
194	Idlewood at Addison	1	6	159
195	Idlewood at Shields	0	24	135
196	Rowland & Idlewood	1	20	116
197	Rowland & Maplewood	0	8	108
198	Rowland & Lakeview	0	11	97
199	Lakeview & Meadow	1	10	88
200	Meadow & Gilbert	0	17	71
201	Meadow & Walker	0	9	62

Order	Description	Ons	Offs	Loads
150	Broad & 1st	86	61	809
151	Broad & Jefferson	31	36	762
152	Broad & Madison	13	24	751
153	Broad & Monroe	6	10	748
154	Broad & Henry	6	49	705
155	Broad & Gilmer	3	21	687
156	Broad & Hancock	13	40	660
157	Broad & Harrison	29	48	641
158	Broad & Ryland	9	33	617
159	Broad & Bowe	9	44	584
160	Broad & Allen	5	34	553
161	Broad & Meadow	6	31	527
162	Broad & Allison	6	15	518
163	Broad & Strawberry	4	26	499
164	Broad & Davis	2	8	491
165	Robinson & Broad	56	67	479
166	Robinson & Monument	12	8	485
167	Robinson & Park	4	17	472
168	Robinson & Kensington	3	21	452
169	Robinson & Stuart	0	3	189
170	Robinson & Hanover	0	24	429
171	Robinson & Grove	4	57	376
172	Robinson & Floyd	3	16	363
173	Robinson & Main	0	18	204
174	Main & Robinson	2	41	98
175	Main & Boulevard	0	9	87
176	Ellwood & Colonial	0	8	79
177	Ellwood & Sheppard	0	1	78
178	Belmont & Ellwood	0	12	66
179	Belmont at Cary	0	10	56
180	Parkwood & Belmont	3	3	56
181	McCloy & Grayland	0	10	46
182	Idlewood at McCloy	2	5	43
183	Idlewood at Freeman	0	6	28
184	Idlewood at Nansemond	0	6	22
185	Rothesay & Rosewood	2	1	23
186	Rothesay & Grant	1	0	24
187	Rothesay & French	0	1	23
188	French & Freeman	0	0	23
189	Douglasdale & French	3	4	22
190	Robinson & Cary	3	13	198
191	Robinson & Grayland	2	16	180
192	Grayland & Davis	1	9	172
193	Grayland & S. Stafford Ave.	0	8	164
203	Meadow & Amelia	0	5	51
204	Meadow & Colorado	0	7	44
205	Meadow & Dakota	0	2	42
206	Meadow & Nevada	1	0	43
207	Meadow & Pennsylvania	0	3	40
208	Pennsylvania & Georgia	0	3	37
209	Pennsylvania & Greenville	0	3	34
210	Pennsylvania & Carter	2	6	30

Order	Description	Ons	Offs	Loads
202	Meadow & Powhatan	2	8	56

Order	Description	Ons	Offs	Loads
211	New York & Carter	7	12	25
Daily Totals		1573	2090	

Route 6

Route 6 provides service between the Montrose Heights neighborhood in the East End and the Shops at Willow Lawn in the West End primarily via Broad Street. For both the eastbound and westbound Route 6 trips, the route segments with the highest passenger loads fall in downtown Richmond. Within the downtown, the Broad route segments are the most popular. The eastern end of the route is characterized by low ridership in relation to the rest of the route. The strength of the western portion of the route is aided by riders' attraction to the Willow Lawn stop. This stop generates the highest number of boardings for the eastbound trip and the highest number of alightings for the westbound trip. Broad & 9th is the most used stop for eastbound alightings and Broad & 6th is the most used for westbound boardings. The eastbound route sees an average of 22 boardings per trip and the westbound route has an average of 23 boardings per trip. For the eastbound route, the 11:00 a.m. trip carries the highest load with 49 passengers and the westbound trip with the highest load is at 1:58 p.m. with 46 passengers.

Figure 25: Route 6

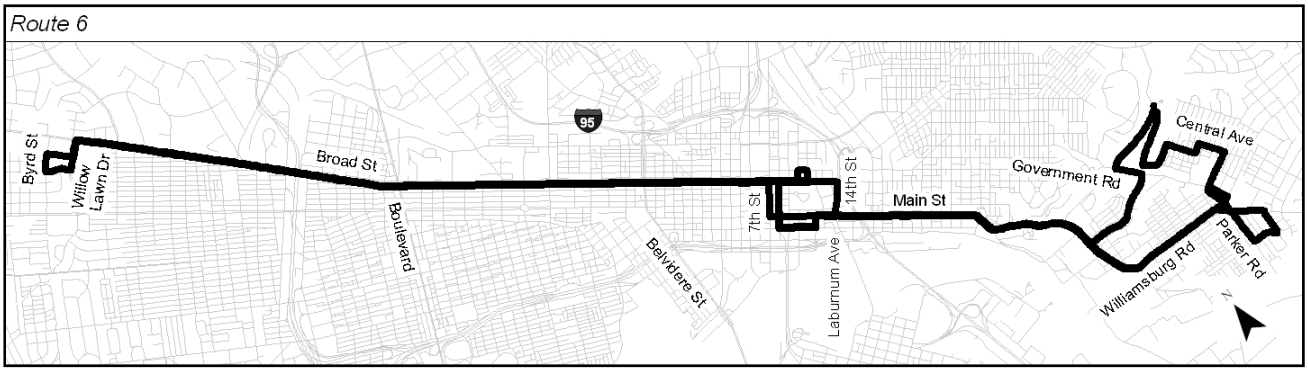


Table 28: 6 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	Willow Lawn & Shelter	244	5	440
2	Broad at Willow Lawn Shopping*	102	3	543
3	Broad & Staples Mill	93	1	635
4	Broad & Chantilly	57	2	695
5	Broad & Blacker	26	0	721
6	Broad & Westmoreland	18	0	740
7	Broad & Commonwealth	21	1	760
8	Broad & Sauer	53	2	811
9	Broad & Malvern	81	1	894
10	Broad & Lafayette	30	3	921
11	Broad & Hamilton	41	1	961
12	Broad & Thompson	29	10	979
13	Broad & Roseneath	27	1	1005

Order	Description	Ons	Offs	Loads
50	Main & 15th	2	0	370
51	Main & 17th	5	3	371
52	Main & 18th	1	2	368
53	Main & 20th	6	2	372
54	Main & 21st	3	3	372
55	Main & 23rd	3	11	365
56	Main & 24th	15	16	363
57	Main & 25th	2	7	358
58	Main & Pear	0	1	357
59	Williamsburg & Main	0	5	353
60	Williamsburg & 31st	0	7	345
61	Williamsburg & Nicholson	0	7	338
62	Williamsburg & Admiral Gravel*	0	6	288

Order	Description	Ons	Offs	Loads
14	Broad & Tilden	40	7	1038
15	Broad & Cleveland	6	3	1041
16	Broad & Belmont	16	5	1051
17	Broad & Wayne	1	1	1051
18	Broad & Sheppard	33	18	1066
19	Broad & Boulevard	81	17	1130
20	Broad & Robinson	25	45	1103
21	Broad & Davis	11	10	1101
22	Broad & Strawberry	14	10	1105
23	Broad & Allison	7	10	1101
24	Broad & Meadow	10	8	1102
25	Broad & Allen	24	18	1108
26	Broad & Lombardy	43	57	1095
27	Broad & Ryland	20	35	1078
28	Broad & Harrison	67	61	1087
29	Broad & Laurel	29	34	1083
30	Broad & Henry	41	41	1084
31	Broad & Monroe	20	16	1091
32	Broad & Jefferson	8	25	1071
33	Broad & Adams	8	14	1065
34	Broad & 1st	22	84	1005
35	Broad & 2nd	18	197	827
36	Broad & 4th	57	168	713
37	Broad Street at 9th Street	34	249	489
38	Broad & 10th	5	38	170
39	Broad & 11th	3	17	114
40	Broad & 12th	2	11	114
41	Broad & Old 14th	0	19	95
42	14th & Franklin St	2	9	56
43	11th & Broad	35	56	304
44	10th & Marshall	18	14	303
45	8th & Franklin	34	16	322
46	Cary & 9th	12	7	327
47	Cary & 10th	8	1	334
48	Main & 13th	40	4	366
49	Main & 14th	7	6	368

Order	Description	Ons	Offs	Loads
63	Williamsburg & Orleans	0	2	286
64	Williamsburg & Goddin	1	2	285
65	Williamsburg & Hatcher	0	4	281
66	Williamsburg & Montebello Cir*	2	13	270
67	Williamsburg & Scott	1	9	263
68	Williamsburg & Arcadia	0	21	244
69	Williamsburg & Waverly	4	34	215
70	Williamsburg & Salem	0	50	162
71	Darbytown & Parker	4	13	54
72	Parker & Winchell	2	3	53
73	Vinton & Parker	9	11	51
74	Edgelawn, east of City limits	3	1	41
75	Henrico Arms Place	23	5	61
76	Parker & Williamsburg	8	14	91
77	Carlisle & Government	1	8	83
78	Carlisle & Creedmore	3	1	86
79	Central & Carlisle	0	11	76
80	Central & Rawlings	0	3	73
81	Luray & Newman	0	5	68
82	Luray & Fenton	0	3	65
83	Accomac & Maverick	1	3	63
84	Accomac & Jennie Scher	7	17	54
85	Admiral Gravely & Williamsburg	6	2	47
86	Admiral Gravely Boulevard & H*	1	1	47
87	Admiral Gravely Boulevard & A*	7	2	52
Daily Totals		1743	1669	

Table 29: 6 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
88	Admiral Gravely Boulevard & A*	15	5	53
89	Government in front of 1334	2	2	55
90	Stoney Run & Government	4	2	57
91	Stoney Run across from 2nd Ap*	1	0	58
92	Stoney Run across from 1506	0	0	58
93	Jennie Scher & Randall	4	0	62
94	Jennie Scher & Central	6	0	68
95	Jennie Scher between Accomac *	14	3	79
96	Accomac & Luray	8	0	87
97	Luray & Fenton	0	1	86
98	Luray & Newman	4	1	89
99	Rawlings & Central	3	1	91
100	Central & Farrand	3	2	92

Order	Description	Ons	Offs	Loads
140	Main & 18th	1	16	376
141	Main & 17th	0	0	376
142	Main & 15th	4	3	377
143	14th & Franklin St	3	2	64
144	Main & 13th	63	48	458
145	Main & 11th	26	27	453
146	Main & 10th	33	11	475
147	Main & 8th	11	28	460
148	7th & Franklin	43	11	487
149	Broad & 6th	292	77	700
150	Broad at 4th	160	45	814
151	Broad & 3rd	104	36	879
152	Broad & 1st	159	18	1020

Order	Description	Ons	Offs	Loads
101	Carlisle & Creedmore	2	1	93
102	Carlisle & Government	4	5	92
103	Government Road at Carlisle	13	0	105
104	Government Road at National S*	0	1	104
105	Williamsburg & Parker	8	5	107
106	Williamsburg & Salem	37	4	236
107	Williamsburg & Montgomery	6	1	241
108	Williamsburg & Waverly	28	4	268
109	Williamsburg & Tompkins	40	4	304
110	Williamsburg & Northhampton	12	1	315
111	Williamsburg & Hatcher	1	0	316
112	Williamsburg & Goddin	4	0	320
113	Williamsburg & Orleans	0	0	320
114	Henrico Arms Place	12	2	58
115	Darbytown in front of 1420 Da*	9	5	70
116	Darbytown & Blue Ridge	14	0	84
117	Parker & Williamsburg	25	3	107
118	Accomac & Jennie Scher	1	6	47
119	Jennie Scher between Central *	3	7	43
120	Jennie Scher & Central	0	1	42
121	Jennie Scher & Randall	1	2	41
122	Stoney Run in front of 1506	1	5	37
123	Stoney Run at 1408	1	2	36
124	Stoney Run at Government Road	4	1	39
125	Government across from 1334	0	2	37
126	Admiral Gravely Boulevard & A*	5	4	38
127	Admiral Gravely Boulevard acr*	0	4	34
128	Admiral Gravely Boulevard & H*	1	1	34
129	Admiral Gravely Boulevard & G*	0	0	34
130	Admiral Gravely Boulevard & W*	1	0	35
131	Williamsburg & Admiral Gravel*	5	0	325
132	Williamsburg & Nicholson	6	1	365
133	Williamsburg & 31st	4	0	369
134	Williamsburg & Main	5	0	374
135	Main & 26th	5	4	377
136	Main & 25th	8	13	372
137	Main & 23rd	12	2	382
138	Main & 21st	9	1	390
139	Main & 20th	1	2	391

Order	Description	Ons	Offs	Loads
153	Broad & Jefferson	72	13	1079
154	Broad & Madison	26	11	1097
155	Broad & Monroe	16	7	1104
156	Broad & Henry	35	21	1118
157	Broad & Gilmer	13	20	1111
158	Broad & Hancock	13	26	1098
159	Broad & Harrison	81	40	1136
160	Broad & Ryland	36	28	1143
161	Broad & Bowe	25	53	1111
162	Broad & Allen	15	37	1091
163	Broad & Meadow	8	19	1080
164	Broad & Allison	10	13	1077
165	Broad & Strawberry	19	28	1068
166	Broad & Davis	11	37	1035
167	Broad & Robinson	17	10	1040
168	Broad & Terminal Place	10	45	1005
169	Broad & Boulevard	52	85	972
170	Broad & Sheppard	9	16	967
171	Broad & Summit	4	13	959
172	Broad & MacTavish	1	51	909
173	Broad & Roseneath	5	47	867
174	Broad & Thompson	5	22	857
175	Broad & Hamilton	3	26	834
176	Broad & Kent	12	12	834
177	Broad & Lafayette	1	15	820
178	Broad & Westwood	11	67	764
179	Broad & Sauer	0	43	721
180	Broad & Commonwealth	2	9	714
181	Broad & Westmoreland	0	39	675
182	Broad & Blacker	0	23	652
183	Broad & Chantilly	0	22	630
184	Broad & Staples Mill	0	106	528
185	Willow Lawn between Broad and*	2	219	315
186	Markel & Byrd	8	70	253
187	Byrd & Old Richmond	3	22	234
188	Byrd & Fitzhugh	5	17	222
189	Fitzhugh & Willow Lawn	15	64	173
190	Willow Lawn & Shelter	126	95	194
	Daily Totals	1922	1924	

Route 10

Route 10 provides service along Broad Street connecting the East End and Richmond Community Hospital with residential neighborhoods south of Rt. 195. Route 10 appears to be relatively well balanced in terms of ridership between its eastern and western ends. Ridership peaks in the middle of the route, along the Broad Street segment located downtown, for both the eastbound and westbound trips. Ridership declines as the route moves farther away from downtown, but declines proportionally in both directions. For the eastbound direction of the route, Broad & 4th is the most common boarding point and 29th & Y is the most common alighting point. For the westbound trip, Harrison & Broad serves the most boardings while Broad & 4th serves the most alightings. On average, there are 14 boardings per trip on the eastbound route and 18 boardings per trip for the westbound route. The

eastbound direction has its highest passenger load at 3:00 p.m. with 28 passengers. The westbound route sees its maximum passenger load at 7:53 p.m. with 26 passengers.

Figure 26: Route 10

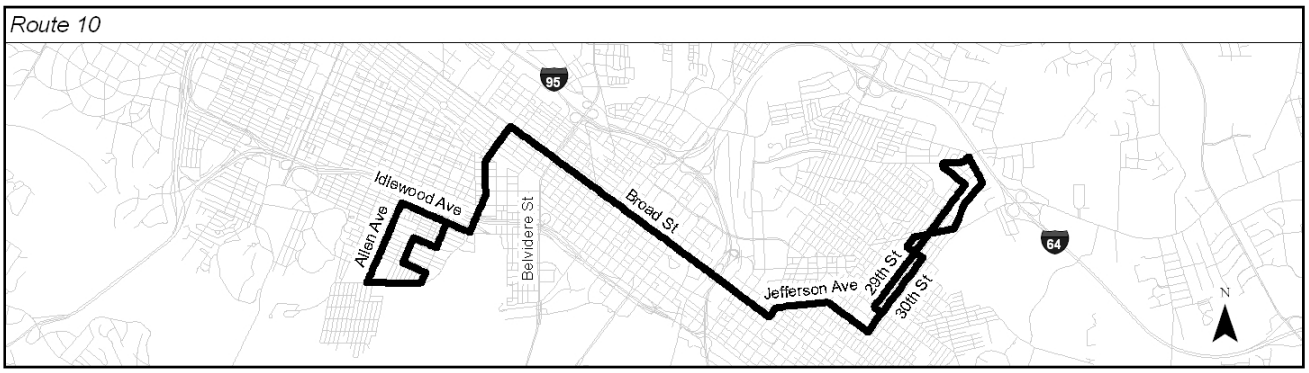


Table 30: 10 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	Allen & Winder	22	7	188
2	Allen & Clairbone	21	6	203
3	Allen & Lakeview	12	1	225
4	Allen & Jacquelin	15	7	233
5	Idlewood & Allen	16	8	230
6	Idlewood & Temple (Use instea*	12	3	239
7	Iddlewood Ave.at Lombardy Str*	9	3	255
8	Idlewood & Lady	10	1	264
9	Idlewood at Randolph	20	2	278
10	Harrison & Grayland	13	2	282
11	Harrison & Cary	11	7	297
12	Harrison & Main	18	6	298
13	Harrison & Grove	3	1	307
14	Harrison & Franklin	1	6	295
15	Harrison & Grace	3	52	268
16	Broad & Harrison	26	6	289
17	Broad & Laurel	42	20	317
18	Broad & Henry	21	13	323
19	Broad & Monroe	9	2	330
20	Broad & Jefferson	17	7	340
21	Broad & Adams	4	2	342
22	Broad & 1st	46	8	381
23	Broad & 2nd	58	52	387
24	Broad & 4th	93	41	441
25	Broad Street at 9th Street	62	11	519
26	Broad & 10th	23	15	524
27	Broad & 11th	30	11	543
28	Broad & 12th	27	11	559
29	Broad & Old 14th	4	1	562
30	Broad & 17th	2	7	557
31	Broad & 18th	7	10	554
32	Broad & 19th	7	1	560
33	21st & Broad	8	12	556
34	Jefferson & Marshall	6	11	551
35	Jefferson & 23rd	3	16	542
36	Jefferson at 25th	3	35	510
37	M & 27th	6	15	491
38	M & 29th	2	17	486
39	30th & M St	1	13	474
40	30th & O St	1	34	441
41	29th & Q St	3	37	407
42	29th & R St	0	20	386
43	29th & T St	1	27	360
44	29th & U St	0	34	326
45	29th & Nine Mile	3	48	281
46	29th & Y St	7	53	235
47	29th & Purcell	9	52	192
48	Newbourne & 29th	11	36	167
49	Fairfield, after turning off *	24	36	124
50	Fairfield & Kane	35	32	138
Daily Totals		787	858	

Table 31: 10 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
51	Fairfield & Kane	24	10	202
52	Kane & 29th - 15 feet from co*	22	2	215
81	Broad & 1st	46	18	353
82	Broad & Jefferson	2	18	337

Order	Description	Ons	Offs	Loads
53	Creighton & Kane	27	8	241
54	Creighton & 2124	42	7	278
55	Creighton & 2009	33	4	307
56	Creighton & Nine Mile	30	10	326
57	Nine Mile & 30th	10	4	332
58	Nine Mile & 29th	4	0	336
59	28th & U St	50	5	381
60	30th & U St	8	0	389
61	30th & S St	24	0	413
62	30th & R St	18	0	431
63	30th & Q St	17	1	447
64	30th & O St	17	1	463
65	M & 30th	16	6	473
66	M & 27th	12	0	485
67	M & 25th	52	3	534
68	Jefferson & 23rd	5	1	538
69	21st & Marshall	13	7	545
70	Broad & 19th	12	4	553
71	Broad & 18th	18	10	561
72	Broad & 17th	15	3	573
73	Broad between 14th and 12th	13	40	546
74	Broad & 12th	30	57	519
75	Broad Street at 10th Street	17	37	499
76	Broad & 9th	32	49	496
77	Broad & 8th	5	24	464
78	Broad & 6th	31	50	445
79	Broad at 4th	28	107	366
80	Broad & 3rd	24	65	325
83	Broad & Madison	4	11	330
84	Broad & Monroe	3	4	329
85	Broad & Henry	11	12	328
86	Broad & Gilmer	2	15	315
87	Broad & Hancock	1	20	296
88	Harrison & Broad	92	46	342
89	Harrison & Franklin	16	9	349
90	Harrison & Park	1	8	342
91	Harrison & Grove	12	6	333
92	Harrison & Main	4	39	303
93	Harrison & Cary	5	3	305
94	Harrison & Parkwood	1	4	299
95	Harrison & Idlewood	3	3	299
96	Idlewood Ave. at Randolph Str*	2	41	260
97	Randolph & Wallace	7	22	245
98	Randolph & Kemper	8	24	229
99	Lavkeiew Ave. at Randolph	1	5	225
100	Lakeview & Lady	3	17	211
101	Lombardy between Lakeview & C*	14	34	191
102	Lombardy & Blair	6	17	189
103	Winder & Lombardy	9	33	165
104	Winder & Randolph	5	4	166
105	Colorado & Meade	12	9	173
106	Colorado & Lombardy	18	5	186
107	Colorado & Maymont Village Ap*	17	16	187
108	Allen & Colorado	20	16	191
109	Allen & Appomatox	14	1	205
110	Allen & Winder	21	16	197
Daily Totals		1009	991	

Route 11

Route 11 provides service between the East End and the Oregon Hill neighborhood. Major destinations along the route include the City Jail, the State Capitol, VCU's West Campus and the Landmark Theater. As a route with limited weekday runs, Route 11 does not attract a large number of riders throughout the course of a day of operation. The most popular segment of the eastbound trip appears to be the eastern end of the route. The first stop on Fairfield Way heading east is the most heavily used stop for both boarding and alighting in this direction. For the westbound trip, the downtown segment in the vicinity of 17th & Main attracts the largest number of riders. For this direction, the last stop located on Coalter Street has the most boardings and the stop located at Main & 10th has the most alightings. Both end segments of this route serve relatively few riders. As the numbers reflect, the number of average boardings per trip for this route is much lower than the other routes. The eastbound route experienced an average of four boardings per trip while the westbound had an average of three boardings per trip. The maximum eastbound load was at 3:15 p.m. with 15 passengers. The highest load for the westbound route occurred at 2:43 p.m. with nine passengers.

Figure 27: Route 11

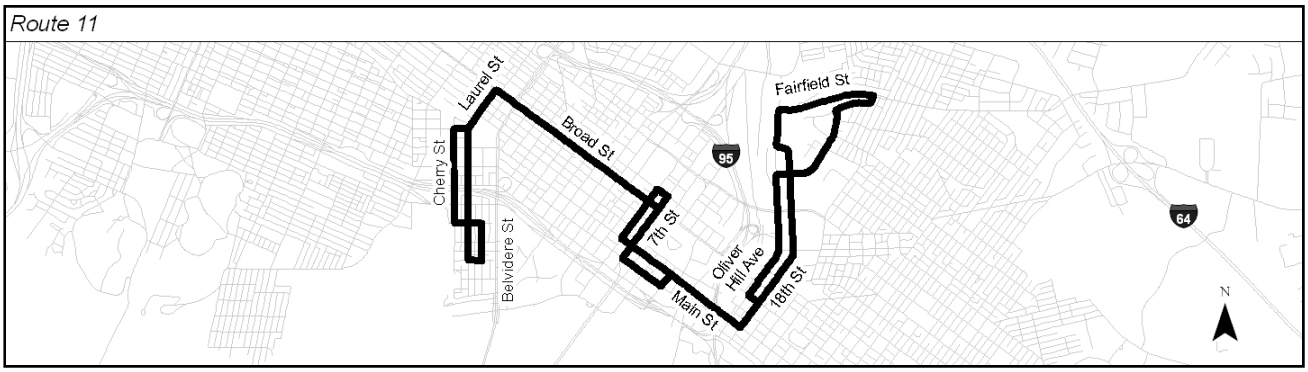


Table 32: 11 Eastbound and Westbound Daily Ridership

Order	Eastbound Stop Description	Ons	Offs	Loads
1	China between Laurel & Pine	9	0	9
2	Pine & China	0	0	9
3	Pine & Spring	0	0	9
4	Albemarle & Pine	1	0	10
5	Cherry & Idlewood	0	0	10
6	Cherry & Cumberland	0	0	10
7	Cherry & Main	1	0	11
8	Laurel & Franklin	0	0	11
9	Laurel & Grace	0	0	11
10	Laurel & Broad	0	0	11
11	Broad & Henry	1	1	11
12	Broad & Monroe	0	0	11
13	Broad & Jefferson	0	0	11
14	Broad & Adams	1	0	12
15	Broad & 1st	1	0	13
16	Broad & 2nd	0	0	13
17	Broad & 4th	6	0	19
18	8th & Franklin	7	8	30
19	Cary & 9th	1	5	26
20	Cary & 10th	0	2	24
21	Main & 13th	5	2	27
22	Main & 14th	1	0	28
23	Main & 15th	3	0	31
24	Main & 17th	0	4	27
25	18th & Main	0	0	27
26	18th & Broad	2	0	29
27	18th & Marshall	0	0	29
28	18th & Venable	0	0	29
29	18th & O St	1	2	28
30	18th & Coalter	1	2	27
31	18th & Balding	1	0	28
32	Fairfield Way entrance to Cit*	14	10	32
33	Fairfield Way & steps up to M*	3	0	35
34	Accomodation & Spotsylvania	2	2	35
35	Accomodation & Gay	6	2	39
Daily Totals		58	40	

Order	Westbound Stop Description	Ons	Offs	Loads
36	Accomodation & Gay	4	0	14
37	Coalter & Richmond	9	3	20
38	Coalter & Redd	4	2	46
39	Coalter & Fairhill Apts	0	0	46
40	Coalter approximately 50 feet*	10	0	56
41	17th & O St	1	0	57
42	17th & Clay	0	0	57
43	17th & Marshall	1	0	58
44	Grace Street at 17th Street	0	3	55
45	18th & Main	0	1	54
46	Main & 17th	0	0	54
47	Main & 15th	1	1	54
48	Main & 13th	1	4	51
49	Main & 11th	1	3	49
50	Main & 10th	0	7	42
51	Main & 8th	0	5	37
52	7th & Franklin	0	2	35
53	Broad & 6th	2	2	3
54	Broad at 4th	0	0	3
55	Broad & 3rd	0	0	3
56	Broad & 1st	0	0	3
57	Broad & Jefferson	0	2	1
58	Broad & Madison	0	0	1
59	Broad & Monroe	0	0	1
60	Broad & Henry	0	0	1
61	Laurel & Broad	0	1	0
62	Laurel & Grace	0	0	0
63	Laurel & Franklin	0	0	0
64	Laurel & Cathedral Place	0	0	0
65	Laurel & Main	0	0	0
66	Laurel & Cary	0	0	0
67	Laurel & Idlewood	0	0	0
68	Laurel & Albemarle	0	0	0
69	Laurel & Spring	0	0	0
70	China between Laurel & Pine	9	0	9
Daily Totals		43	36	

Route 13

Route 13 provides service through Cary Town and the Church Hill area, with major stops at the State Capitol and the River Road Shopping Center. In the eastbound direction of Route 13, the route segment located along Cary Street approaching downtown has the heaviest ridership. This portion of the route actually has a higher ridership along the inbound approach then it does in the immediate downtown vicinity of the Capitol, unlike the other Blue Routes. This may the result of the circuitous route the bus takes through downtown once turning off Cary. The daily route load drops significantly at Cary & 3rd, the last stop before turning off Cary for the first time. The Cary & Meadow stop has the highest number of boardings. The most people alight 7th & Broad. On average, each eastbound trip attracts six boardings. The 9:54 a.m. trip has the highest load with 12 passengers.

In the westbound direction, ridership is highest in the corresponding outbound route west of downtown along Main Street. The stop located at 5th & Main is the most popular boarding stop and the Main & Meadow stop is the most popular place for alighting. The westbound route had an average of seven passengers per trip. The highest load occurs at the following trip times for the westbound route: 6:05 a.m., 7:35 a.m., 9:10 a.m., and 10:40 a.m. each with 9 passengers.

Figure 28: Route 13

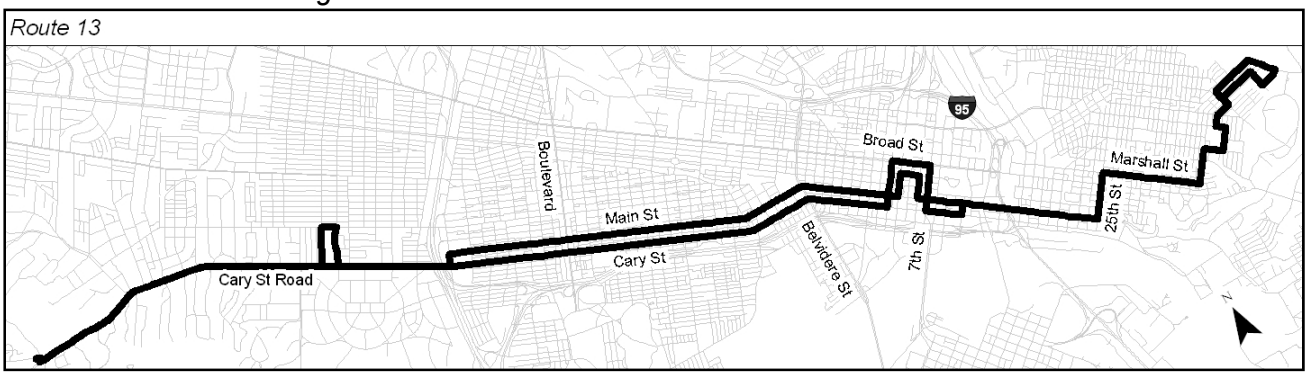


Table 33: 13 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	River Shopping Center	6	0	6
2	Rt 147 & River Rd.	0	1	5
3	River & Bridgeway	0	0	5
4	River & Kanawha	1	1	5
5	Cary & Rio Vista La	1	0	6
6	Cary & Libbie	0	0	6
7	Cary & Granite	0	0	6
8	Cary & Wilton	0	0	6
9	Cary & Paxton	0	0	6
10	Cary & Ampthill	0	1	5
11	Cary & Hillcrest	0	0	5
12	Cary & Lexington	0	0	5
13	Cary & Clark	0	0	5
14	Cary & Virginia	0	0	5

Order	Description	Ons	Offs	Loads
41	Cary & Foushee	2	2	86
42	Cary & 2nd	0	0	86
43	Cary & 3rd	1	0	87
44	Franklin & 5th	0	12	35
45	Franklin & 6th	0	1	15
46	7th & Broad	0	13	43
47	Marshall & 7th	4	7	40
48	8th & Marshall	0	11	29
49	8th & Franklin	1	3	27
50	Cary & 9th	3	0	30
51	Cary & 10th	0	1	29
52	Main & 13th	3	5	27
53	Main & 14th	1	2	26
54	Main & 15th	0	0	26

Order	Description	Ons	Offs	Loads
15	Cary & Locke Lane	0	0	5
16	Grove & Commonwealth	1	0	10
17	Commonwealth & Cary	1	0	11
18	Cary & Windsor	0	0	16
19	Cary & Canterbury	0	0	16
20	Cary & Lafayette	0	0	16
21	Cary & Banbury	1	0	17
22	Cary & Nansemond	15	1	31
23	Cary & Freeman	2	0	33
24	Cary & McCloy	6	0	39
25	Cary & Belmont	2	2	39
26	Cary & Sheppard	6	0	45
27	Cary & Boulevard	5	0	50
28	Cary & Robinson	8	3	55
29	Cary & Davis	2	0	57
30	Cary & Addison	1	0	58
31	Cary & Rowland	2	1	59
32	Cary & Meadow	19	5	73
33	Cary Street at Granby Street	6	0	79
34	Cary & Allen	7	0	86
35	Cary & Lombardy	1	0	87
36	Cary & Randolph	0	1	86
37	Cary & Harrison	2	3	85
38	Cary & Laurel	3	0	88
39	Cary & Belvidere	0	2	86
40	Cary & Jefferson	0	0	86
55	Main & 17th	1	1	26
56	Main & 18th	2	0	28
57	Main & 20th	0	0	28
58	Main & 21st	0	1	27
59	Main & 23rd	2	3	26
60	Main & 24th	1	1	26
61	25th & Main	0	0	26
62	25th & Grace	0	1	25
63	25th & Broad	0	1	24
64	Marshall & 25th	0	4	20
65	Marshall & 27th	0	1	19
66	Marshall & 29th	1	1	19
67	Marshall & 31st	0	0	19
68	Marshall & 33rd	0	0	19
69	Marshall & Chimborazo Bouleva*	0	0	19
70	35th & Marshall	0	3	16
71	35th & Glenwood	0	0	16
72	M & 35th	0	0	16
73	37th & East End School	0	3	13
74	O & 37th	0	1	12
75	P & 36th	0	0	12
76	R & 36th	0	0	12
77	35th & Canepa	3	0	15
78	Briel & 35th	2	1	16
79	Briel & Hill Tops Apt	0	2	14
Daily Totals		119	102	

Table 34: 13 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
80	Briel & Hill Tops Apt	1	0	15
81	driveway Midway of Apt Complex	0	0	15
82	Oakwood & Cemetery Gate	0	1	15
83	Oakwood at Canepa	2	3	14
84	R & Oakwood	3	0	17
85	R & 36th	1	0	18
86	36th & P St	0	0	18
87	O Mid Block between 36th & 37*	5	0	23
88	37th & N St	3	0	26
89	M & 37th	3	0	29
90	M & 35th	1	0	30
91	35th & Leigh	0	0	30
92	35th & Marshall	1	0	31
93	Marshall & Chimborazo Bouleva*	1	1	31
94	Marshall & 33rd	5	1	35
95	Marshall & 31st	1	0	36
96	Marshall & 29th	6	0	42
97	Marshall & 27th	1	0	43
98	25th & Marshall	4	2	45
99	25th & Grace	0	0	45
100	Main & 25th	6	0	51
121	Main & Cherry	2	2	85
122	Main & Harrison	4	4	85
123	Main & Brunswick	1	0	86
124	Main & Plum	0	0	86
125	Main & Lombardy	1	1	86
126	Main & Allen	0	12	74
127	Main & Meadow	2	19	57
128	Main & Shields	0	5	52
129	Main & Stafford	0	5	47
130	Main & Robinson	2	7	42
131	Main & Boulevard	1	2	41
132	Ellwood & Colonial	0	0	41
133	Ellwood & Sheppard	0	0	41
134	Ellwood & Belmont	0	1	40
135	Ellwood & Auburn	0	1	39
136	Ellwood & Dooley	1	2	38
137	Ellwood & Crenshaw	0	0	38
138	Ellwood & Nansemond	1	16	23
139	Thompson between Ellwood & Ca*	1	4	20
140	Cary & Hamilton	0	2	18
141	Cary & LaFayette	0	2	16

Order	Description	Ons	Offs	Loads
101	Main & 23rd	6	0	57
102	Main & 21st	0	0	57
103	Main & 20th	1	0	58
104	Main & 18th	0	0	58
105	Main & 17th	0	0	58
106	Main & 15th	3	2	59
107	Main & 13th	6	10	55
108	Main & 11th	5	4	56
109	Main & 10th	7	4	59
110	Main & 8th	7	11	55
111	7th & Franklin	7	3	59
112	5th Street at Grace Grace Str*	13	6	66
113	5th Street at Main Street	23	4	85
114	Main & 3rd	3	2	86
115	Main & 1st	4	0	90
116	Main & Adams	0	2	88
117	Main & Madison	0	1	87
118	Main & Monroe	0	1	86
119	Main & Belvidere	0	0	86
120	Main & Laurel	0	1	85

Order	Description	Ons	Offs	Loads
142	Cary & Malvern	0	1	15
143	Cary & Windsor Way	0	1	14
144	Cary & Commonwealth	0	2	12
145	Cary & Westmoreland	0	0	12
146	Grove & Commonwealth	2	0	10
147	Cary & Locke Lane	0	0	10
148	Cary & Maxwell	0	0	10
149	Cary & Clark	0	0	10
150	Cary & Lexington	0	0	10
151	Cary & Stratford Crescent	1	2	9
152	Cary & Tuckahoe	0	0	9
153	Cary & Wilton	0	0	9
154	Cary & Granite	0	0	9
155	Cary & Libbie	0	0	9
156	Cary & Rio Vista La	0	0	9
157	River & Kanawha	0	0	9
158	River & Bridgeway	0	0	9
	Daily Totals	148	150	

Route 16

Route 16 connects the University of Richmond to the downtown area via Grove Avenue with stops at The Shops at Libbie & Grove, the Virginia Museum of Fine Arts, Retreat Hospital, VCU's West Campus and destinations along Grace St in downtown. Eastbound Route 16 sees its strongest ridership on the inbound approach to downtown via Grove Ave, especially between Grove & Thompson and Franklin & 1st. Despite the middle of the route carrying the largest number of passengers, stops on the eastern end of the route were the most common for boarding and alighting. The stop at Grace & 8th attracted the most boarding passengers and the stop at 8th & Franklin attracted the most alighting passengers. These two stops are in the center of several downtown attractions. Route 16 sees an average of eight boardings per trip in the eastbound direction. The trip with the highest load—17 passengers—occurs at 7:29 a.m.

On the outbound trip heading west, ridership is heaviest from the start of the trip until Grove & Nansemond. Within this route segment, ridership peaks along Lombardy Street and along Hanover Avenue as the bus leaves downtown Richmond. The stop at Grace & Harrison was the most popular boarding location for this route in the westbound direction. The greatest alighting demand was found at the western end of the route at the University of Richmond campus. For the westbound route, an average of five boardings per trip was observed. At 4:58 p.m., the highest load of 15 passengers was observed.

Figure 29: Route 16

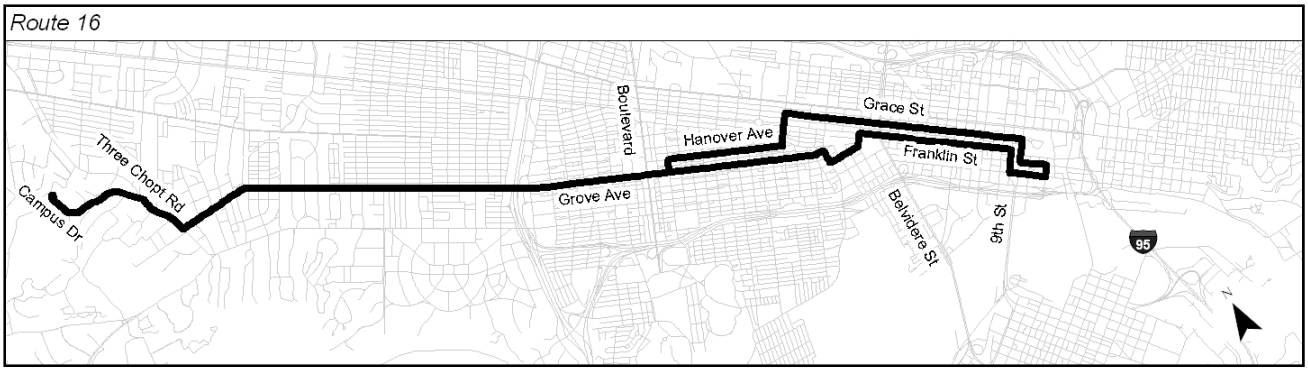


Table 35: 16 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	University of Richmond & Boat*	8	2	23
2	University of Richmond Waitin*	20	0	43
3	Campus & Bostwick Lane	7	0	50
4	Campus & Towana Road	0	0	50
5	Campus & Roselawn	0	0	50
6	Campus & Three Chopt	1	0	51
7	Three Chopt & Tapoan	0	0	51
8	Three Chopt & Iris	0	1	50
9	Grove & Three Chopt	5	0	55
10	Grove & Somerset	6	1	60
11	Grove & Maple	1	0	61
12	Grove & Libbie	15	0	76
13	Grove & Granite	7	1	82
14	Grove & Seneca	1	0	83
15	Grove & Matoaka	0	0	83
16	Grove & Tuckahoe	4	0	87
17	Grove & Greenway Lane	2	0	89
18	Grove & Roslyn	1	0	90
19	Grove & Oak Lane	0	0	90
20	Grove & Lexington	5	1	94
21	Grove & Clarke	1	1	94
22	Grove & Maxwell	5	0	99
23	Grove & West Locke Lane	4	0	103
24	Grove & Lock Lane	2	0	105
25	Grove & Willway	2	1	106
26	Grove & Westmoreland	4	0	110
27	Grove & Commonwealth	3	1	112
28	Grove & Woodlawn	1	1	112
29	Grove & Sauer	0	1	111
30	Grove & Antrim	0	0	111
31	Grove & Malvern	1	0	112
32	Grove & Lafayette	3	0	115
33	Grove & Hamilton	11	0	126
34	Grove & Thompson	23	5	144
35	Grove & Nansemond	15	2	157
36	Grove & Crenshaw	12	1	168
37	Grove & Auburn	13	0	181
38	Grove & Belmont	13	5	189
39	Grove & Sheppard	6	2	193
40	Grove & Boulevard	13	2	204
41	Grove & Robinson	13	18	199
42	Grove & Stafford	5	1	194
43	Grove & Strawberry	0	3	191
44	Grove & Shields	0	1	190
45	Grove & Rowland	2	0	192
46	Grove & Meadow	7	1	198
47	Grove & Allen	0	1	197
48	Grove & Vine	0	3	194
49	Grove & Lombardy	4	2	196
50	Grove & Plum	1	0	197
51	Grove & Harvie	0	2	195
52	Grove & Harrison	0	18	177
53	Floyd & Cherry	1	10	168
54	Laurel & Franklin	0	2	166
55	Franklin & Pine	0	5	161
56	Franklin & Belvidere	1	6	156
57	Franklin & Monroe	2	1	157
58	Franklin & Madison	0	3	154
59	Franklin & Adams	1	1	154
60	Franklin & 1st	1	12	143
61	Franklin & 2nd	4	18	129
62	Franklin & 3rd	0	2	127
63	Franklin & 4th	1	9	119
64	Franklin & 5th	0	2	25
65	Franklin & 6th	0	0	24
66	Franklin & 7th	0	10	96
67	8th & Franklin	4	24	76
68	Cary & 9th	6	23	59
69	Cary & 10th	10	14	55
70	Main & 11th	23	10	68
71	Main & 10th	14	5	77
72	9th & Main	8	3	82
73	Grace Street at 8th Street	34	7	109
Daily Totals		357	245	

Table 36: 16 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
74	Grace Street at 8th Street	14	3	126
75	Grace at 5th Street	21	1	146
76	Grace & 4th	14	2	158
77	Grace & 3rd	21	1	178
78	Grace Street at 1st Street	17	0	195
79	Grace & Foushee	3	0	198
80	Grace & Adams	6	1	203
81	Grace & Jefferson	2	0	205
82	Grace & Madison	3	2	206
83	Grace & Monroe	0	1	205
84	Grace & Henry	1	0	206
85	Grace & Belvidere	2	3	205
86	Grace & Laurel	10	4	211
87	Grace & Shaffer	6	2	215
88	Grace & Harrison	23	10	228
89	Grace & Ryland	3	0	231
90	Lombardy & Grace	4	2	233
91	Lombardy & Park	5	0	238
92	Hanover & Vine	0	3	235
93	Hanover Ave. at Allen Ave.	0	1	234
94	Hanover & Meadow	0	5	229
95	Hanover & Rowland	0	6	223
96	Hanover & Shields	0	4	219
97	Hanover & Stafford	0	4	215
98	Hanover & Davis	1	0	216
99	Robinson & Hanover	0	4	212
100	Grove & Robinson	5	4	213
101	Grove & Boulevard	4	11	206
102	Grove & Sheppard	3	5	204
103	Grove & Belmont	1	11	194
104	Grove & Tilden	0	6	188
105	Grove & Roseneath	1	7	182
106	Grove & Nansemond	2	14	170
107	Grove & Thompson	2	24	148
108	Grove & Hamilton	4	10	142
109	Grove & Lafayette	0	6	136
110	Grove & Malvern	0	2	134
111	Grove & Antrim	1	2	133
112	Grove & Sauer	0	4	129
113	Grove & Woodlawn	0	3	126
114	Grove & Commonwealth	0	10	116
115	Grove & Westmoreland	0	1	115
116	Grove & Locke Lane	0	0	115
117	Grove & Bunting	0	3	112
118	Grove & Wisteria	0	5	107
119	Grove & Lexington	0	3	104
120	Grove & Oak Lane	0	0	104
121	Grove & Roslyn Road	0	0	104
122	Grove & Greenway Lane	0	4	100
123	Grove & Tuckahoe	0	2	98
124	Grove & Matoaka	0	0	98
125	Grove & North Wilton	0	3	95
126	Grove & Seneca	0	1	94
127	Grove & Granite	0	9	85
128	Grove & Libbie	1	6	80
129	Grove & Maple	0	8	72
130	Grove & Somerset	0	7	65
131	Grove & Three Chopt	2	8	59
132	Three Chopt & York	0	0	59
133	Three Chopt & St Christopher	0	1	58
134	Towana & Three Chopt	0	0	58
135	Campus & Roselawn	0	3	55
136	Campus & Old Mill	0	5	50
137	Campus & Bostwick Lane	0	12	38
138	University of Richmond Waitin*	0	26	12
139	University of Richmond & Boat*	6	5	13
Daily Totals		188	290	

Purple Routes

Route 7

Route 7 current provides service from downtown to the Fair Oaks Park-and-Ride along Nine Mile Rd and Laburnum Ave. The portion of Route 7 that experiences the highest ridership extends from Broad & 7th until Nine Mile & Meadowspring. This stretch of the route is shared by all buses before they split and begin to serve opposite directions of the loop at the western end of the route. Although ridership is heavy from central downtown until the route intersects Laburnum, the route segments carrying the largest passenger loads fall east of I-95, farther out from the

downtown core. In the eastbound direction, the stop at Broad & 12th has the highest recorded boardings and the stop near Nine Mile and Laburnum has the highest alightings. In the westbound direction, the same stop—located at Broad and 7th—has the highest number of boardings and alightings. The eastbound route had an average of 12 boardings per trip while the westbound route had an average of 19 boardings per trip. The eastbound route sees its highest load with 29 passengers at 4:42 p.m. The westbound trip with the highest load is at 7:02 a.m. with 45 passengers. In the ridership table below, each route branch is shaded a different color to indicate deviations from the common segment. The common leg of the route is unshaded.

Figure 30: Route 7

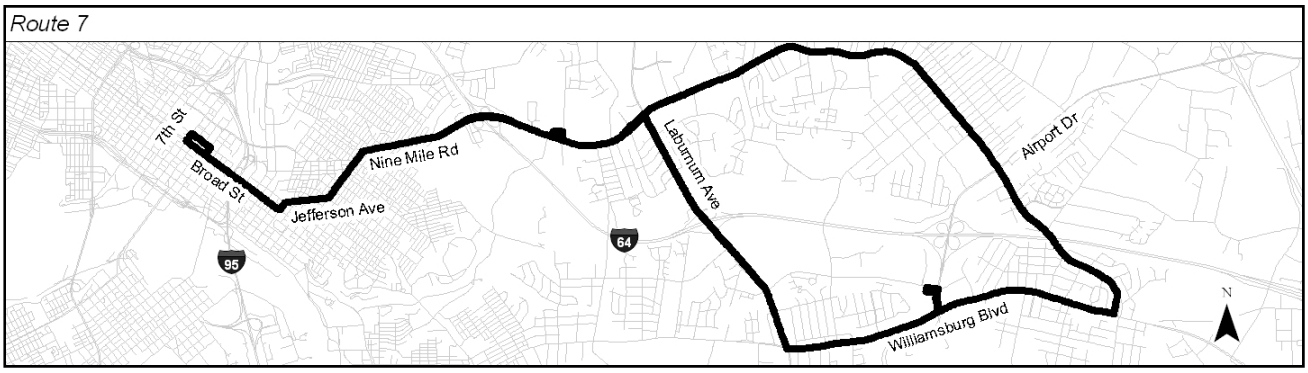


Table 37: 7 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	7th & Broad	14	1	132
2	Marshall & 7th	41	2	171
3	10th & Marshall	9	2	179
4	Broad & 12th	50	0	229
5	Broad & 17th	17	0	248
6	Broad & 18th	1	2	247
7	Broad & 19th	3	3	247
8	21st & Broad	12	2	257
9	Jefferson & Marshall	0	1	256
10	Jefferson & 23rd	2	1	257
11	25th Street at Jefferson Ave	2	1	258
12	25th & O St	3	2	259
13	25th & Q St	6	7	258
14	25th & R St	5	9	254
15	Nine Mile & 27th	2	6	250
16	Nine Mile & 29th	3	1	252
17	Nine Mile & 31st	10	3	259
18	Nine Mile & Bunche Pl	6	5	260
19	Nine Mile & Gordon Lane	1	10	251
20	Henrico Govt. Ctr. At Dabb's *	8	10	249
21	Nine Mile & entrance to Mason*	0	9	240
22	Nine Mile & Marlin	1	8	233
23	Nine Mile & Meadowspring	4	21	216

Order	Description	Ons	Offs	Loads
33	Nine Mile & Newbridge	3	20	78
34	Nine Mile & Lake	0	2	76
35	Nine Mile across from Lee	0	1	75
36	Nine Mile & Beech	1	1	75
37	Nine Mile & Elm	2	3	74
38	Nine Mile & Holly	1	4	71
39	Nine Mile in front of County *	5	5	71
40	Nine Mile Road at Oak Ave.	1	5	67
41	Nine Mile across from Rose	2	3	66
42	Nine Mile & Airport	2	7	61
43	Nine Mile & Banks	1	5	57
44	Nine Mile & Lumber	3	5	49
45	Laburnum & K-Mart	1	6	71
46	Laburnum & Colwyck	0	0	71
47	Laburnum & Glensprings	1	5	67
48	Laburnum & Thronhurst	0	0	67
49	Laburnum & Gay	1	3	65
50	Laburnum & Jan	0	0	65
51	Laburnum & Maxwells Resturant	0	0	65
52	Laburnum & Laburnum Square	0	8	57
53	Williamsburg & Robins	2	4	55
54	Williamsburg & Oakleys La	1	4	52
55	Williamsburg & Lewis	1	1	52

Order	Description	Ons	Offs	Loads
24	Nine Mile & 2nd Entrance East*	6	27	119
25	Nine Mile across from Cedar F*	0	7	112
26	Nine Mile & Power Line	0	4	108
27	Nine Mile across from E. Ceda*	0	8	100
28	Nine Mile & Oakleys Lane	5	0	105
29	Nine Mile & Pleasants	1	6	100
30	Nine Mile & Ainsworth	1	5	96
31	Nine Mile across from Westover	0	1	95
32	Nine Mile & Lowell	0	0	95

Order	Description	Ons	Offs	Loads
56	Williamsburg & Sanborn	1	1	52
57	Williamsburg across from Mote*	4	2	54
58	Williamsburg & Carter	0	2	52
59	Williamsburg & Confederate	0	0	52
60	Williamsburg & Naglee	0	2	50
61	Williamsburg & Rhodes	0	0	50
62	Williamsburg & Monterey	3	0	53
63	West between Williamsburg & N*	2	1	54
64	Nine Mile & Dakar	3	4	50
	Daily Totals	254	268	

Table 38: 7 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
65	Nine Mile & Dakar	3	4	49
66	Nine Mile & Garland	3	2	50
67	Nine MIle & Naglee	0	1	49
68	Nine Mile & Hanover	8	1	56
69	Nine Mile & Hart	7	2	61
70	Nine Mile & Airport	8	2	67
71	Nine Mile & Quince	5	6	66
72	Nine Mile & Kalmia	9	1	74
73	Nine Mile & Holly	5	4	75
74	Nine Mile & Elm	8	1	82
75	Nine mile & Beech	0	0	82
76	Nine Mile & Lee	0	0	82
77	Nine Mile & A P Hill	5	0	87
78	Nine Mile & Barker	14	3	98
79	Nine Mile & Virginia	10	0	108
80	Nine Mile & Westover	6	0	114
81	Nine Mile & Ainsworth La	3	2	115
82	Nine Mile & Orams La	6	1	120
83	Nine Mile & Baya	16	0	136
84	East Cedar Fork Road	7	7	136
85	Nine Mile & Power Line	3	5	134
86	Nine Mile & Cedar Fork	9	1	142
87	Nine Mile Rd. at Kenway Ave.	26	2	166
88	Nine Mile & Lumber	3	0	52
89	Nine Mile Road at McClellen	1	2	51
90	Nine Mile & Naglee	2	1	52
91	Nile Mile & Garland	2	0	54
92	Nine Mile & Monterey	0	1	53
93	West & Williamsburg	0	1	52
94	Williamsburg & East Lake	0	2	50
95	Williamsburg & Garland	1	0	51
96	Williamsburg & Naglee	2	0	53
97	Williamsburg Rd. at Confedera*	1	0	51
98	Williamsburg & Pickett	0	0	54
99	Williamsburg & Airport	4	0	61
100	Williamsburg & EastCoast Stat*	0	0	61
101	Williamsburg & Sanborn Pkwy	3	2	62

Order	Description	Ons	Offs	Loads
102	Williamsburg & Airport Square	4	7	59
103	Williamsburg & Lea Lane	3	5	57
104	Williamsburg & Allenshaw	10	9	58
105	Laburnum & Finley	8	5	61
106	Laburnum & Jan	4	1	64
107	Laburnum & Gay	6	2	68
108	Laburnum & Thronhurst	1	0	69
109	Laburnum & Glensprings	0	0	69
110	Laburnum & Colwyck	1	1	69
111	Nine Mile across from Meadow *	26	6	255
112	Nine Mile & E Richmond	15	0	270
113	Nine Mile across from entranc*	4	0	274
114	Nine Mile & entrance to Dabbs*	1	4	288
115	Henrico Govt. Ctr. at Dabb's *	16	3	291
116	Nine Mile & entrance to Dabbs*	1	4	288
117	Nine Mile & Echo	3	2	289
118	Nine Mile & Gordon Lane	1	4	286
119	Nine Mile & Bunche Place	2	6	282
120	Nine Mile & Creighton	4	8	278
121	Nine Mile & 30th	8	4	282
122	Nine Mile & 29th	6	3	285
123	Nine Mile & 27th	13	0	298
124	25th & R St	5	12	291
125	25th & Venable	9	1	299
126	25th & O St	6	9	296
127	Jefferson & 23rd	6	6	296
128	21st & Marshall	11	9	298
129	Broad & 19th	4	6	296
130	Broad & 18th	8	3	301
131	Broad & 17th	2	2	301
132	Broad between 14th and 12th	2	41	262
133	Broad & 12th	4	34	232
134	Broad Street at 10th Street	6	38	200
135	Broad & 9th	32	57	175
136	Broad & 8th	18	56	137
137	7th & Broad	53	67	118
	Daily Totals	483	469	

Route 56

Route 56 provides transit service from downtown to the Richmond International Airport primarily via Darbytown Rd. Route 56 provides limited service between downtown and the airport during the morning and afternoon peak travel periods. Although the route connects downtown to the airport, the ridership data suggests that it is not primarily used to travel between the two destinations. Route loads for both the eastbound and westbound directions of the route are highest along the central segment of the route. In addition to the central segment, the route also carries its largest passenger loads to and from downtown. The most popular stops in the eastbound direction for boardings is the Airport Park & Ride and for alightings the stop at Eubank & Lewis. The most used stops in the westbound direction for boardings and alightings is the first stop on Lewis and 7th & Broad, respectively. An average of seven boardings per trip was observed for the eastbound route and four boardings per trip for the westbound route. The maximum observed load occurred at 6:39 a.m. for the eastbound route with 15 passengers. The westbound route carried 21 passengers as its highest load at 3:55 p.m.

Figure 31: Route 56

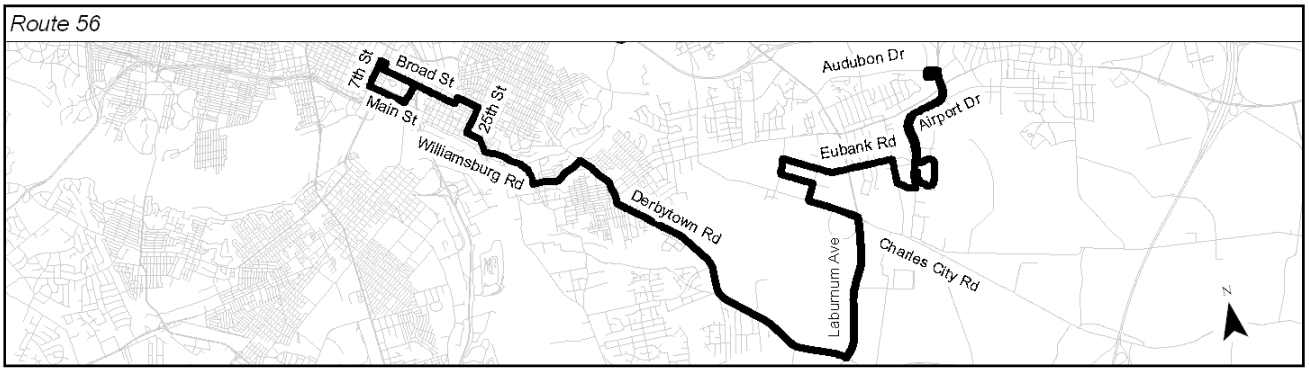


Table 39: 56 Eastbound and Westbound Daily Ridership

Order	Eastbound Stop Description	Ons	Offs	Loads
1	Broad Street at 9th Street	7	0	7
2	Broad & 10th	4	0	14
4	Broad & 12th	2	0	16
5	Broad & Old 14th	2	0	18
6	14th & Franklin St	0	1	3
7	Main & 13th	0	0	3
8	Main & 11th	0	0	3
9	Main & 10th	0	0	3
10	9th & Main	6	0	9
14	Broad & 10th	4	0	14
15	Broad & 12th	2	0	16
16	Broad & Old 14th	2	0	18
17	Broad & 17th	0	0	17
18	Broad & 18th	0	0	17
19	Broad & 19th	0	0	17
20	21st & Broad	1	0	18
21	Marshall & 22nd	0	0	18

Order	Westbound Stop Description	Ons	Offs	Loads
53	Airport Park & Ride Lot	2	0	2
54	Airport Terminal & S/Main / E*	2	2	2
55	Terminal Rd. S/Main Entr/Airp*	1	0	3
56	Norman across from Tredegar M*	1	0	4
57	Lewis across from 5640	6	0	10
58	Eubank at Lewis 350 ft West	0	0	10
59	Eubank & Raleigh	1	0	11
60	Eubank across from Beacon Pre*	0	0	11
61	Eubank & Glen Alden	1	0	12
62	Eubank & 4312	0	0	12
63	Eubank across from Carolina C*	0	0	12
64	Klochner & PCI of VA INC	5	0	17
65	Sarellen & 4305	3	0	20
66	Glen Alden & Sarellen	0	0	20
67	Charles City Rd. Across from *	0	0	20
68	Charles City at Laburnum	2	0	22
69	Laburnum & Seven Hills Blvd	0	0	22

Order	Eastbound Stop Description	Ons	Offs	Loads
22	Marshall & 24th	1	0	19
23	25th & Marshall	0	0	19
24	25th & Grace	0	0	19
25	Main & Pear	0	0	19
26	Williamsburg & Main	0	0	19
27	Williamsburg & 31st	2	0	21
28	Williamsburg & Nicholson	0	0	21
29	Admiral Gravely & Williamsburg	0	0	21
30	Admiral Gravely Boulevard & H*	0	0	21
31	Admiral Gravely Boulevard & A*	0	0	21
32	Government Road at Carlisle	0	0	21
33	Parker & Williamsburg	0	0	21
34	Darbytown & Henrico Arms	0	0	21
35	Darbytown & Shirelydale	0	0	21
36	Darbytown & Lousia	0	0	21
37	Darbytown Road at Wyeth	0	0	21
38	Laburnum & Seven Hills Blvd	0	1	20
39	Charles City & Laburnum	1	1	20
40	Charles City & B F I Co	0	3	17
41	Glen Alden & Sarellen	0	3	14
42	Sarellen across from 4305	0	0	14
43	Klochner across from PCI of V*	0	0	14
44	Eubank & Entrance to Carolina	0	0	14
45	J. M. Fry Corp.	0	0	14
46	Eubank & Glen Alden	0	0	14
47	Eubank & Raleigh	0	4	10
48	Eubank & 300 ft Lewis	0	7	3
49	Lewis & Norman	0	3	0
50	Norman & Entrance to Tredegar*	0	0	0
51	Terminal Rd. S/Main Entr/Airp*	0	0	0
52	Airport Park & Ride Lot	12	0	12
Daily Totals		39	23	

Order	Westbound Stop Description	Ons	Offs	Loads
70	Darbytown & entrance to AH Ro*	3	0	25
71	Darbytown & Buckner	0	0	25
72	Darbytown & Shirelydale	0	0	25
73	Darbytown in front of 1420 Da*	0	0	25
74	Darbytown & Blue Ridge	3	1	27
75	Parker & Williamsburg	0	0	27
76	Parker & Williamsburg	0	0	27
77	Admiral Gravely Boulevard & A*	0	0	27
78	Admiral Gravely Boulevard acr*	0	0	27
79	Admiral Gravely Boulevard & H*	0	0	27
80	Admiral Gravely Boulevard & G*	0	0	27
81	Admiral Gravely Boulevard & W*	0	0	27
82	Williamsburg & Nicholson	0	0	27
83	Williamsburg & 31st	0	0	27
84	Williamsburg & Main	0	0	27
85	Main & 26th	0	0	27
86	25th & Main	0	2	25
87	25th & Grace	0	0	25
88	25th & Broad	0	0	25
89	Marshall & 25th	0	3	22
90	Marshall & 23rd	0	0	22
91	21st & Marshall	0	1	21
92	Broad & 19th	0	0	21
93	Broad & 18th	0	0	21
94	Broad & 17th	0	0	21
95	Broad between 14th and 12th	1	0	22
96	Broad & 12th	0	0	21
97	Broad Street at 10th Street	0	0	21
98	Broad & 9th	0	0	17
99	7th & Broad	1	12	6
100	Marshall & 7th	1	4	3
101	Broad Street at 9th Street	0	0	3
Daily Totals		31	25	

Orange Routes

Route 18

Route 18, the Henrico Shuttle, does not travel into downtown Richmond. Instead, this route circulates riders around several important destinations in Henrico County including the Shops at Willow Lawn, the Henrico Government Center, Henrico Human Resources and the Glenside Park-and-Ride lot. Ridership is heaviest along Broad Street near the Willow Lawn Shopping Center, the southeast leg of the route, in both directions. In the eastbound direction, the last stop on Willow Lawn generates the most passenger boardings and the Broad Street stop for the Willow Lawn Shopping Center attracts the most alightings. In the opposite direction, the first stop on Willow Lawn sees the most boardings and a stop farther north at Broad & Glenside is the most popular place for alighting passengers. The eastbound route had an average of 8 boardings per trip while the westbound route had an average of 13 boardings per trip. Route 18 eastbound had a maximum load of 16 passengers during the 3:33 p.m. trip. The 7:37 a.m. trip has the highest load for the westbound route with 31 passengers.

Figure 32: Route 18

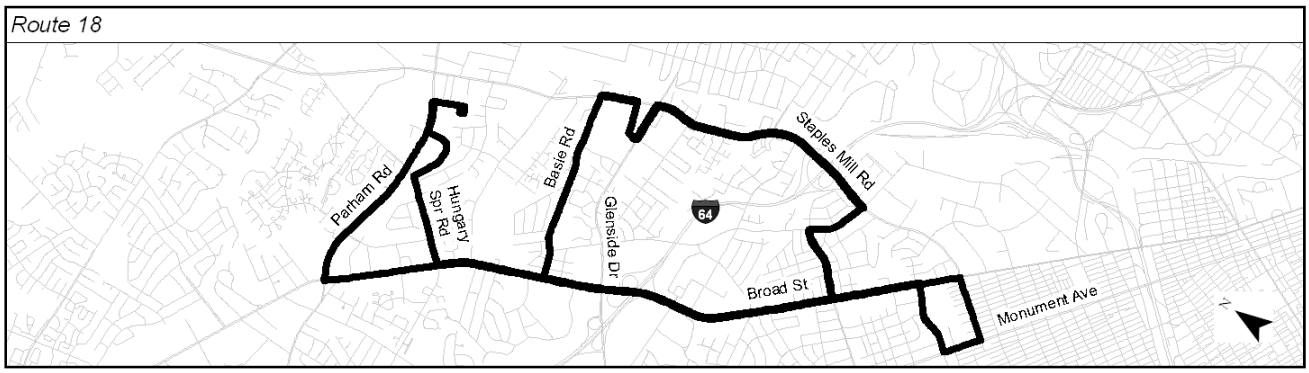


Table 40: 18 Eastbound and Westbound Daily Ridership

Order	Eastbound Stop Description	Ons	Offs	Loads
1	Human Services (Dixon Powers)	1	0	79
2	Hooper (Juvenile & Domestic R*	0	0	79
3	Parham 150 ft south of Hungar*	3	1	81
4	Parham & Health South Hospital	4	2	83
5	Parham & Shrader	5	5	83
6	Parham & entrance to Crestar *	8	6	85
7	Broad & Carousel Lane	1	2	84
8	Broad & Westland Shopping Cen*	7	2	89
9	Broad & Enterprise Parkway	5	1	93
10	Broad & Hungary Spring	7	2	98
11	Broad & Wistar	2	0	100
12	Broad & Sunnybrook	4	3	102
13	Broad & Willard	8	1	109
14	Broad & Emerywood Parkway	0	0	64
15	Broad & Entrance to Reynolds *	3	0	67
16	Broad Street at Home Depot	2	5	64
17	Broad & Morningside	4	1	67
18	Broad & Crestwood	0	1	66
19	Broad & Bremo	2	0	68
20	Bethlehem & Fountain	1	0	46
21	Basie & Count	1	0	47
22	Bremner Blvd & Beth	2	1	48
23	Bremner Blvd & Fernwood	1	0	49
24	Bremner Blvd & Balmoral	1	0	50
25	Staples Mill & Amtrak	1	2	49
26	Staples Mill & Crockett	2	5	46
27	Glenside & Cloverdale (Parki*	2	1	47
28	Staples Mill & Talley	1	0	47
29	Staples Mill & Townhouse	7	2	52
30	Staples Mill & Hamlet Apt	2	2	52
31	Libbie @ Argus (nearside)	0	0	52
32	Libbie @ Indigo (nearside)	1	0	54
33	Broad & Lake	0	8	114
34	Broad & Byrd	0	6	108

Order	Westbound Stop Description	Ons	Offs	Loads
42	Willow Lawn & Shelter	89	6	120
43	Broad & Byrd	17	1	136
44	Broad & 5604 West Broad	14	0	150
45	Broad & Bremo	1	0	83
46	Broad & Crestwood	0	2	82
47	Broad & 6020 West Broad	1	2	81
48	Broad Street at 6504 West Bro*	4	8	77
49	Broad & Brookfield	0	11	66
50	Broad & Glenside	0	15	51
51	Libbie @ Indigo (Farside)	0	0	68
52	Libbie @ Argus (farside)	0	0	68
53	Staples Mill Rd. at Southside*	0	0	68
54	Staples Mill & Northside	0	5	63
55	Staples Mill Rd. at Aspen Ave.	1	1	63
56	Staples Mill & Talley	0	0	63
57	Glenside & Cloverdale (Parki*	1	2	62
58	Crockett 150 ft west of Stapl*	5	2	65
59	Amtrac Station	1	3	63
60	Bremner Blvd & Balmoral	3	2	64
61	Bremner Blvd & Fernwood	2	2	64
62	Bremner Blvd & Beth	3	1	66
63	Basie & Count	0	4	62
64	Bethlehem & Fountain	1	0	63
65	Broad & Bethlehem	0	2	112
66	Broad & Calloway	0	8	104
67	Broad & Sunnybrook	0	7	97
68	Broad & Wistar	0	6	90
69	Broad & Cardinal	1	4	87
70	Hungary Spring & Broad	0	7	80
71	Hungary Spring & C & P	2	6	76
72	Hungary Spring 150 ft south o*	0	0	76
73	Henrico Government Complex Ce*	3	2	77
74	Prince Henry & Administration*	4	6	75
75	Human Services (Dixon Powers)	14	11	78

Order	Eastbound Stop Description	Ons	Offs	Loads
35	Broad at Willow Lawn Shopping*	0	30	78
36	Broad & Staples Mill	5	23	57
37	Staples Mill & Radford	0	8	49
38	Staples Mill & Augusta	0	3	46
39	Monument & Westlyn ave	0	1	45
40	Willow Lawn at Monument	0	9	36
41	Willow Lawn & Shelter	9	21	24
Daily Totals		102	154	

Order	Westbound Stop Description	Ons	Offs	Loads
Daily Totals		167	126	

Route 19

Route 19 operates along a direct route connecting Henrico County to downtown Richmond along the Broad Street corridor northwest of the city. Major destinations along this route include the Shops at Willow Lawn, Fountain Square Shopping Center, Merchants Walk Shopping Center, Westland Shopping Center, Loehmann's Plaza, Sassafras Square and Westpark Shopping Center. Although this route reaches into downtown, it appears that many riders use it for transportation along Broad Street outside of the downtown core area. In both directions, ridership is highest along the middle stretch of the route. Ridership declines more sharply on the Henrico end of the route than on the Richmond end. In the eastbound direction, the stop at Broad & Sundance Station at the beginning of the route received the most boardings and the stop at Broad & 9th at the end of the route received the most alightings. In the westbound direction, the most popular boarding and alighting stops were also out either end of the route. The first stop attracted the most boardings and the last stop had the greatest demand for alightings. On average, the eastbound route had 11 passengers per trip. The westbound route had an average of 18 boardings per trip. At 5:17 p.m., the eastbound route achieved its highest load with 19 passengers. The westbound bus saw a maximum load of 23 passengers at both 7:51 a.m. and 9:51 a.m.

Figure 33: Route 19

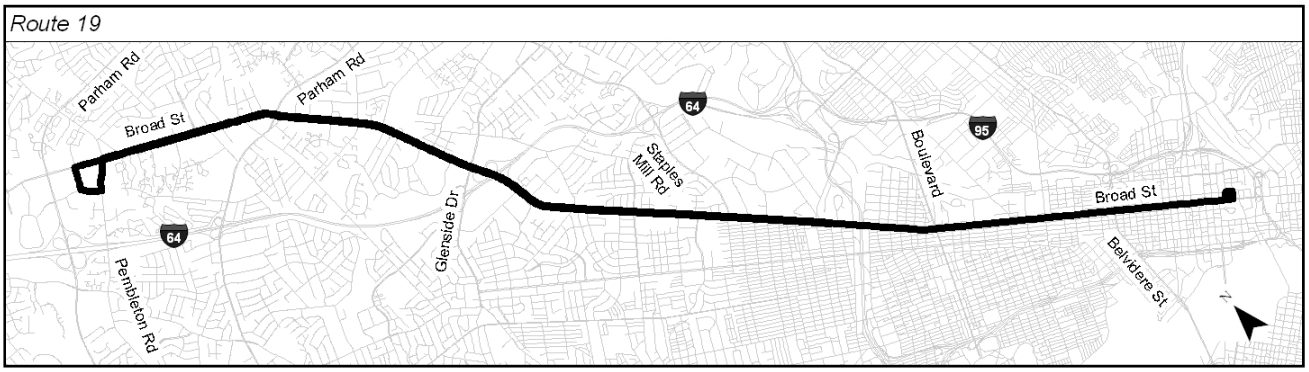


Table 41: 19 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	Pemberton and Broad	11	0	23
2	Stillman Pky. and Mayland Dr.	4	3	25
3	Broad Between Stillman Pky an*	2	2	25
4	Broad Street at Tanelorn Dr. *	6	0	29

Order	Description	Ons	Offs	Loads
32	Broad & Lafayette	0	0	65
33	Broad & Hamilton	1	0	66
34	Broad & Thompson	6	2	70
35	Broad & Roseneath	4	1	73

Order	Description	Ons	Offs	Loads
5	Broad & Sundance Station	14	0	43
6	Broad & Tuckernuck	7	0	50
7	Broad & Homeview	2	1	51
8	Broad & Skipwith	0	2	49
9	Broad & Carousel Lane	0	0	49
10	Broad & Westland Shopping Cen*	6	1	54
11	Broad & Enterprise Parkway	2	0	56
12	Broad & Hungary Spring	1	1	56
13	Broad & Wistar	1	1	56
14	Broad & Sunnybrook	0	0	56
15	Broad & Willard	2	1	57
16	Broad & Emerywood Parkway	8	2	63
17	Broad & Entrance to Reynolds *	3	0	66
18	Broad Street at Home Depot	1	0	67
19	Broad & Morningside	2	3	66
20	Broad & Crestwood	1	0	67
21	Broad & Bremo	1	1	67
22	Broad & Lake	0	2	65
23	Broad & Byrd	0	0	65
24	Broad at Willow Lawn Shopping*	0	1	64
25	Broad & Staples Mill	3	2	65
26	Broad & Chantilly	1	0	66
27	Broad & Blacker	0	0	66
28	Broad & Westmoreland	0	0	66
29	Broad & Commonwealth	0	0	66
30	Broad & Sauer	0	1	65
31	Broad & Malvern	0	0	65

Order	Description	Ons	Offs	Loads
36	Broad & Tilden	0	0	73
37	Broad & Cleveland	0	0	73
38	Broad & Belmont	0	0	73
39	Broad & Wayne	0	1	72
40	Broad & Sheppard	3	1	74
41	Broad & Boulevard	0	1	73
42	Broad & Robinson	2	10	65
43	Broad & Davis	1	0	64
44	Broad & Strawberry	0	1	63
45	Broad & Allison	0	1	62
46	Broad & Meadow	0	1	61
47	Broad & Allen	0	0	61
48	Broad & Lombardy	0	0	61
49	Broad & Ryland	0	2	59
50	Broad & Harrison	0	4	55
51	Broad & Laurel	1	5	51
52	Broad & Henry	0	1	50
53	Broad & Monroe	0	1	49
54	Broad & Jefferson	0	1	48
55	Broad & Adams	0	3	45
56	Broad & 1st	1	4	42
57	Broad & 2nd	0	3	39
58	Broad & 4th	2	5	36
59	Broad Street at 9th Street	0	22	14
60	Broad & 10th	1	1	14
61	11th & Broad	3	9	8
62	10th & Marshall	3	0	7
Daily Totals		106	104	

Table 42: 19 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
63	10th & Marshall	**16**	0	24
64	Broad & 9th	14	0	38
65	Broad & 8th	13	0	51
66	Broad & 6th	5	0	56
67	Broad at 4th	8	0	64
68	Broad & 3rd	11	0	75
69	Broad & 1st	7	0	82
70	Broad & Jefferson	2	0	84
71	Broad & Madison	1	0	85
72	Broad & Monroe	1	1	85
73	Broad & Henry	5	0	90
74	Broad & Gilmer	0	0	90
75	Broad & Hancock	0	0	90
76	Broad & Harrison	7	0	97
77	Broad & Ryland	2	0	99
78	Broad & Bowe	1	0	100

Order	Description	Ons	Offs	Loads
93	Broad & Kent	0	0	113
94	Broad & Lafayette	0	0	113
95	Broad & Westwood	0	0	113
96	Broad & Sauer	0	0	113
97	Broad & Commonwealth	0	0	113
98	Broad & Westmoreland	0	1	112
99	Broad & Blacker	0	0	112
100	Broad & Chantilly	1	0	113
101	Broad & Staples Mill	1	2	112
102	Broad & Byrd	1	1	112
103	Broad & 5604 West Broad	1	3	110
104	Broad & Bremo	1	0	111
105	Broad & Crestwood	1	2	110
106	Broad & 6020 West Broad	1	7	104
107	Broad Street at 6504 West Bro*	0	4	100
108	Broad & Brookfield	0	7	93

Order	Description	Ons	Offs	Loads
79	Broad & Allen	2	0	102
80	Broad & Meadow	0	0	102
81	Broad & Allison	1	1	102
82	Broad & Strawberry	1	0	103
83	Broad & Davis	1	0	104
84	Broad & Robinson	1	0	105
85	Broad & Terminal Place	2	0	107
86	Broad & Boulevard	3	1	109
87	Broad & Sheppard	0	0	109
88	Broad & Summit	0	0	109
89	Broad & MacTavish	0	0	109
90	Broad & Roseneath	1	0	110
91	Broad & Thompson	5	1	**114**
92	Broad & Hamilton	0	1	113

Order	Description	Ons	Offs	Loads
109	Broad & Glenside	1	15	79
110	Broad & Bethlehem	0	7	72
111	Broad & Calloway	1	4	69
112	Broad & Sunnybrook	0	7	62
113	Broad & Wistar	0	5	57
114	Broad & Cardinal	0	4	53
115	Broad & Enterprise Parkway	0	3	50
116	Broad & Fountain Square	0	1	49
117	Broad & Carousel Lane	0	3	46
118	Broad & Skipwith	0	0	46
119	Broad & Homeview	0	4	42
120	Broad & Tuckernuck	0	9	33
121	Broad & Sundance Station	0	13	20
122	Pemberton and Broad	5	**15**	10
	Daily Totals	124	122	

Black Routes

Route 20

Route 20 provides primarily east-west service north of downtown Richmond with service to the Shops at Willow Lawn and the Science Museum of Virginia provided via Broad St and Brookland Park Blvd. This route makes very few trips per day, and, therefore, attracts relatively few riders. The eastern end of the route along W. Brookland Park is the most used segment of the route. This portion of the route may be used as a way to connect residents to other routes headed toward downtown and other common travel destinations. Even the most commonly used bus stops attracted relatively few riders. An average of five boardings per trip was observed for the eastbound route. The westbound route saw an average of one boarding per trip. The 7:22 a.m. trip for the eastbound route reflects the highest route load of 16 passengers. With a load of 14 passengers, the 6:45 a.m. trip has the highest westbound load.

Figure 34: Route 20

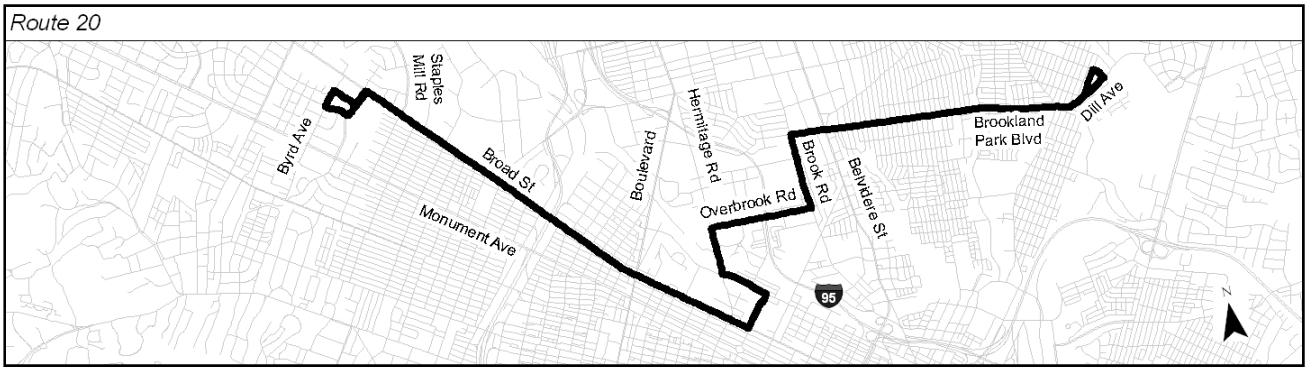


Table 43: 20 Eastbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	Willow Lawn & Shelter	0	0	3
2	Broad at Willow Lawn Shopping*	0	0	3
3	Broad & Staples Mill	0	0	3
4	Broad & Chantilly	0	0	3
5	Broad & Blacker	0	0	3
6	Broad & Westmoreland	0	0	3
7	Broad & Commonwealth	0	0	3
8	Broad & Sauer	0	0	3
9	Broad & Malvern	0	0	3
10	Broad & Lafayette	0	0	3
11	Broad & Hamilton	0	0	3
12	Broad & Thompson	0	0	3
13	Broad & Roseneath	0	0	3
14	Broad & Tilden	0	0	3
15	Broad & Cleveland	0	0	3
16	Broad & Belmont	0	0	3
17	Broad & Wayne	0	0	3
18	Broad & Sheppard	0	0	3
19	Broad & Boulevard	0	0	3
20	Broad & Robinson	0	0	3
21	Broad & Davis	0	0	3
22	Broad & Strawberry	0	0	3
23	Broad & Allison	0	0	3
24	Broad & Meadow	0	1	2
25	Allen at Lowe's	2	0	4
26	Allen at James River Bus Lines	1	0	5
27	Leigh & Dineen	0	0	5
28	Hermitage & Leigh	0	0	5
29	Leigh & Ownby	0	0	5
30	Hermitage & Overbrook	2	0	7
31	Overbrook & Meyers	0	0	7
32	Overbrook & Ownby Lane	0	0	7
33	Overbrook & City Meter Depart*	4	0	11
34	Overbrook & Langston	0	0	11
35	Overbrook & Brook	1	0	12
36	Brook & Edgehill	0	0	12
37	Brook & Sherwood	0	0	13
38	Brook & Brookland Park Boulev*	0	0	13
39	Brookland Park Boulevard & Se*	0	0	13
40	Brookland Park Boulevard & Ch*	1	0	14
41	Brookland Park Boulevard & No*	0	0	14
42	Brookland Park Boulevard & Mo*	1	0	15
43	Brookland Park Boulevard & Mo*	0	0	15
44	Brookland Park Boulevard & Gr*	0	0	15
45	Brookland Park Boulevard & Ha*	2	0	17
46	Brookland Park Boulevard & Ga*	3	0	20
47	Brookland Park Boulevard & No*	0	0	20
48	Brookland Park Boulevard & La*	0	0	20
49	Brookland Park Blvd. at Woodr*	0	0	20
50	Brookland Park Boulevard & Cl*	0	0	20
51	Brookland Park Boulevard & We*	0	0	20
52	Brookland Park Boulevard & Du*	1	0	21
53	Dill & Pollock	0	0	19
Daily Totals		18	1	

Table 44: 20 Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
54	Pollock & Utah Pl.	1	1	18
55	Utah Pl & Front	0	0	18
56	Dill & 3rd	0	1	17
57	Dill & 2nd	0	0	17
58	Brookland Park Boulevard & Wo*	0	0	17
59	Brookland Park Boulevard & Le*	0	0	17
60	Brookland Park Boulevard & Na*	0	2	15
61	Brookland Park Boulevard & We*	0	1	14
62	Brookland Park Boulevard & Ri*	0	0	14
63	Brookland Park Blvd & Woodrow	0	0	14
64	Brookland Park Blvd. & Lamb	0	0	14
65	Brookland Park Boulevard & Ba*	0	0	14
66	Brookland Park Boulevard & No*	0	0	14
67	Brookland Park Blvd. at Haynes	0	1	13
68	Brookland Park Boulevard & Gr*	0	0	13
69	Brookland Park Boulevard & Mo*	0	2	11
70	Brookland Park Boulevard & Mo*	0	0	11
86	Leigh Street at Hermitage Road	0	0	5
87	Leigh & Dineen	0	0	5
88	Allen Avenue at fence across *	0	0	5
89	Broad & Allen	0	0	5
90	Broad & Meadow	0	0	5
91	Broad & Allison	0	0	5
92	Broad & Strawberry	0	0	5
93	Broad & Davis	0	0	5
94	Broad & Robinson	0	0	5
95	Broad & Terminal Place	0	0	5
96	Broad & Boulevard	0	0	5
97	Broad & Sheppard	0	2	3
98	Broad & Summit	0	0	3
99	Broad & MacTavish	0	0	3
100	Broad & Roseneath	0	0	3
101	Broad & Thompson	0	0	3
102	Broad & Hamilton	0	0	3

Order	Description	Ons	Offs	Loads
71	Brookland Park Boulevard & No*	0	1	10
72	Brookland Park Boulevard & Ch*	0	0	10
73	Brookland Park Boulevard & Se*	0	0	10
74	Brook & Brookland Park Boulev*	0	0	10
75	Brook & Sherwood	0	0	10
76	Brook & Edgehill	0	0	10
77	Brook & Dubois	0	2	8
78	Overbrook & Brook	0	2	6
79	Overbrook & Langston	0	0	6
80	Overbrook & Meter & Gas City	0	1	5
81	Overbrook & 1405	0	0	5
82	Overbrook & Ownby Lane	0	1	4
83	Overbrook & Meyers	1	0	5
84	Overbrook & Hermitage	0	0	5
85	Hermitage & Railroad	0	0	5

Order	Description	Ons	Offs	Loads
103	Broad & Kent	0	0	3
104	Broad & Lafayette	0	0	3
105	Broad & Westwood	0	0	3
106	Broad & Sauer	0	0	3
107	Broad & Commonwealth	0	0	3
108	Broad & Westmoreland	0	0	3
109	Broad & Blacker	0	0	3
110	Broad & Chantilly	1	0	4
111	Broad & Staples Mill	0	0	4
112	Willow Lawn between Broad and*	0	0	4
113	Markel & Byrd	0	0	4
114	Byrd & Old Richmond	0	1	3
115	Byrd & Fitzhugh	0	0	3
116	Fitzhugh & Willow Lawn	0	0	3
117	Willow Lawn & Shelter	0	0	3
Daily Totals		3	18	

Route 22

Route 22 connects the Northside to downtown via Broad St and Brook Rd. Major destinations along the route include the VCU Seigel Center, the Governor's School, Virginia Union University and the former site of Azalea Mall. The segment of Route 22 that attracts the highest number of riders for both directions serves Broad Street and Lombardy Street. This route enables residents to travel from the area north of the city into the downtown. Although ridership declines on both ends of the route, ridership is just as strong at the northern most end and in the downtown core. For both directions, the most popular boarding and alighting bus stops fall near opposite ends of the route. For the northbound direction, Broad & 8th generates the most boardings and the Azalea Mall attracts the most alightings. The opposite pattern is true of the southbound direction: the northern stop located at Westbrook & Westminster-Canterbury is the most common boarding stop and the downtown stop located at Broad & 9th has the highest demand for alightings. Route 22 has an observed average of seven boardings per trip for the northbound route. The southbound route had an average of four boardings per trip. The 4:06 p.m. trip held the highest load for the northbound route with 15 passengers. The 7:10 a.m. trip yielded the highest passenger load of 12 passengers for the southbound route.

Figure 35: Route 22

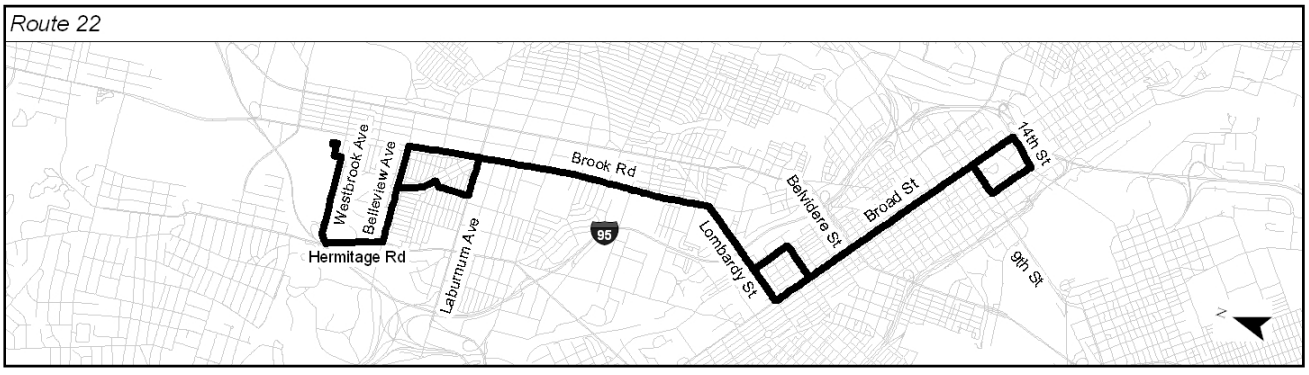


Table 45: 22 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	14th & Franklin St	4	1	24
2	Main & 13th	4	4	24
3	Main & 11th	4	0	28
4	Main & 10th	5	2	31
5	9th & Main	8	0	39
6	Broad & 8th	20	3	56
7	Broad & 6th	16	0	72
8	Broad at 4th	16	2	86
9	Broad & 3rd	19	2	103
10	Broad & 1st	14	0	117
11	Broad & Jefferson	5	2	120
12	Broad & Madison	0	3	117
13	Broad & Monroe	0	0	117
14	Broad & Henry	4	1	120
15	Broad & Gilmer	0	0	120
16	Broad & Hancock	7	4	123
17	Broad & Harrison	9	6	126
18	Broad & Ryland	5	4	127
19	Broad & Bowe	3	3	127
20	Lombardy Street at Kroger's	5	2	130
21	Lombardy & W. Moore	3	3	130
22	Lombardy & Admiral	0	1	129
23	Lombardy at Hovey Field	3	9	123
24	Brook & Lombardy	2	12	113
25	Brook & Overbrook	1	7	107
26	Brook & Edgehill	0	4	103
27	Brook & Sherwood	4	13	93
28	Brook & Brookland Park Boulev*	1	14	80
29	Brook & Rennie	1	3	78
30	Brook & Westwood	0	3	75
31	Brook & Palmyra	0	2	73
32	Brook & Walton	1	2	72
33	Laburnum & Fauquier	0	3	69
34	Laburnum & Lamont	0	1	68
35	Newport & Laburnum	0	5	63
36	Newport & Avondale	0	0	63
37	Newport & Graycourt	0	0	63
38	Claremont & Fauquier	0	3	60
39	Fauquier & Nottoway	0	1	59
40	Fauquier & Bellevue	1	6	54
41	Bellevue & McArthur	0	2	52
42	Bellevue & Crestwood	0	7	45
43	Bellevue & Pope	1	1	45
44	Hermitage & Princeton	0	6	39
45	Westbrook and Crestwood	0	4	35
46	Westbrook & Stratford	1	4	32
47	Azalea Mall at island near re*	5	27	19
Daily Totals		172	182	

Order	Southbound Stop Description	Ons	Offs	Loads
48	Azalea Mall at island near re*	3	0	21
49	Westbrook & Stratford	0	0	21
50	Westbrook & Crestwood	0	0	21
51	Westbrook & Westminister Cant*	10	0	31
52	Hermitage & Princeton	0	0	31
53	Bellevue midblock between Her*	1	1	31
54	Bellevue & Monticello	3	0	34
55	Bellevue & Fauquier	1	0	35
56	Bellevue & Newport	4	0	39
57	Brook & Amherst	2	1	40
58	Brook & Claremont	3	1	42
59	Brook & Greycourt	3	0	45
60	Brook & Avondale	0	0	45
61	Brook & Laburnum	2	0	47
62	Brook & Confederate	1	0	48
63	Brook & Palmyra	2	0	50
64	Brook & Westwood	2	0	52
65	Brook & Rennie	1	0	53
66	Brook & Whitby	0	0	53
67	Brook & Brookland Park Boulev*	1	0	54
68	Brook & Sherwood	5	0	59
69	Brook & Edgehill	3	0	62
70	Brook & Dubois	1	0	63
71	Brook & Overbrook	2	1	64
72	Brook & Graham	2	0	66
73	Brook & Lombardy	6	0	72
74	Lombardy at Ellison Hall (VUU)	3	0	75
75	Lombardy at VUU Library (Admi*	1	1	75
76	Lombardy at Maggie Walker Hig*	2	1	76
77	Leigh Street at Kinney	2	1	77
78	Leigh Street at Harrison	3	2	78
79	Harrison Street at Clay Street	1	0	79
80	Harrison Street at Marshall S*	0	7	72
81	Broad & Harrison	3	6	69
82	Broad & Laurel	3	3	69
83	Broad & Henry	2	1	70
84	Broad & Monroe	2	1	71
85	Broad & Jefferson	0	0	71
86	Broad & Adams	0	0	71
87	Broad & 1st	0	1	70
88	Broad & 2nd	0	12	58
89	Broad & 4th	4	13	49
90	Broad Street at 9th Street	3	15	37
91	Broad & 10th	0	5	32
92	Broad & 11th	0	5	27
93	Broad & 12th	2	8	21
94	Broad & Old 14th	4	4	21
95	14th & Franklin St	2	2	21
Daily Totals		95	92	

Route 24

Route 24 offers fairly similar service to Route 22, connecting areas north of the city to downtown along Broad St, Boulevard and Hermitage Ave. Major destinations along the route include the Diamond, Richmond Technical Center and the AP Hill Monument. Route 24 operates farther west than Route 22 and serves a larger stretch of Broad Street, which is the segment of the route in both directions with the highest ridership demand. Ridership is also strong along Boulevard, where the route turns north. The most popular bus stops fall along this segment of the route that experiences the highest passenger loads. In the northbound direction, the most passengers use the Broad & 8th stop to board and the Boulevard stop at The Diamond to alight. In the southbound direction, the Boulevard stop at the Greyhound station is the most common boarding point and the Broad & 9th stop has the highest demand for passenger alighting. The northbound route had an average of ten boardings per trip while the southbound route averaged nine boardings per trip. The 7:06 a.m. trip carried the highest load with 22 passengers for the northbound route. The southbound route experienced its highest load at 1:45 p.m. with 20 passengers.

Figure 36: Route 24

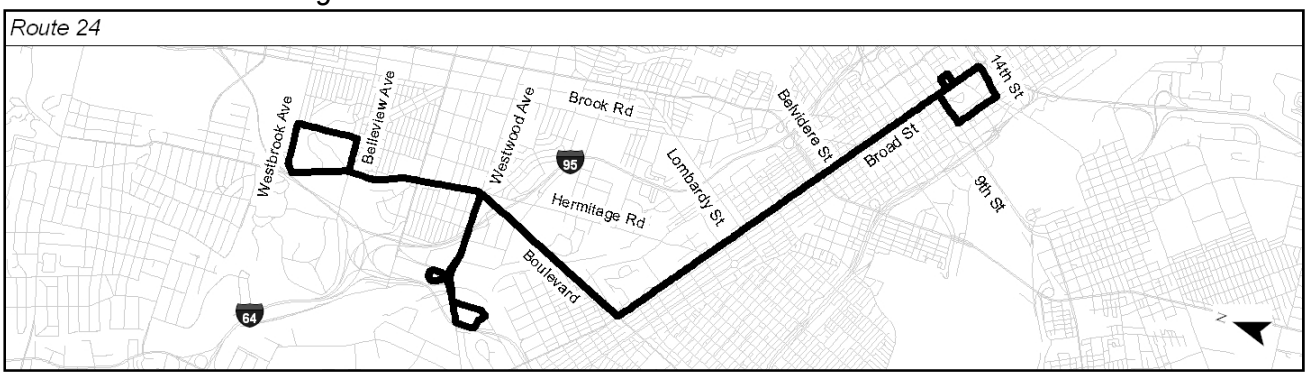


Table 46: 24 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	14th & Franklin St	1	0	22
2	Main & 13th	6	2	26
3	Main & 11th	6	0	32
4	Main & 10th	4	0	36
5	9th & Main	2	0	38
6	Broad & 8th	57	1	94
7	Broad & 6th	33	0	127
8	Broad at 4th	17	1	143
9	Broad & 3rd	15	0	158
10	Broad & 1st	24	6	176
11	Broad & Jefferson	12	4	184
12	Broad & Madison	0	2	181
13	Broad & Monroe	1	0	182
14	Broad & Henry	5	5	182
15	Broad & Gilmer	3	1	184
16	Broad & Hancock	2	4	182
17	Broad & Harrison	8	10	180
18	Broad & Ryland	5	6	179

Order	Southbound Stop Description	Ons	Offs	Loads
49	Crestwood & Westbrook	2	1	18
50	Westbrook & Westminister Cant*	2	1	14
51	Hermitage & Toll Road	5	1	23
52	Hermitage & Princeton	4	0	27
53	Hermitage & Bellevue	16	0	43
54	Hermitage & Nottoway	0	0	43
55	Hermitage & Claremont	2	1	44
56	Hermitage & Laburnum	9	2	51
57	Hermitage & Wilmington	1	0	52
58	Hermitage & Maple Shade Ln	0	0	52
59	Hermitage & Seddon	3	0	55
60	Hermitage & Elmsmere	0	0	55
61	Hermitage & Oakdale	8	0	63
62	Boulevard & Westwood	7	1	71
63	Boulevard & Arlington	6	0	77
63	Westwood & Hamilton	0	1	9
64	Boulevard & Ellen	13	0	90
64	Technical Center	2	0	5

Order	Northbound Stop Description	Ons	Offs	Loads
19	Broad & Bowe	0	15	164
20	Broad & Allen	1	6	159
21	Broad & Meadow	0	0	159
22	Broad & Allison	0	2	157
23	Broad & Strawberry	0	2	155
24	Broad & Davis	0	3	152
25	Broad & Robinson	9	3	158
26	Broad & Terminal Place	3	4	157
27	Boulevard & Broad	23	15	165
28	Boulevard & Clay	0	1	164
29	Boulevard & 1119 Car Pool	1	1	164
30	Boulevard & Leigh	0	3	161
31	Boulevard & The Diamond	0	47	114
32	Boulevard & Robinhood	0	13	101
33	Boulevard & Arlington	0	4	97
34	Boulevard & Brookland Parkway	0	6	54
35	Hermitage & Palmyra	1	7	64
36	Hermitage & Confederate	0	1	63
37	Hermitage & Maple Shade Ln	0	3	60
38	Hermitage & Wilmington	0	0	60
39	Hermitage & Laburnum	0	15	45
40	Hermitage & Claremont	1	3	43
41	Hermitage & Nottoway	0	0	43
42	Hermitage & Bellevue	0	16	27
43	Bellevue midblock between Her*	0	1	23
44	Bellevue & Monticello	0	1	22
45	Crestwood & Bellevue	2	5	22
46	Crestwood & Fauquier	1	1	22
47	Crestwood & Lorriane	0	1	21
48	Crestwood & Westbrook	8	12	17
63	Westwood & Hamilton	0	1	11
64	Technical Center	0	1	3
Daily Totals		251	235	

Order	Southbound Stop Description	Ons	Offs	Loads
65	Boulevard & Greyhound Bus Sta*	32	1	121
66	Boulevard & Moore	0	0	121
67	Boulevard & Clay	0	5	116
68	Broad & Boulevard	22	9	129
69	Broad & Robinson	6	5	130
70	Broad & Davis	4	1	131
71	Broad & Strawberry	6	0	137
72	Broad & Allison	4	0	141
73	Broad & Meadow	3	1	143
74	Broad & Allen	9	0	152
75	Broad & Lombardy	7	5	154
76	Broad & Ryland	6	9	151
77	Broad & Harrison	7	5	153
78	Broad & Laurel	6	5	154
79	Broad & Henry	8	5	157
80	Broad & Monroe	6	1	162
81	Broad & Jefferson	1	3	160
82	Broad & Adams	0	3	157
83	Broad & 1st	1	12	146
84	Broad & 2nd	4	22	128
85	Broad & 4th	9	38	99
86	Broad Street at 9th Street	2	52	49
87	Broad & 10th	1	15	35
88	Broad & 12th	2	16	21
89	Broad & Old 14th	0	2	19
90	14th & Franklin St	0	5	20
Daily Totals		226	228	

Route 32

Route 32 connects the Northside to downtown via 1st St and North Ave. Route 32 attracts the most riders along the route's north approach and regress path to downtown along 1st Street and 2nd Street. This section of the route attracts considerably higher ridership than the segment of the route operating in downtown and in the multi-directional loop at the north end. Heading northbound, the most popular individual stops occur early in the route. The most used boarding stop is located at Broad & 3rd and the most used alighting stop is located at 1st & Hill. In the southbound direction, the 1st and Hill stop sees the highest number of boardings and the 1st & Marshall stop has the highest number of alightings. The northbound route averaged 13 boardings per trip and the southbound route averaged 14 boardings per trip. The 4:45 p.m. trip had the highest load of 45 passengers for the northbound direction while the southbound route carried its highest load of 47 passengers at 9:22 a.m. In the ridership table below, the two northern branches (North and Fendall) are shaded different colors. The common leg of the route is unshaded.

Figure 37: Route 32

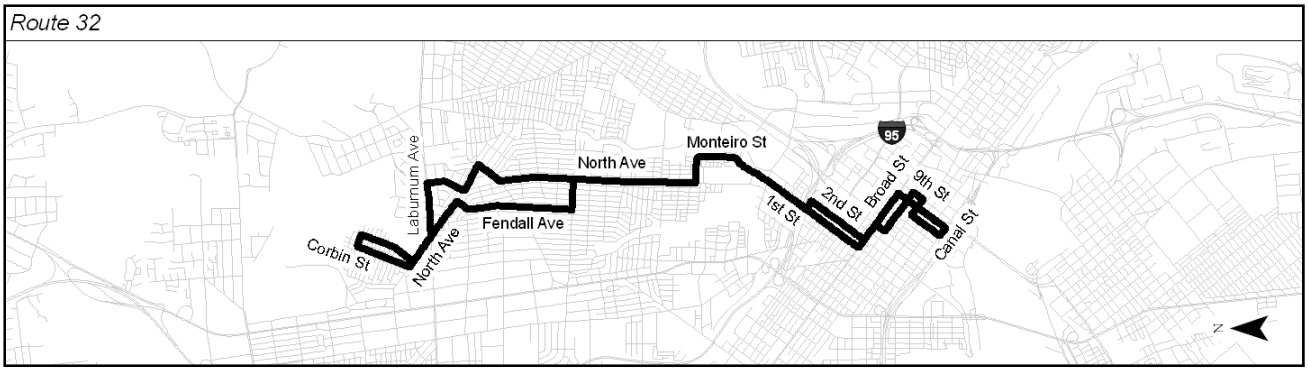


Table 47: 32 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	8th & Canal	0	3	16
2	Canal btw 8th & 7th	0	1	15
3	7th & Cary	8	5	148
4	7th & Main	11	3	191
5	7th & Franklin	38	0	230
6	Grace at 5th Street	61	7	283
7	Broad & 3rd	351	2	618
8	2nd & Marshall	222	11	837
9	2nd & Leigh	59	8	893
10	Duval near 1st	41	25	911
11	1st & Baker	10	50	871
12	1st & Federal	19	50	840
13	1st & Hill Hospital	22	101	762
14	Monteiro & Fells	9	21	750
15	Monteiro & Wellford	1	13	738
16	Poe & Lamb	11	19	731
17	Poe & Barton	3	14	720
18	North & Poe	3	22	701
19	North & Roberts	1	29	673
20	North & Graham	8	53	631
21	North & E Lancaster	3	17	617
22	North & Norwood	0	27	590
23	North & Hooper	1	17	574
24	North & Essex	2	34	542
25	Brookland Park Boulevard & No*	11	54	179
26	Brookland Park Blvd. at Haynes	2	17	165
27	Fendall & Brookland Park Boul*	2	16	151
28	Fendall & Stuart School	7	7	151
29	Fendall & Ladies Mile	2	12	141
30	Fendall & Westwood	1	4	138
31	Fendall & Culpeper	1	6	133
32	Fendall & Garland	2	5	130
33	Fendall & North	2	6	126
34	North & Alma	0	26	102
35	North & Laburnum	0	17	85
36	North & Brookland Park Boulev*	11	53	277
37	North & Crawford	0	14	262
38	North & Gladstone	0	13	249

Order	Southbound StopDescription	Ons	Offs	Loads
53	Moss Side & Akron	16	14	111
54	Moss Side & Lincoln	7	0	118
55	Maggie Walker & Moss Side	3	6	115
56	Corbin & Maggie Walker	4	2	117
57	Corbin & Cheatwood	15	8	125
58	Corbin & Rex	5	6	124
59	Corbin & North	21	1	144
60	North & Moss Side	15	0	159
61	North & Montrose	69	4	224
62	Laburnum & Plymouth	15	0	132
63	Laburnum & Alma	77	2	209
64	Pilots lane at Trafton Street	9	0	218
65	Pilots Lane & Westcliff	9	7	217
66	Hazelhurst & North	9	0	233
67	Hazelhurst & Cliff	4	6	231
68	Ladies Mile & Hazelhurst	23	0	254
69	North - 150 Feet from Ladies *	11	6	259
70	North & Meredith	12	7	264
71	North & Gladstone	9	5	269
72	North & Crawford	13	4	278
73	North & Henrico Boulevard	21	2	123
74	North & Fendall	20	0	143
75	Fendall & Garland	10	0	153
76	Fendall & Culpeper	8	0	161
77	Fendall & Westwood	4	0	165
78	Fendall & Ladies Mile	8	0	173
79	Fendall in front of Stuart Sc*	4	2	175
80	Fendall & Brookland Park Boul*	12	4	182
81	Brookland Park Boulevard & Ga*	8	1	189
82	North & Brookland Park Boulev*	49	4	502
83	North & Hooper	101	6	605
84	North & Norwood	52	8	649
85	North & Overbrook	21	4	665
86	North & Wickham	34	10	689
87	North & Roberts	25	10	701
88	Poe & North	21	4	722
89	Poe & Lamb	26	7	741
90	Monteiro & Minor	7	6	742

Order	Northbound Stop Description	Ons	Offs	Loads
39	North & Meredith	2	7	244
40	North & Ladies Mile	2	12	234
41	Ladies Mile & Cliff	0	18	216
42	Hazelhurst & Ladies Miles	0	18	198
43	Hazelhurst & Cliff	3	4	197
44	Pilots Lane & North	0	12	185
45	Pilots Lane & Westcliff	0	9	176
46	Pilots Lane & Alton	1	4	173
47	Pilots Lane & Laburnum	0	46	127
48	Laburnum & Alma	1	28	100
49	North & Montrose	0	47	138
50	Moss Side & North	7	41	106
51	Moss Side & Rex	4	6	103
52	Moss Side & Akron	4	11	95
Daily Totals		949	1045	

Order	Southbound StopDescription	Ons	Offs	Loads
91	Monteiro & Fells	18	2	759
92	1st & Hill	118	15	862
93	1st & Federal	68	10	926
94	1st & Baker	41	15	953
95	1st & Duval	7	3	957
96	1st & Leigh	2	21	938
97	1st & Clay	1	2	937
98	1st & Marshall	2	267	672
99	Broad & 2nd	24	143	553
100	Broad & 4th	18	194	366
101	8th & Franklin	18	155	185
102	8th & Cary	8	53	133
103	8th & Canal	10	19	126
Daily Totals		1112	1045	

Route 34

Route 34 serves the northwest corridor radiating out from central downtown, primarily along 4th Avenue and includes stops at City Hall, Hebrew Cemetery and Shockoe Cemetery. The route experiences its highest passenger loads as it travels to and from downtown along 4th Avenue. Beyond this central segment, passenger loads remain high into the city in the south and until Brookland Park Boulevard in the north. The most popular boarding and alighting points in the northbound direction are 9th & Marshall and Brookland Park & 4th, respectively. The most popular stops in the southbound direction are Brookland Park & 4th for passenger boarding and 8th & Marshall for passenger alighting. On average, the northbound route saw ten boardings per trip. The southbound route carried an average of 13 boardings per trip. The northbound route had its highest load of 44 passengers at 5:44 p.m. The southbound route carried its highest load of 35 passengers at 7:16 a.m.

Figure 38: Route 34

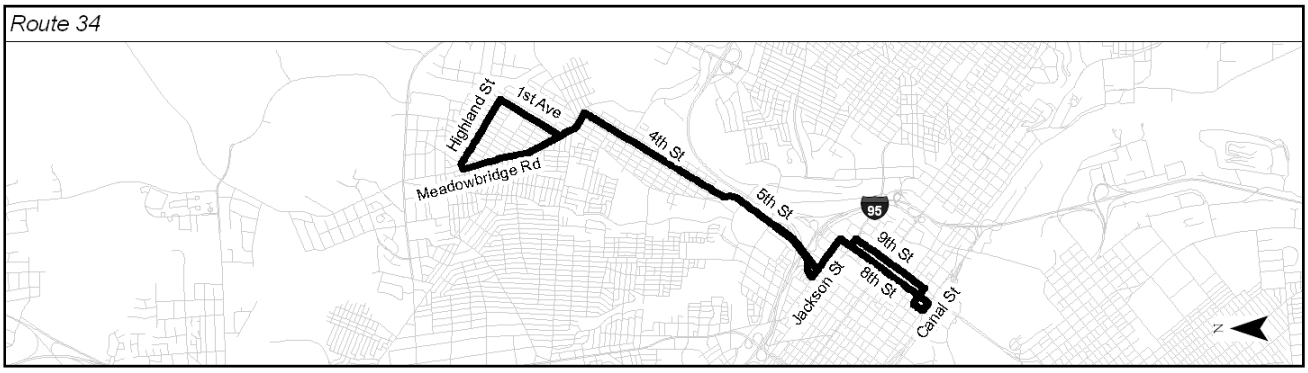


Table 48: 34 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	7th & Cary	5	4	192
2	Cary & 8th	5	1	196
3	9th & Cary	35	11	220
4	9th & Main	55	1	273
5	9th & Marshall (Mid-block bet*	375	8	640

Order	Southbound Stop Description	Ons	Offs	Loads
33	Highland & Missouri	41	19	212
34	Patrick & Meadowbridge	33	13	232
35	Meadowbridge & Milton	31	3	260
36	Meadowbridge & Hazelhurst	21	10	271
37	Meadowbridge & Pollock	21	10	282

Order	Northbound Stop Description	Ons	Offs	Loads
6	9th Street at Marshall Street	100	8	732
7	Leigh Street at 8th Street	8	10	730
8	4th & Jackson	10	7	733
9	5th north of I-64 underpass	25	5	753
10	5th & Hospital	13	8	758
11	Rowen & Court	3	13	748
12	4th & Trigg	2	15	736
13	4th & Chestnut	0	19	717
14	4th & Cypress	1	36	683
15	4th & Juniper	1	22	662
16	4th & Spruce	0	44	619
17	4th & Magnolia	2	42	580
18	4th & Victor	2	25	557
19	4th & Custer	0	19	538
20	Brookland Park Boulevard & 4th	0	112	426
21	Meadowbridge & 2nd	3	80	350
22	1st & Front	13	60	302
23	1st & Burns	1	27	255
24	1st & Pollock	2	17	241
25	1st & Milton	12	28	225
26	Highland & 1st	2	15	212
27	Highland & Enslow	4	25	193
28	Highland & Carolina	3	15	181
29	Highland & Maryland	1	9	173
30	Highland & Delaware	0	10	163
31	Highland & Florida	1	14	150
32	Highland & Missouri	9	51	104
Daily Totals		693	761	

Order	Southbound Stop Description	Ons	Offs	Loads
38	Meadowbridge & Bancroft	15	3	294
39	Meadowbridge & Gladstone	15	1	308
40	Meadowbridge & Northside	30	2	336
41	Meadowbridge & Arnold	44	10	370
42	Meadowbridge & Craigie	26	2	394
43	Meadowbridge & Highlandview	13	1	406
44	Meadowbridge & Brookland Park*	97	1	501
45	Brookland Park Boulevard & 4th	160	11	649
46	4th & Custer	15	0	664
47	4th & Victor	31	3	692
48	4th & Magnolia	39	3	728
49	4th & Spruce	31	2	757
50	4th & Juniper	35	0	792
51	4th & Cypress	39	1	830
52	4th & Chestnut	18	2	846
53	4th & Trigg	23	3	866
54	4th & Rowen	2	3	865
55	5th & Hospital	3	18	850
56	5th North & I-64 underpass	0	2	848
57	Jackson & 4th	3	49	803
58	8th & Clay	5	64	714
59	8th & Marshall	42	460	296
60	8th & Franklin	45	127	213
61	8th & Cary	8	34	187
62	8th & Canal	4	24	166
63	Canal btw 8th & 7th	3	4	150
64	7th & Cary	19	8	158
Daily Totals		912	893	

Route 37

Route 37 provides service along Chamberlayne Ave between the Northside and downtown, with stops at the former site of Azalea Mall and John Marshall High School. Route 37 experiences its highest passenger loads on the segment of the route stretching from the edge of downtown until Chamberlayne intersects Claremont. In the northbound direction, Route 37 experiences its heaviest boardings at the Broad & 3rd stop as well as the following and proceeding stops. The final stop in the northbound direction at Brook & Azalea generates the highest demand for alightings. In the reverse direction, Chamberlayne & Westminster recorded the largest number of boardings and 1st & Marshall had the largest number of alightings. The northbound route averaged 21 boardings per trip and the southbound route averaged 22 boardings per trip. The 3:17 p.m. trip had the highest load of 68 passengers for the northbound direction. The 6:10 a.m. trip carried the highest load of 41 passengers for the southbound route.

Figure 39: Route 37

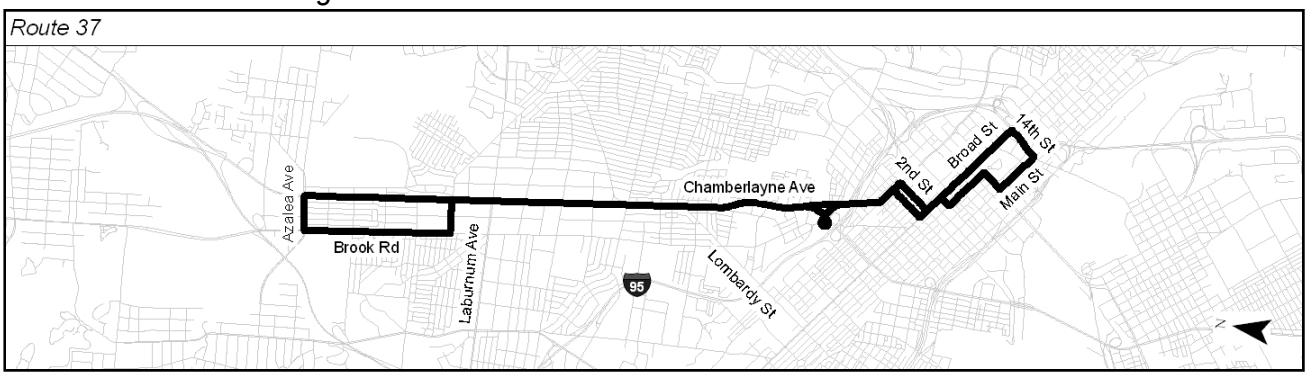


Table 49: 37 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	14th & Franklin St	5	2	120
2	Main & 13th	26	8	139
3	Main & 11th	11	11	139
4	Main & 10th	23	10	152
5	9th & Main	11	5	158
6	Grace Street at 8th Street	43	6	195
7	Grace at 5th Street	23	2	216
8	Broad at 4th	180	1	396
9	Broad & 3rd	206	6	596
10	2nd & Marshall	156	10	742
11	Leigh & 1st	24	0	768
12	Chamberlayne & Price	20	24	764
13	Chamberlayne & Duval	10	19	755
14	Chamberlayne Pky at Charity S*	38	37	756
15	Chamberlayne & Calhoun	5	17	744
16	Chamberlayne & Bacon	6	21	729
17	Chamberlayne Ave at Fritz St.	3	15	717
18	Chamberlayne & Fells	2	27	692
19	Chamberlayne & School	4	15	681
20	Chamberlayne & Tazewell	5	22	664
21	Chamberlayne & Sledd	0	18	647
22	Chamberlayne & Graham	2	16	633
23	Chamberlayne & Overbrook	5	26	612
24	Chamberlayne approx 50 feet s*	3	34	581
25	Chamberlayne & Hammond	4	29	556
26	Chamberlayne & Brookland Park*	12	26	542
27	Chamberlayne & Ladies Mile	4	19	527
28	Chamberlayne & Rennie	1	16	512
29	Chamberlayne & Westwood	5	30	487
30	Chamberlayne & Melrose	2	21	468
31	Chamberlayne & Walton	3	29	442
32	Chamberlayne & Laburnum	7	23	426
33	Chamberlayne & Ordway	5	42	389
34	Claremont & Chamberlayne	4	48	344
35	Claremont & Seminary	1	5	340
36	Brook & Claremont	2	11	331

Order	Southbound Stop Description	Ons	Offs	Loads
45	Brook & Azalea	59	21	235
46	Azalea & West Seminary	52	5	282
47	Chamberlayne & Watkins	47	13	318
48	Chamberlayne & Westbrook	55	31	342
49	Chamberlayne & Westminster	72	33	381
50	Chamberlayne & Bellevue	57	12	426
51	Chamberlayne & Claremont	58	9	475
52	Chamberlayne & Ordway	39	5	509
53	Chamberlayne & Laburnum	56	7	558
54	Chamberlayne & Walton	34	4	588
55	Chamberlayne & Melrose	37	2	623
56	Chamberlayne & Westwood	35	1	657
57	Chamberlayne & Rennie	18	4	671
58	Chamberlayne & Ladies Mile	27	4	694
59	Chamberlayne & Brookland Park*	29	17	706
60	Chamberlayne & Hammond	18	6	718
61	Chamberlayne & Edgehill	32	8	742
62	Chamberlayne & Overbrook	21	8	755
63	Chamberlayne & Wickham	26	7	774
64	Chamberlayne & Sledd	24	7	791
65	Chamberlayne & Tazewell	12	1	802
66	Chamberlayne & School	20	8	814
67	Chamberlayne & Fritz	18	8	824
68	Chamberlayne & Mitchell	12	7	829
69	Brook & Overpass	11	14	826
70	Chamberlayne & Baker	29	24	831
71	Chamberlayne Ave at Jackson *	4	14	821
72	Chamberlayne at Price	0	12	809
73	Leigh & 1st	0	21	788
74	1st & Clay	1	21	768
75	1st & Marshall	1	192	577
76	Broad & 2nd	6	92	491
77	Broad & 4th	12	112	391
78	Broad Street at 9th Street	15	157	248
79	Broad & 10th	10	101	157
80	Broad & 11th	10	45	122

Order	Northbound Stop Description	Ons	Offs	Loads
37	Brook in front of 3913	1	11	321
38	Brook & Bellevue	1	9	313
39	Brook in front of 4219	1	6	308
40	Brook & Westminster	0	15	293
41	Brook & Lorraine	17	20	289
42	Brook & Westbrook	0	21	268
43	Brook & Watkins	9	12	266
44	Brook & Azalea	70	135	201
Daily Totals		960	880	

Order	Southbound Stop Description	Ons	Offs	Loads
81	Broad & 12th	16	25	113
82	Broad & Old 14th	4	17	100
83	14th & Franklin St	6	10	96
Daily Totals		983	1085	

Route 93

The Azalea Connector, Route 93, provides limited east-west service north of downtown largely in Henrico County. This route connects several residential areas with shopping destinations on the west end of the route and provides service to several important destinations, including Henrico High School, the Virginia Department of the Blind and Vision Impaired, Azalea Shopping Center and the former site of Azalea Mall. Although total ridership is low on this route, it appears to be relatively consistent for all route segments. The only segment with registering lower passenger loads than the rest of the route is a branch that serves Chamberlayne Avenue on specific trips. Since ridership on this route is low, it is difficult to identify stops that attract a disproportionate number of boardings and alightings. Both the northbound and southbound directions of this route averaged one boarding per trip. The 7:40 a.m. and 4:55 p.m. trips shared the maximum load of four passengers for the northbound route. Likewise, the 7:50 a.m. and 4:40 p.m. trips had the highest loads for the southbound route with four passengers.

Figure 40: Route 93

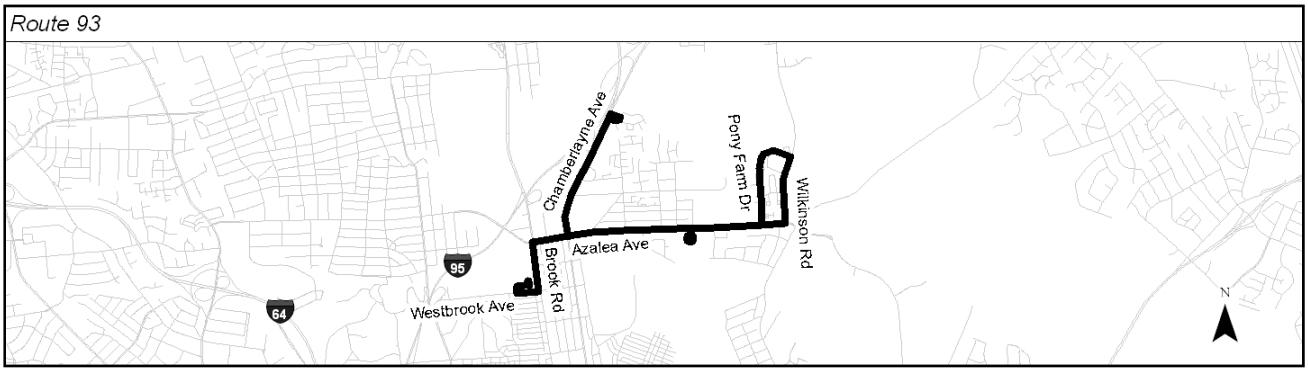


Table 50: 93 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	Azalea Mall at island near re*	3	0	14
2	Brook & Westbrook	0	0	14
3	Brook & Watkins	0	0	14
4	Brook & Azalea	4	2	16
5	Azalea & West Seminary	4	1	19
6	Azalea at Crenshaw Avenue (ne*	2	0	19
7	Azalea at Woodrow Avenue	0	0	19
8	Department for the Blind and *	0	1	18

Order	Southbound Stop Description	Ons	Offs	Loads
16	Pony Farm Drive near Queens T*	2	0	18
17	Wilkinson Road at Pony Farm D*	0	0	18
18	Wilkinson Road at Kirkland Dr*	0	1	17
19	Wilkinson Road at Azalea (acr*	0	0	17
20	Azalea at Pony Farm Drive	0	0	17
21	Azalea at Henrico High School*	2	0	19
22	Azalea at Woodrow Avenue	0	0	19
23	Azalea at Crenshaw Avenue	1	0	20

Order	Northbound Stop Description	Ons	Offs	Loads
9	Azalea Avenue at Sandpiper Dr*	0	1	17
10	Azalea Avenue at Meadowood Ch*	0	0	17
11	Pony Farm Drive at Roundtable*	0	0	17
12	Pony Farm Drive at Kirkland D*	4	3	18
13	Pony Farm Drive near Rental o*	4	1	21
14	Pony Farm Drive at Tivoli Cir*	0	2	19
15	Pony Farm Drive near Queens T*	0	3	16
Daily Totals		21	14	

Order	Southbound Stop Description	Ons	Offs	Loads
24	Chamberlayne at Azalea	0	2	8
25	Chamberlayne across the stree*	0	0	8
26	Chamberlayne at Wilmer Avenue	0	0	8
27	Chamberlayne at Brook Hill Ci*	0	2	6
28	Grammarcy Circle at Kirkstone*	7	1	12
29	Chamberlayne at Brook Hill Ci*	1	0	13
30	Chamberlayne at Wilmer	0	0	13
31	Chamberlayne at Brook Hill Az*	0	2	11
32	Azalea Avenue at Seminary	0	4	17
33	Brook Rd. at Azalea Ave	5	7	15
34	Azalea Mall at island near re*	1	2	11
Daily Totals		19	21	

Green Routes

Route 62-63

Route 62-63 is one of the most heavily ridden routes in the GRTC system. This bus route serves downtown Richmond and then branches out in multiple directions once it crosses the James River. Route 62 travels south along Hull St and Borad Rock Rd to provide service to Chippenham Mall, Southside Plaza and the McGuire VA Hospital. Route 63 serves Midlothian Turnpike with stops at George Wythe High School, Cloverleaf Mall and Beaufont Mall. Daily passenger loads are highest on the segment of this route that is shared by all four branches. Passenger loads decrease as the route branches out and serves more specialized areas with lower density development. In the northbound direction, the most popular place to board is the Plaza & the Medical Center stop. The most common alighting destination is located downtown at 7th & Broad. In the southbound direction, two stops on the downtown loop of the route registered the highest number of boardings and alightings: 8th & Marshall and Marshall & 7th, respectively. An observed average of 18 boardings per trip was recorded for the northbound route while the southbound route had an average of 15 boardings per trip. The 5:12 p.m. trip for the northbound route yielded the maximum load with 38 passengers. The southbound route had its highest load at 5:13 p.m. with 49 passengers. In the ridership tables presented below, each route branch is shaded a different color to indicate deviations from the common segment. The common leg of the route is unshaded.

Figure 41: Route 62

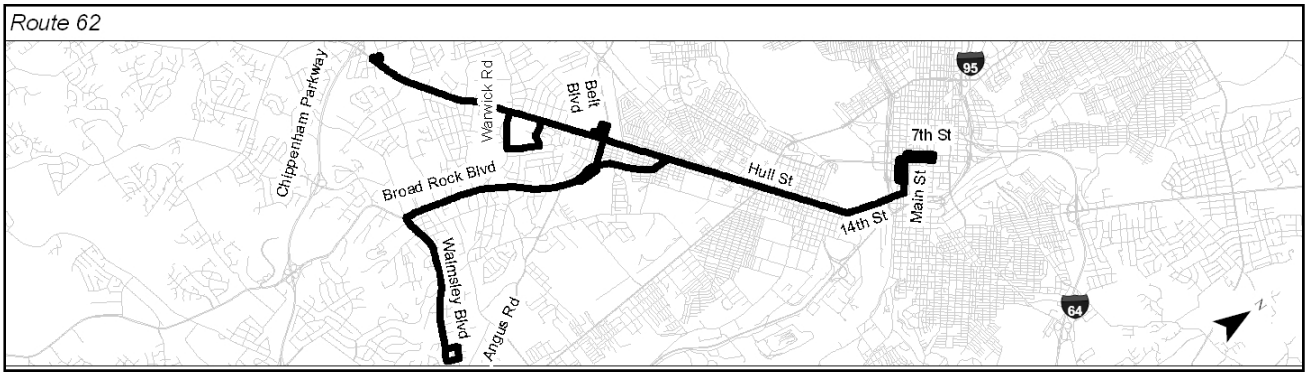


Figure 42: Route 63

Route 63

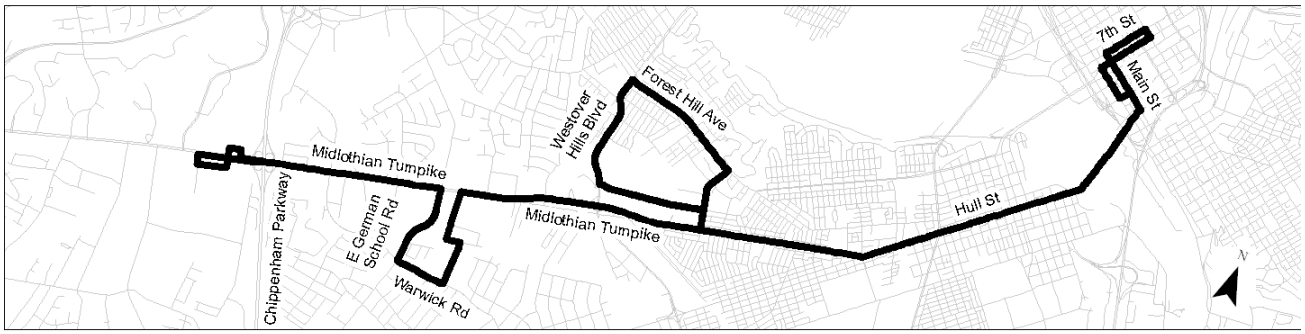


Table 51: 62-63 Northbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	Chippenham Mall Parking Lot	26	6	63
8	Hull & Elkhat School	1	0	64
12	Hull St @ 6200 Blk	2	0	3
13	Hull & Hey	2	0	68
14	Hull & Orcutt	14	0	82
16	Hull Street at Berrywood	1	0	83
18	Hull & Silverwood	1	0	84
20	Hull & Chesterfield	8	0	92
22	Hull & Pinebrook Apts	4	0	96
24	Hull & Warwick	3	2	97
27	Hull & Woodhaven	2	0	71
37	Briary & Woodhaven	7	0	55
49	Hull & Welton	1	0	18
62	Hull St. & McGuire Drive	4	1	84
63	Hull & 36th	2	0	86
64	Hull & 33rd	0	5	81
65	Hull & E. Blake	3	0	84
3	Clarkson & Warwick	17	16	58
4	Clarkson & Day Care Center	0	7	23
5	Clarkson & 1722	6	1	63
6	Clarkson Rd & Warwick	1	9	15
9	Southwood Pkwy (formerly Bria*	4	0	67
11	Warwick & Hull	0	13	5
42	Southwood & Tifton	0	0	14
29	Hull & Dixon	18	0	163
34	Hull & Arizona	7	0	170
39	Plaza at Belt Boulevard	22	0	241
40	Belt Boulevard & Stockton	27	0	385
66	Hull & Playn	12	2	621
67	Hull & 30th	15	7	629
68	Hull & Tynick	16	1	645

Order	Description	Ons	Offs	Loads
28	Walmsley Boulevard & Dorsett	1	4	29
30	Walmsley Boulevard & Southall	9	0	38
32	Broad Rock & 3309	22	0	60
35	Broad Rock & Epperson	5	0	65
38	Broad Rock & Welfo	5	0	70
41	Broad Rock & Jervie	3	0	73
44	Broad Rock & Ferguson	6	0	79
45	Broad Rock & Haworth	10	0	89
48	Broad Rock at Warwick	6	2	93
51	Broad Rock & Chatsworth	3	0	96
53	Broad Rock & Terminal	6	0	102
54	Broad Rock & Cooks	2	0	104
56	Broad Rock & Cranford	0	0	104
58	Broad Rock & Leake	2	0	106
59	Broad Rock & S Kinsley	6	0	112
60	Broad Rock & Horner Lane	4	0	116
61	Belt Boulevard & Merry Oaks	0	1	118
26	McGuire Hospital Shelter	16	3	163
31	2nd McGuire Hospital Stop	12	3	172
33	Broad Rock & Clover Lane	9	1	296
36	Plaza & the Medical Center	136	12	399
43	Broad Rock & Belt Boulevard	34	2	443
46	Broad Rock & McGuire	44	1	482
47	Broad Rock & 36th	27	3	506
50	Broad Rock & 34th	14	10	512
52	Broad Rock & Holly Springs	12	0	523
55	Broad Rock & Decatur	9	9	523
57	Broad Rock between Hull & Dec*	5	1	527
1	Cloverleaf Mall Parking Lot	34	5	67
2	Midlothian Pike & K-Mart	10	3	74
3	K-Mart Store End of Line (Route 71)	0	0	0

Order	Description	Ons	Offs	Loads
69	Hull & 28th	3	3	645
70	Hull & Evans	19	6	659
2	Banton & Dupont	0	5	12
7	Dupont & Fluvanna	3	0	15
10	Fluvanna & Walmsley Boulevard	1	0	16
15	Walmsley Boulevard & Shacklef*	10	0	26
17	Walmsley Boulevard & Vial	3	0	29
19	Walmsley Boulevard & Susan	1	0	30
21	Wamsley Boulevard & Hopkins	0	0	30
23	Walmsley Boulevard & Olive	2	0	32
25	Walmsley Boulevard & Woodmere	0	0	32
15	Giant & Midlothian	7	1	217
16	Midlothian Pike & Memco - Eri*	14	2	229
17	Midlothian Pike & Rodman	3	3	229
18	Midlothian Pike & Covington	10	1	238
19	Midlothian Pike & Division	4	0	242
20	Midlothian Pike & George Wyth*	28	2	268
21	Midlothian Pike & Midlothian *	19	1	286
22	Midlothian Pike & Darden	9	2	293
23	Crutchfield & Norcroft Townho*	12	6	98
24	Crutchfield & Charnwood Apt	24	9	113
25	Westover Hills Boulevard & Cr*	22	9	126
26	Westover Hills Boulevard & Br*	21	8	139
27	Westover Hills Boulevard & Ba*	12	4	147
28	Westover Hills Boulevard & Re*	2	1	148
29	Westover Hills Boulevard & 12*	3	3	148
30	Forest Hill & 47th	5	5	148
31	Forest Hill & 46th	1	3	146
32	Forest Hill & 45th	1	0	147
33	Forest Hill & Taylor	1	0	148
34	Forest Hill & 43rd	0	0	148
35	Forest Hill & 41st	3	1	150
36	Forest Hill & Roanoke	5	1	154
37	Roanoke & Dunston	2	0	156
38	Roanoke & Northrop	2	0	153
39	Roanoke & Crutchfield	7	0	160
43	Midlothian Pike & East Blake *	20	6	527
47	Midlothian Pike & Clopton	18	11	548
40	Midlothian Pike & 37th	39	1	491
41	Midlothian Pike & 34th	8	2	497
42	Midlothian Pike & 33rd	20	4	513
44	Midlothian Pike & Broad Rock	17	8	536
45	Midlothian Pike & 29th	6	4	538
46	Midlothian Pike & 28th	3	0	541

Order	Description	Ons	Offs	Loads
4	Midlothian Pike & Carnation	8	0	86
5	Midlothian Pike & Warwick	19	1	104
6	Midlothian Pike & Goodwill	49	0	153
7	Midlothian Pike & Labrook	20	0	173
8	Midlothian Pike & Southgate S*	1	0	174
9	German School & 201	3	0	177
10	German School & Shallow Parkw*	4	2	179
11	Warwick & 5901	4	1	182
12	Warwick Village & Warwick Road	15	1	196
13	Warwick Village & Biggs	14	1	209
14	Giant Dr. (100 block)	2	0	211
81	Hull Street at 7th Street	10	3	1302
82	Hull & 5th	7	2	1307
83	Hull & 3rd	3	1	1309
84	Hull & 1st	5	1	1313
85	14th Bridge at Great Coastal	3	2	724
86	14th & Dock	5	17	1302
87	Main & 13th	10	119	1195
88	Main & 11th	6	45	1155
89	Main & 10th	8	50	1113
90	Main & 8th	10	71	945
91	7th & Franklin	11	95	861
92	7th & Grace	7	32	915
93	7th & Broad	100	481	479
Daily Total		1673	1362	

Order	Description	Ons	Offs	Loads
71	Hull & 25th	21	2	1226
72	Hull & Pilkington	18	10	1234
73	Hull & 20th	13	18	1229
74	Hull & Cowardin	43	68	1206
75	Hull & 17th	34	13	1228
76	Hull & 15th	29	11	1245
77	Hull & 14th	21	10	1257
78	Hull & 12th	39	10	1286
79	Hull & 11th	19	10	1295
80	Hull & 9th	44	43	1296

Order	Description	Ons	Offs	Loads

Table 52: 62-63 Southbound Daily Ridership

Order	Description	Ons	Offs	Loads
51	7th & Broad	86	84	728
52	Marshall & 7th	128	108	748
53	8th & Marshall	349	94	1003
54	8th & Franklin	232	20	1215
55	Cary & 9th	65	6	1274
56	Cary & 10th	29	7	1296
57	Main & 13th	96	4	1388
58	14th & Main	17	5	1400
59	14th & Dock	27	1	1426
60	14th & Reynolds Aluminum	0	2	1424
61	Hull & 3rd	17	7	1434
62	Hull & Brander	9	10	1433
63	Hull & 5th	1	7	1427
64	Hull & 7th	2	7	1422
65	Hull & 9th	68	34	1456
66	Hull & 11th	9	10	1455
67	Hull & 12th	17	27	1445
68	Hull & 14th	12	22	1435
69	Hull & 15th	9	24	1420
70	Hull & Cowardin	153	68	1505
71	Hull & 20th	31	14	1522
72	Hull & 21st	7	14	1515
73	Hull & 24th	6	14	1507
74	Hull & Evans	12	31	1576
75	Hull & 28th	5	4	1577
76	Hull & Tynick	4	13	1568
77	Hull & 30th	4	19	1553
78	Hull & Swansboro Lane	3	32	1524
79	Hull & Blake Lane	8	39	1493
80	Hull & 33rd	2	25	1470
81	Hull & 35th	2	43	1429
82	Hull & 37th	2	15	1416
83	Hull St & Spaine	3	70	1349

Order	Description	Ons	Offs	Loads
93	Briary & Woodhaven	1	14	22
94	Hull & Warwick	1	5	247
95	Hull & Pinebrook Apts	2	4	245
96	Hull & Swanson	0	5	240
97	Hull & Silverwood	4	0	244
98	Hull & Roberson	0	3	241
99	Hull & Orcutt	0	7	234
100	Hull & Derwent	0	6	228
101	Chippenham Mall Parking Lot	6	40	194
102	Plaza at Belt Boulevard	13	29	506
103	Plaza & the Medical Center	9	47	468
104	Belt Boulevard & Stockton	0	4	464
105	Broad Rock & Belt Boulevard	1	43	422
106	Broad Rock & Clover Lane	0	6	416
107	Broad Rock & Horner Lane	0	13	403
108	Broad Rock & 7 - 11 Store - Kinsley	0	25	378
109	Broad Rock & Leake	0	4	374
110	Broad Rock & Cranford	0	2	372
111	Broad Rock & Terminal	0	32	340
112	Broad Rock & Chatsworth	0	3	337
113	Broad Rock & Rt 644 - Warwick	2	10	329
114	Broad Rock & Bryce Lane	0	7	322
115	Broad Rock & Rockcreek Apts	0	10	312
116	Broad Rock & Orcutt Lane	3	4	311
117	Broad Rock & Snead	0	12	299
118	Broad Rock & Country Side Apt	3	9	293
119	Broad Rock & Southall	0	7	286
120	Walmsley Blvd & Dorset	0	5	281
121	Walmsley Blvd & Woodmere	0	3	278
122	Walmsley Blvd & Olive	0	6	272
123	Walmsley Blvd & Grubbs	0	9	263
124	Walmsley Blvd & Hopkins	0	5	258
125	Walmsley Blvd & Arnwood	1	0	259

84	Hull in front of Plaza	20	88	673
85	Hull & Arizona	1	13	661
86	Hull & Dixon	0	13	648
87	Hull & Woodhaven	0	5	643
88	Warwick & Hull	0	6	59
89	Clarkson & Warwick	6	3	62
90	Clarkson and Briary	2	17	47
91	Clarkson & 1722	1	13	35
92	Clarkson & Day Care Ctr	2	2	35

126	Walmsley Blvd & Walmsley Terrace	7	4	262
127	Banton & Walmsley Boulevard	0	6	256
128	Banton & Dupont	0	3	253
129	Midlothian Pike & Clopton	12	21	992
130	Midlothian Pike & 28th	4	7	989
131	Midlothian Pike & 29th	9	15	983
132	Midlothian Pike & Broad Rock	4	23	964
133	Midlothian Pike & West Blake Lane	2	22	944
134	Midlothian Pike & Dundee	3	12	935

Order	Description	Ons	Offs	Loads
135	Midlothian Pike & 35th	0	8	927
136	Midlothian Pike & Bland	0	12	915
137	Midlothian Pike & Darden	5	3	572
138	Midlothian Pike & Midlothian Village	3	18	557
139	Midlothian Pike & George Wythe	7	30	534
140	Midlothian Pike & Belt Boulevard	2	12	524
141	Midlothian Pike & Covington	3	4	523
142	Midlothian Pike & Agency	0	10	513
143	Midlothian Pike & Erich	0	14	499
144	Giant & Midlothian	1	12	488
145	Giant Dr. (100 block)	0	10	478
146	Warwick Village & Biggs	3	13	468
147	Warwick Village & Warwick Road	0	4	464
148	Warwick Rd. (5800 Block)	0	9	455
149	German School & Shallow Parkway	0	8	447
150	German School & 201	1	2	446
151	Midlothian at Overland Tranportation	2	3	445
152	Midlothian Pike & Beaufont Hills dr	3	56	392
153	Midlothian Pike & Warwick	0	18	374
154	Midlothian Pike & Carnation	2	7	369
155	Midlothian at Taco Bell	1	16	354
156	Midlothian Pike & K-Mart	1	16	339
157	Beaufont Mall	6	30	315
158	Cloverleaf Mall Parking Lot	14	46	283
159	Midlothian Pike & Roanoke	0	9	549
160	Roanoke between Moody & Midloth	3	12	540
161	Crutchfield & Roanoke	3	25	518
162	Crutchfield 80 feet west of # 4037	4	11	511
163	Crutchfield & Norcroft Townhouse	12	14	509
	Total	1610	1964	

Route 67

Route 67 connects the Chippenham Mall, south of the James River, to Richmond's central business district with limited peak-hour service. On this route, passenger loads are highest along the segment connecting downtown with the areas just south of the river, particularly north of Hull Street. In the northbound direction, the Chippenham Mall generates the greatest demand for passenger boardings of all the

stops and the Broad & 9th stop has the highest demand for alightings. In the southbound direction, the Chippenham Mall stop registered the highest number of both boardings and alightings. The northbound direction averaged 13 boardings per trip while the southbound route saw an average of 4 boardings per trip. The 7:15 a.m. trip for the northbound route has the highest load with 22 passengers. The southbound route sees its highest load of 13 at 4:55 p.m.

Figure 43: Route 67

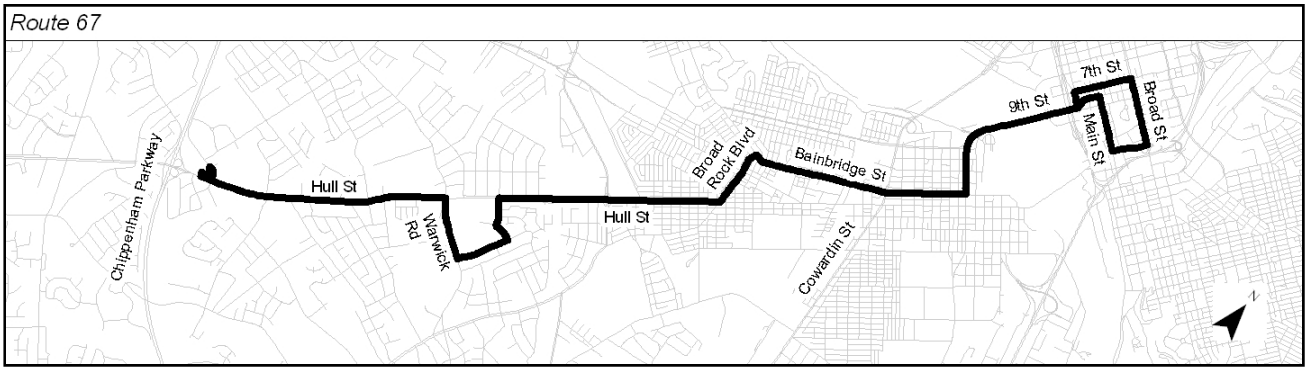


Table 53: 67 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	Chippenham Mall Parking Lot	18	0	27
2	Hull & Elkhart School	5	0	32
3	Hull & Hey	0	1	31
4	Hull & Orcutt	6	0	37
5	Hull Street at Berrywood	1	0	38
6	Hull & Silverwood	2	0	40
7	Hull & Pinebrook Apts	2	0	42
8	Hull & Warwick	0	0	42
9	Clarkson & Warwick	5	0	47
10	Clarkson & 1722	3	0	50
11	Southwood Pkwy (formerly Bria*	8	0	58
12	Briary & Woodhaven	2	0	60
13	Southwood & Tifton	6	0	66
14	Hull & Dixon	4	0	70
15	Hull & Arizona	1	0	71
16	Hull & Welton	1	4	68
17	Hull St. & McGuire Drive	0	0	68
18	Hull & 36th	0	1	67
19	Hull & 33rd	4	1	70
20	Broad Rock & Midlothian	5	1	74
21	Bainbridge & Cowardin	1	3	72
22	Commerce at Porter	1	1	72
23	Commerce & Perry	0	0	72
24	Canal & 8th	0	4	68
25	Canal btw 8th & 7th	1	0	69
26	7th & Cary	0	4	65

Order	Southbound Stop Description	Ons	Offs	Loads
35	14th & Franklin St	2	0	32
36	Main & 13th	3	0	35
37	Main & 11th	2	0	37
38	Main & 10th	0	0	37
39	8th & Cary	4	0	41
40	8th & Byrd	0	0	31
41	Commerce & Perry	0	0	31
42	Commerce & Bainbridge	0	0	31
43	Bainbridge & Cowardin	0	0	31
44	Broad Rock & Midlothian	1	0	32
45	Hull & 33rd	0	1	31
46	Hull & 35th	0	1	30
47	Hull & 37th	0	1	29
48	Hull St & Spaine	0	1	28
49	Hull in front of Plaza	0	1	27
50	Hull & Arizona	1	1	27
51	Hull & Dixon	1	0	28
52	Woodhaven & Hull	0	2	26
53	Briary & Woodhaven	0	0	26
54	Clarkson and Briary	0	5	21
55	Clarkson & 1722	0	0	21
56	Clarkson & Day Care Center	0	0	21
57	Clarkson Rd & Warwick	0	0	21
58	Warwick & Hull	0	0	21
59	Hull & Pinebrook Apts	0	4	17
60	Hull & Swanson	0	1	16

Order	Northbound Stop Description	Ons	Offs	Loads
27	7th & Main	0	5	60
28	7th & Franklin	0	8	52
29	Broad Street at 9th Street	0	24	28
30	Broad & 10th	2	2	28
31	Broad & 11th	0	7	21
32	Broad & 12th	2	4	19
33	Broad & Old 14th	0	10	9
34	14th & Franklin St	0	1	8
Daily Totals		80	81	

Order	Southbound Stop Description	Ons	Offs	Loads
61	Hull & Silverwood	0	1	13
62	Hull & Roberson	0	0	13
63	Hull & Orcutt	0	0	13
64	Hull & Derwent	0	0	13
65	Hull & Elkhat School	0	3	10
66	Chippenham Mall Parking Lot	8	7	9
Daily Totals		22	29	

Route 70-71

Route 70-71 connects the area of Richmond south of the James River to downtown. The southern portion of the route branches into two distinct service areas: Route 70 serves a western area along Forest Hill Ave with stops at Wal-Mart, Huguenot High School, Stony Point Shopping Center and Stony Point Medical Center. Route 71 serves a southern area along Jahnke Road with stops at Chppenham Hospital and the K-mart on Midlothian Turnpike. Daily passenger loads are highest along the shared portion of the route traveling to and from downtown Richmond. Once the route splits, ridership on each individual branch declines, which is the result of fewer buses and lower demand. Between the two branches, ridership is equivalent; passenger loads are largest the closer the bus is to downtown and thin out when the bus is near the end of the route. In the northbound direction, the final stop at Broad & 4th recorded the largest number of both boardings and alightings. In the southbound direction, the stop at Broad & 4th had the highest number of boardings and the stop at Wal-Mart on Forest Hill had the highest number of alightings. For route 70-71, there was an average of 15 boardings per trip observed for the northbound direction and an average of 10 boardings per trip for the southbound direction. The northbound route saw its highest load of 32 passengers at 5:36 a.m. The 9:58 a.m. bus had the highest load of 27 passengers for the southbound direction. In the ridership tables presented below, each route branch is shaded a different color to indicate deviations from the common segment. The common leg of the route is unshaded.

Figure 44: Route 70

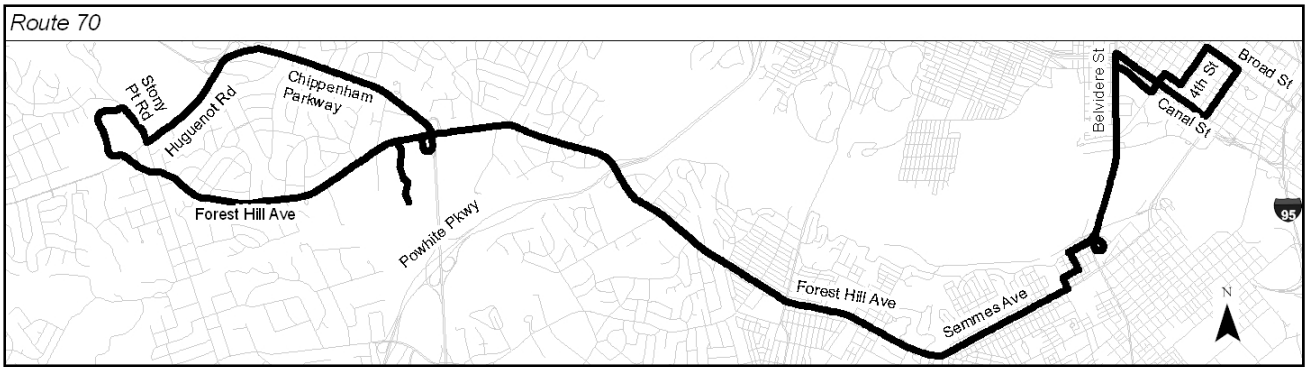


Figure 45: Route 71

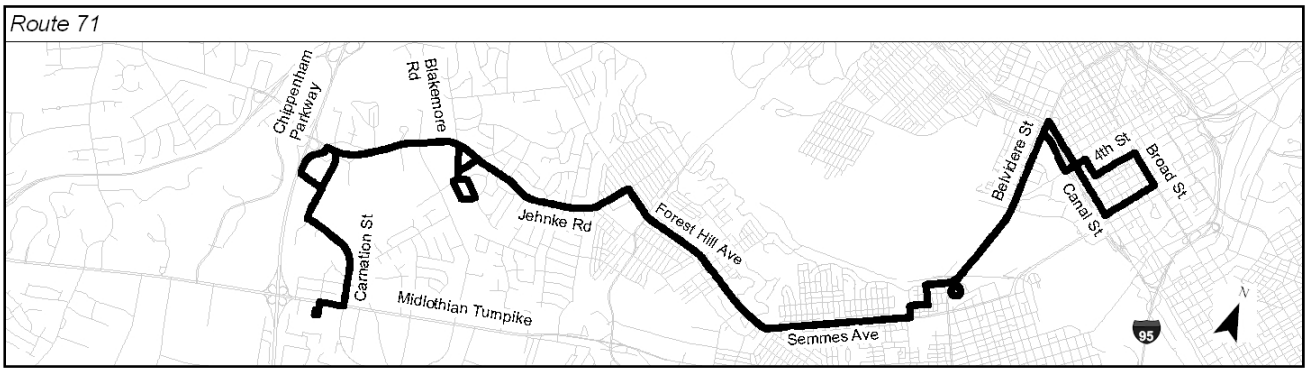


Table 54: 70-71 Northbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	K-Mart Store End of Line (Rou*	24	4	32
2	Carnation & Midlothian Pike	11	0	43
3	Carnation & Warwick	12	2	53
4	Carnation & Newport Manor	17	0	70
5	Carnation & Beaufont Oaks dri*	2	0	72
6	Hioaks & Carnation	6	0	78
7	909 Hioaks	9	0	87
8	driveway - Hioaks	8	4	94
9	Jahnke & Marlowe	4	0	98
10	Jahnke & Westover Gardens	13	0	111
11	Jahnke & St. John Woods	8	0	119
12	Jahnke & German School	7	2	124
13	Jahnke & Shopping Center	19	2	141
14	Jahnke & Blakemore	8	0	149
15	Blakemore & Renaissance Apts	4	0	153
16	Glenway & Glenway Court	4	0	157
17	Glenway Ct & Gridway in Loop	2	0	159
18	Wainwright & Blandy	1	0	160
19	Glenway & Blakemore	1	0	161
20	Newell & Janhke	6	3	164
21	Jahnke & Spruance	4	0	168
22	Jahnke & 5743	2	1	169
23	Jahnke & Redd School	1	0	170
24	Jahnke & Irby	7	0	177
25	Jahnke & Byswick Lane	1	0	178
26	Jahnke & Bouroughbridge	5	0	183
27	Jahnke & Clarence	0	0	183
28	Jahnke & Boscobel	1	0	184
29	Forest Hill & Jahnke	8	17	350
30	Forest Hill & Westover Hills *	47	19	378
31	Forest Hill & 47th	20	1	397
32	Forest Hill & 46th	3	3	397
33	Forest Hill & 45th	5	0	402
34	Forest Hill & Taylor	2	0	404
46	Forest Hill & Sheila Lane	11	1	115
47	Forest Hill & Stony Point Med*	1	1	20
48	Stony Point & Ukrops store	8	0	28
49	Chippenham Parkway & Weyburn	0	0	28
50	Chippenham Parkway & Stratford	0	0	28
51	Chippenham Parkway & Custis	0	0	28
52	Chippenham Parkway & Grantwood	1	0	29
53	Forest Hill & 7047	16	0	160
54	Forest Hill & Cherokee	4	0	164
55	Forest Hill & Hathaway	16	2	178
56	Forest Hill & Melborne	3	0	181
57	Forest Hill & Woodberry La	2	0	178
58	Forest Hill & Retig	0	0	178
59	Forest Hill & Willow Oaks	0	0	178
60	Forest Hill & Bliley	0	2	176
61	Forest Hill & Langdon	0	0	176
62	Forest Hill & Leicester	0	1	175
63	Forest Hill & 43rd	2	1	405
64	Forest Hill & 41st	2	0	403
65	Forest Hill & Roanoke	16	7	412
66	Forest Hill & Brookside	1	0	413
67	Forest Hill & Carson	3	1	415
68	Semmes & 34th	11	1	425
69	Semmes & 32nd	3	0	428
70	Semmes & 30th	8	2	434
71	Semmes & 28th	2	1	435
72	Semmes & 26th	6	6	435
73	Semmes & 24th	17	4	448
74	22nd & Semmes	12	6	454
75	Springhill & 21st	0	3	451
76	Springhill & 20th	2	6	447
77	20th & Stonewall	11	0	458
78	20th & Riverside	6	1	463
79	Belvidere & VA War Memorial	22	9	476

Order	Description	Ons	Offs	Loads
35	Forest Hill & Stony Point Me*	0	1	33
36	Forest Hill & Lake Village	10	3	40
37	Forest Hill & Stony Lake	5	2	43
38	Forest Hill & driveway to Sto*	3	0	46
39	Forest Hill & Choctaw	11	4	53
40	Forest Hill Ave. at Anwell Dr.	5	0	58
41	Forest Hill & 8133 driveway	0	2	56
42	Forest Hill & Huguenot School	4	2	62
43	Forest Hill & Thompson School	4	1	65
44	Forest Hill & Kenmore	10	0	75
45	Forest Hill Wal-Mart	31	1	105

Order	Description	Ons	Offs	Loads
80	Belvidere & Spring	1	5	472
81	Belvidere & Byrd	1	8	465
82	2nd & Canal	0	4	461
83	Cary & 3rd	0	10	451
84	4th & Main	13	19	445
85	4th & Franklin	12	19	439
86	4th & Broad	86	230	286
Daily Totals		654	424	

Table 55: 70-71 Southbound Daily Ridership

Order	Description	Ons	Offs	Loads
87	4th & Broad	88	36	373
88	Broad & 5th	35	27	381
89	Broad & 6th (EB)	30	27	384
90	8th & Franklin	80	44	420
91	8th & Cary	30	5	445
92	8th & Canal	7	4	459
93	Canal btw 8th & 7th	2	2	459
94	Canal & 7th	0	1	458
95	Canal & 4th	3	0	461
96	Canal & 2nd	3	1	463
97	Belvidere & Idlewood	12	3	472
98	Belvidere & Spring	1	30	443
99	Belvidere & Holly	3	2	444
100	20th & Stonewall	2	20	426
101	20th & Springhill	0	4	422
102	21st & Springhill	0	1	421
103	22nd & Semmes	13	0	434
104	Semmes & 25th	9	14	429
105	Semmes & 27th	5	10	439
106	Semmes & 29th	1	1	439
107	Semmes & 31st	4	5	438
108	Semmes & 33rd	0	4	434
109	Semmes & 34th	3	14	423
110	Semmes & Dundee	2	5	420
111	Forest Hill & Brookside	2	6	416
112	Forest Hill & Roanoke	2	8	410
113	Forest Hill & 41st	5	11	404
114	Forest Hill & 43rd	1	6	399
115	Forest Hill & 44th	1	6	394
116	Forest Hill & Cedar Lane	0	6	388
117	Forest Hill & Prince George	2	11	379
118	Forest Hill & Westover Hills *	17	28	368
119	Forest Hill & Prince Arthur	14	5	228
120	Forest Hill & Peterbourough	0	3	225
121	Forest Hill & Dorchester	1	4	222

Order	Description	Ons	Offs	Loads
137	Chippenham Parkway & Weyburn	0	1	39
138	Stony Point & Stony Point Learning	0	6	33
139	Forest Hill & Professional	0	0	22
140	Forest Hill & Stony Point Med*	2	1	22
141	Forest Hill Wal-Mart	4	54	51
142	Forest Hill & Grantwood	0	5	46
143	Forest Hill & Kenmore	0	5	41
144	Forest Hill & Thompson School	0	12	29
145	Forest Hill & Lansdale	0	3	22
146	Forest Hill & Professional	0	0	22
147	Forest Hill Ave. at Anwell Dr.	0	1	21
148	Forest Hill & Choctaw	1	2	20
149	Forest Hill & McRae	0	3	17
150	Forest Hill & driveway to Sto*	1	8	10
151	Forest Hill & Stony Lake	1	0	11
152	Forest Hill & 9211	0	0	11
153	Forest Hill & Stony Point Med*	2	1	22
154	Jahnke & Forest Hill	3	2	150
155	Jahnke & Dorchester	0	0	150
156	Jahnke & Clarence	0	1	149
157	Jahnke Rd. & Boroughbridge	0	0	149
158	Jahnke across from Byswick La*	1	7	143
159	Jahnke & Irby	3	6	140
160	Jahnke & 5550	0	0	140
161	Jahnke & Oakhurst Lane	1	4	137
162	Jahnke & Spruance	0	5	132
163	Jahnke & 1st driveway to Conv*	0	16	116
164	Glenway & Glenway Court	0	4	112
165	Glenway Ct & Glenway	1	6	107
166	Glenway Ct & Gridway in Loop	0	1	106
167	Wainwright & Blandy	0	3	103
168	Glenway & Blakemore	0	0	103
169	Blakemore & Janhke	0	1	102
170	Jahnke & Blakemore	1	2	101
171	Jahnke & Entrance to Shopping*	0	2	99

Order	Description	Ons	Offs	Loads
122	Forest Hill & Leicester	2	3	221
123	Forest Hill & Langdon	0	2	219
124	Forest Hill & N Riverside	0	0	219
125	Forest Hill & Pineway	0	2	217
126	Forest Hill & Fairlee	1	3	215
127	Forest Hill & Retig	0	3	212
128	Forest Hill & Windsor View	2	3	211
129	Forest Hill & 6750	0	5	206
130	Forest Hill & Hathaway	1	22	185
131	Forest Hill & Cherokee	1	17	169
132	Forest Hill & 7314	0	13	101
133	Forest Hill & 7038	0	10	45
134	Chippenham Parkway & Ingalls	0	3	42
135	Chippenham Parkway & Custis	0	2	40
136	Chippenham Parkway & Stratford	0	0	40

Order	Description	Ons	Offs	Loads
172	Jahnke & German School	1	10	90
173	Jahnke & St John's Wood	0	2	88
174	Jahnke & Westover Gardens Bou*	0	3	85
175	Jahnke & Marlowe	0	7	78
176	Chippenham Hospital Entrance	4	16	66
177	Chippenham Hospital Driveway *	2	8	60
178	Hioaks & Carnation	1	5	53
179	Carnation & Beaufont Oaks dri*	0	11	42
180	Carnation & Newport Manor	0	2	40
181	Carnation & Atmore	0	2	38
182	Carnation & Midlothain Pike	0	13	25
183	K-Mart Store End of Line (Rou*	1	14	12
Daily Totals		415	697	

Route 72-73

Routes 72 & 73 connect the Southside to downtown primarily via Cowardin Ave. Route 72 serves Phillip Morris and Maxxim Medical on Commerce Rd whil Route 73 serves the Food Lion via Jefferson Davis Highway. Route 72-73 maintains relatively consistent passenger loads throughout the route, especially along the segment shared by both Route 72 and Route 73. The shared route segment extends from south of the James River to downtown. Once the route splits at the southern end, daily ridership declines on each of the route branches. Between the two branches, Route 73 attracts more riders than Route 72. In the northbound direction, the final stop at Grace & 5th records the most boardings. Riders are boarding at the final stop in this direction because the north end of the route is a loop and those riders are boarding for the southbound trip. The stop at Grace & 8th receives the most alightings. In the southbound direction, the Franklin & 8th stop attracts the most boardings and the Jefferson Davis & Hopkins stop attracts the most alightings. The northbound route attracted an average of 17 boardings per trip and the southbound route averaged 10 boardings per trip. The northbound trip with the highest load occurred at 6:52 a.m. with 49 passengers. The highest southbound load of 48 passengers occurred on the 5:20 p.m. trip. In the ridership tables presented below, each route branch is shaded a different color to indicate deviations from the common segment.

Figure 46: Route 72

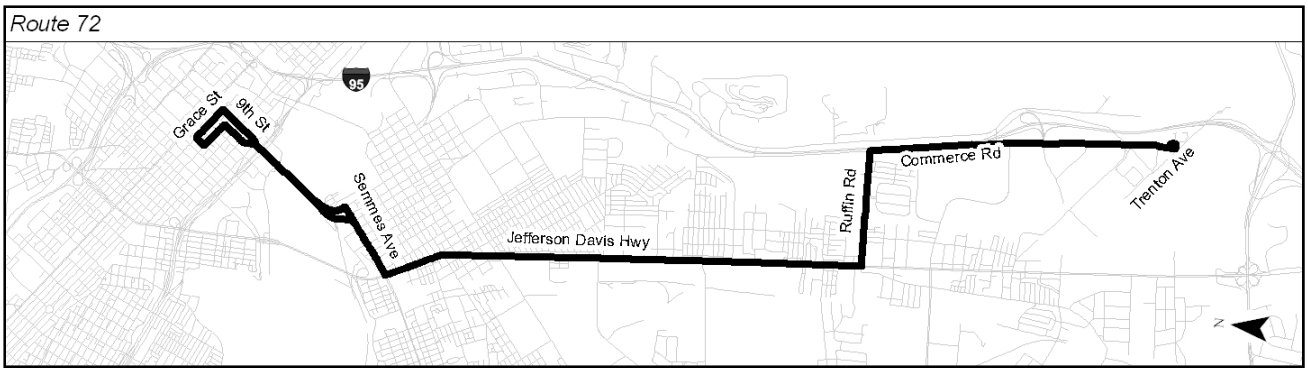


Figure 47: Route 73

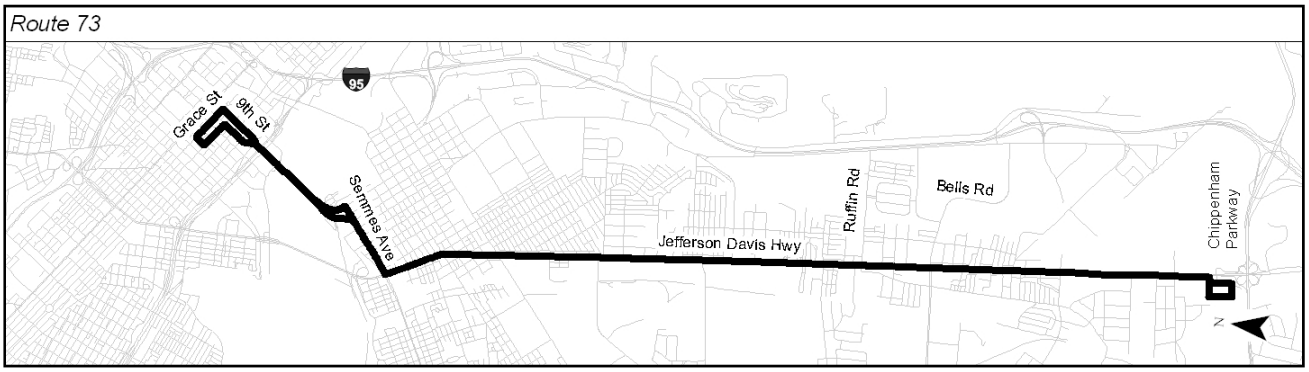


Table 56: 72-73 Northbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	K-Mart Layover (Route 73)	23	17	97
2	Dupont Gate	29	1	125
3	Jefferson Davis Hwy & 4631 Fa*	10	1	134
4	Jefferson Davis Hwy & Walmsle*	12	1	145
5	Jefferson Davis Hwy & Calvert*	16	0	161
6	Jefferson Davis Hwy & Dale	10	0	171
7	Jefferson Davis Hwy & Buford	3	0	174
8	Jefferson Davis Hwy & Sisco	11	1	184
9	Jefferson Davis Hwy & Courtla*	23	1	206
10	Jefferson Davis Hwy & Bells	19	1	224
11	Jefferson Davis Hwy & Alexand*	12	0	236
12	Jefferson Davis Hwy & Lambert	12	1	247
13	Jefferson Davis Hwy & Ruffin	19	2	264
14	Maxxim Medical	6	2	33
15	Commerce & Bells	3	0	36
16	Commerce Road at Gate "K"	8	0	44
17	Ruffin & Commerce	9	0	53
18	Ruffin & Frank	4	0	57
19	Ruffin & Davee	1	0	58
20	Ruffin & Ruffin Apts	10	0	68
21	Ruffin & Lynhaven Ave	1	0	69
22	Ruffin & Jefferson Davis Hwy	4	0	73
23	Jefferson Davis Hwy & Summer *	24	0	352
24	Jefferson Davis Hwy & Terminal	45	1	396
25	Jefferson Davis Hwy & Lumpkin	18	1	413
26	Jefferson Davis Hwy & Yorktown	4	0	417
27	Jefferson Davis Hwy & Atwell	22	5	434
28	Jefferson Davis Hwy & Bellmea*	19	4	449
29	Jefferson Davis Hwy & Warwick	27	6	470
30	Jefferson Davis Hwy & Webber	3	2	471
31	Jefferson Davis Hwy & Oakland	8	2	477
32	Jefferson Davis Hwy & Mimosa	2	1	478
33	Jefferson Davis Hwy & 1500	13	2	489
34	Jefferson Davis Hwy & Wood To*	0	3	486
35	Jefferson Davis Hwy & Halifax	63	7	542
36	Jefferson Davis Hwy & Gordon	11	5	548
37	Jefferson Davis Hwy & Fairfax	8	3	553
38	Jefferson Davis Hwy & Dinwidd*	6	6	553
39	Jefferson Davis Hwy & Boston	9	4	558
40	Jefferson Davis Hwy & Maury	4	1	561
41	Jefferson Davis Hwy & Stockton	4	16	549
42	Jefferson Davis Hwy & Decatur	5	42	512
43	Cowardin Ave at Hull Street	7	30	488
44	Cowardin & Bainbridge	12	5	495
45	Cowardin & Perry	12	1	506
46	Semmes & Cowardin	2	4	504
47	Semmes & 14th	6	2	508
48	Semmes & 12th	5	5	508
49	Semmes & 10th	6	4	510
50	9th & Byrd	1	13	498
51	9th & Cary	1	24	475
52	9th & Main	7	60	422
53	Grace Street at 8th Street	89	249	262
54	Grace & 6th	40	94	208
55	5th Street at Grace Grace Str*	115	32	291
Daily Totals		843	662	

Table 57: 72-73 Southbound Daily Ridership

Order	Description	Ons	Offs	Loads
56	5th Street at Grace Grace Str*	68	11	360
57	Franklin & 6th	4	2	145
58	Franklin & 7th	32	3	414
59	8th & Franklin	135	9	540
60	8th & Cary	9	1	548
61	8th & Byrd	8	0	556
62	Semmes & 10th	4	17	543
63	Semmes at 12th	2	11	534
64	Semmes & 14th	3	11	526
65	Cowardin & Perry	12	4	534
66	Cowardin & Wall	3	11	516
67	Cowardin & Bainbridge	13	13	516
68	Cowardin & Hull	73	10	579
69	Jefferson Davis Hwy & Stockton	11	11	579
70	Jefferson Davis Hwy & Maury	2	3	578
71	Jefferson Davis Hwy & Boston	4	18	564
72	Jefferson Davis Hwy & Dinwidd*	3	8	559
73	Jefferson Davis Hwy & Fairfax	4	14	549
74	Jefferson Davis Hwy & Hopkins	23	66	506
75	Jefferson Davis Hwy & Bridge	1	12	495
76	Jefferson Davis Hwy & Mimosa	4	5	494
77	Jefferson Davis Hwy & Webber	1	16	479
78	Jefferson Davis Hwy & Warwick	3	15	457
79	Jefferson Davis Hwy & Bellmea*	2	20	439
80	Jefferson Davis Hwy & Atwell	9	19	429
81	Jefferson Davis Hwy & Yorktown	5	15	419
82	Jefferson Davis Hwy & Lumpkin	0	12	407
83	Jefferson Davis Hwy & Terminal	10	27	390
84	Jefferson Davis Hwy & Lockhav*	2	20	372
85	Jefferson Davis Hwy & Summer *	1	39	334
86	Ruffin & Jefferson Davis Hwy	0	7	65
87	Ruffin & Lynhaven Ave	2	11	56
88	Ruffin Apts	0	9	47
89	Ruffin & Davee	1	1	47
90	Ruffin & Frank	2	3	46
91	Ruffin & Commerce	0	10	36
92	Commerce & Gate A	9	5	40
93	Commerce & Bells	4	2	42
94	Commerce & Wamsley Boulevard	6	2	46
95	Hardees before Bells	0	15	31
96	Maxxim Medical	1	3	29
97	Jefferson Davis Hwy & Ruffin	2	21	243
98	Jefferson Davis Hwy & Lambert	1	23	221
99	Jefferson Davis Hwy & Alexand*	3	22	202
100	Jefferson Davis Hwy & Bells	1	16	187
101	Jefferson Davis Hwy & Coles	2	11	178
102	Jefferson Davis Hwy & Sisco	0	10	168
103	Jefferson Davis Hwy & Buford	0	15	153
104	Jefferson Davis Hwy & Lancelot	0	3	150
105	Jefferson Davis Hwy & Dale	0	11	139
106	Jefferson Davis Hwy & Calvert*	1	15	125
107	Jefferson Davis Hwy & Walmsle*	0	12	113
108	Jefferson Davis Hwy & Falling*	0	10	103
109	Jefferson Davis Hwy & Goolsby	0	12	91
110	Jefferson Davis Hwy & Cogbill	0	17	74
111	K-Mart Layover (Route 73)	24	45	91
Daily Totals		510	734	

Route 74

Route 74 connects downtown to the Southside across the James River via the Manchester Bridge. Passenger loads on Route 74 are highest while the bus crosses the James River between downtown and the southern area of Richmond. Generally, ridership peaks just south of the River on Commerce Road, but is strongest throughout the central portion of the route. In the northbound direction, the Lone & Harwood stop sees the most boardings and the Broad & 8th stop has the most alightings. In the southbound direction, the Broad & 4th stop generates the most boardings and the Lone & Harwood stop attracts the most alightings. On average, there are 16 boardings per trip in the northbound direction and 12 boardings per trip in the southbound direction. The 2:53 p.m. trip carried the highest northbound load with 28 passengers. The 4:06 p.m. trip had the highest southbound load with 36 passengers.

Figure 48: Route 74

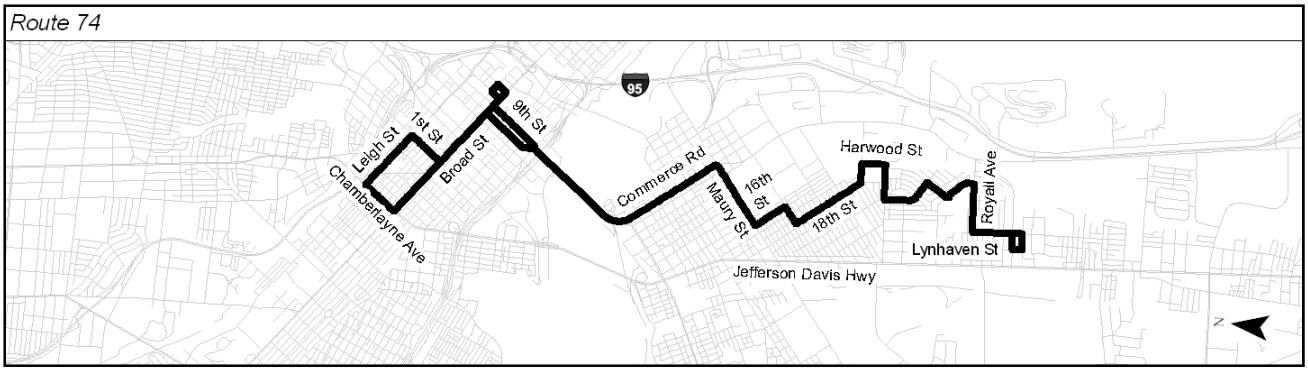


Table 58: 74 Northbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	Lynhaven Ave & Brady	11	3	62
2	Lynhaven Ave & Bellmeade	40	3	99
3	Lynhaven Ave & Warwick	15	1	114
4	Lynhaven Ave & Wright	4	0	118
5	Royall & Krouse	9	0	127
6	Royal & Thaxton	2	0	129
7	Gunn & Royall	14	0	143
8	Minefee & Gunn	14	0	157
9	Chambers & Minefee	14	0	171
10	Chambers & Bowen	7	2	176
11	Chambers & Harwood	24	3	197
12	Hardwood & Drewry	15	0	212
13	Lone & Harwood	117	3	326
14	Lone & Bruce	40	0	366
15	Bruce & 18th St	12	1	377
16	18th & Joplin	6	1	382
17	18th & Ingram	10	1	391
18	18th & Halifax	13	2	402
19	18th & Gordon	13	1	414
20	18th & Fairfax	5	0	419
21	18th St & Dinwiddie	12	4	427
22	Dinwiddie & 17th	6	0	433
23	16th & Dinwiddie	4	0	437
24	16th & Boston	3	2	438
25	16th & Maury	21	5	454
26	Maury & 15th	0	2	452
27	Maury & 12th	4	3	453
28	Maury & 10th	21	0	474
29	Commerce & Maury	6	1	479
30	Commerce & Stockton	7	7	479
31	Commerce & Hull	9	28	460
32	Commerce at Porter	5	1	464
33	Commerce & Perry	2	1	465
34	9th & Byrd	0	4	461
35	9th & Cary	1	7	455
36	9th & Main	4	27	432
37	Broad & 8th	6	166	272
38	Broad & 6th	11	57	226
39	Broad at 4th	17	62	181
40	Broad & 3rd	18	46	153
41	Broad & 1st	6	24	116
42	Broad & Jefferson	2	11	107
43	Broad & Madison	2	12	97
44	Broad & Monroe	3	4	96
45	Broad & Henry	12	15	93
46	Leigh & Henry	5	9	84
47	Leigh & Judah	9	5	92
48	Leigh & Adams	11	16	87
49	Leigh & 1st	3	1	89
50	1st & Clay	5	5	89
51	1st & Marshall	22	2	105
Daily Totals		622	548	

Table 59: 74 Southbound Daily Ridership

Order	Description	Ons	Offs	Loads
52	1st & Marshall	3	6	137
53	Broad & 2nd	38	4	171
54	Broad & 4th	77	9	239
55	Broad Street at 9th Street	63	16	286
56	Broad & 10th	24	6	304
57	11th & Broad	41	9	335
58	10th & Marshall	18	2	351
59	8th & Franklin	75	6	420
60	8th & Cary	11	3	428
61	8th & Byrd	4	1	431
62	Commerce & Perry	2	10	423
63	Commerce & Bainbridge	3	3	423
64	Commerce & Hull	31	8	446
65	Commerce & Stockton	0	1	445
66	Maury & 9th	0	32	413
67	Maury & 10th	0	11	402
68	Maury & 12th	1	9	394
69	Maury & 15th	1	4	391
70	16th & Maury	5	8	388
71	16th & Boston	1	6	383
72	16th & Dinwiddie	0	4	379
73	Dinwiddie & 17th	0	6	373
74	18th & Dinwiddie	1	3	371
75	18th & Fairfax	0	6	365
76	18th & Gordon	0	11	354
77	18th & Halifax	2	7	349
78	18th & Ingram	0	12	337
79	18th & Joplin	1	10	328
80	18th & Keswick	1	13	316
81	Lone & Bruce	1	36	281
82	Lone & Harwood	10	102	189
83	Harwood & 18th	2	12	179
84	Harwood & 21st	1	20	160
85	Chambers & Bowen	0	21	139
86	Chambers & Minefee	0	13	126
87	Minefee & Presson Boulevard	1	8	119
88	Minefee & Mimosa	2	12	109
89	Royall & Gunn	1	13	97
90	Royall & Krouse	0	8	89
91	Royall & Lynhaven Ave	1	3	87
92	Lynhaven Ave & Wright	1	5	83
93	Lynhaven Ave & Warwick	1	11	73
94	Lynhaven Ave & Afton	5	19	59
95	Columbia Street at Brady Stre*	7	15	51
96	Lynhaven Ave & Brady	12	8	55
Daily Totals		448	532	

Express Routes

Express routes all generally serve the same function: they directly transport passengers from park-and-ride lots outside of downtown to the central business district during the peak travel periods. In general, these routes make very few stops in between the point of origin and destination. The ridership data observed for all of the GRTC bus routes follow this ridership pattern. Passengers board at one end of the route and ride to the other end.

Route 26

Route 26 provides express service to downtown from the Parham Rd Park-and-Ride in western Henrico County. Although passenger loads fluctuate to some degree between stops, the majority of the route is operated without stopping. It is during this segment of the trip from the west end to downtown that passenger loads are highest. During the inbound trip, at its highest frequency in the morning, the Parham Park-and-ride generates the most boardings and the downtown stop at 8th & Clay has the highest demand for passenger alightings. The trip in the reverse direction displays the opposite pattern, boardings are heaviest at downtown stops and the majority of passengers alight at the park-and-ride. The eastbound route averaged eight boardings per trip while the westbound route averaged four boardings per trip.

For the eastbound route, the 6:30 a.m. and 7:40 a.m. trips yielded the maximum load of 21 passengers. The 4:53 p.m. route in the southbound direction had the highest load of 25 passengers.

Figure 49: Route 26

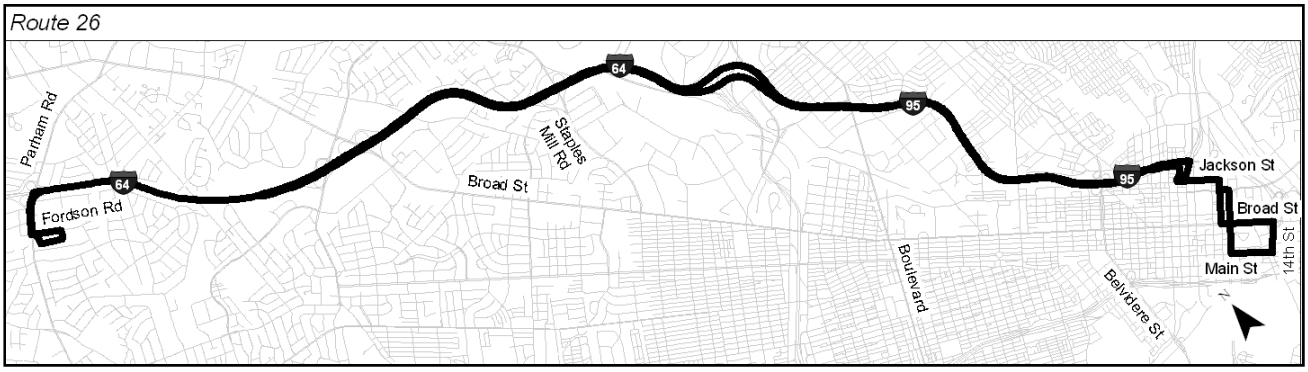


Table 60: 26 Eastbound and Westbound Daily Ridership

Order	Description	Ons	Offs	Loads
1	Fordson & Parham (Parking Lot)	112	19	126
2	Jackson & 4th	7	1	132
3	8th & Clay	0	30	101
4	Broad Street at 9th Street	4	20	83
Daily Totals		123	70	

Order	Description	Ons	Offs	Loads
5	Broad Street at 9th Street	6	10	63
6	14th & Franklin St	1	0	40
7	Main & 13th	5	2	43
8	Main & 11th	7	9	41
9	Main & 10th	13	7	47
10	9th & Main	6	4	49
11	9th & Marshall (Mid-block bet*	11	0	60
12	9th Street at Marshall Street	10	2	68
13	Leigh Street at 8th Street	1	0	69
14	4th & Jackson	4	0	84
15	Fordson & Parham (Parking Lot)	2	57	45
Daily Totals		66	91	

Route 27

Route 27 provides express service to downtown from the Glenside Park-and-Ride in northwestern Henrico County. Ridership appears fairly stable throughout Route 27. The ridership pattern generally fits with the expectations of an express route, passengers boarding at one end and riding to the other. The passenger loads appear to be heaviest in the downtown loop for the westbound direction of this route, but that is a result of the bus officially changing directions before eastbound riders have arrived at their downtown destination. For both directions, the first and last stops are responsible for the most boardings and alightings, respectively. Route 27 had an average of 12 boardings per trip in the eastbound direction and 10 boardings per trip in the westbound direction. The 7:15 a.m. and 6:54 a.m. trips for the eastbound route had the highest load of 24 passengers. The westbound route had a maximum load of 19 passengers that occurred at 4:55 p.m.

Figure 50: Route 27

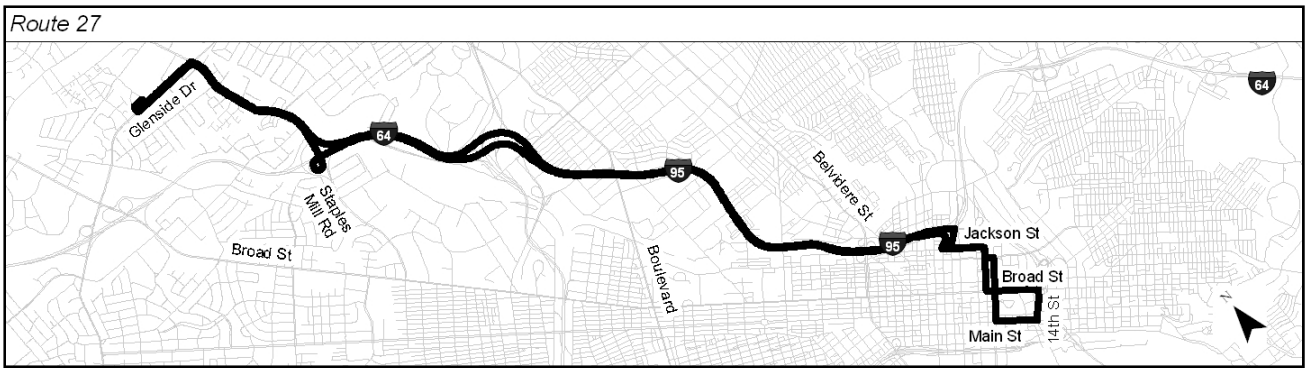


Table 61: 27 Eastbound and Westbound Daily Ridership

Order	Eastbound Stop Description	Ons	Offs	Loads
1	Glenside & Cloverdale (Parki*	98	2	98
2	Staples Mill & Talley	3	0	101
3	Staples Mill & Townhouse	0	0	101
4	Staples Mill & Hamlet Apt	2	0	103
5	Jackson & 4th	2	6	99
6	8th & Clay	0	8	91
7	Broad Street at 9th Street	1	35	52
Daily Totals		106	51	

Order	Westbound Stop Description	Ons	Offs	Loads
9	Broad & 10th	11	5	72
10	Broad & 11th	1	9	64
11	Broad & 12th	1	1	64
12	Broad & Old 14th	2	7	59
13	14th & Franklin St	1	0	60
14	Main & 13th	1	0	61
15	Main & 11th	1	5	57
16	Main & 10th	2	6	53
17	9th & Main	4	1	56
18	9th & Marshall (Mid-block bet*	6	5	57
19	9th Street at Marshall Street	6	0	63
20	Leigh Street at 8th Street	7	1	69
21	4th & Jackson	0	8	61
22	Staples Mill Rd. at Southside*	0	5	56
23	Staples Mill & Northside	1	0	57
24	Staples Mill Rd. at Aspen Ave.	0	0	57
25	Staples Mill & Talley	0	1	56
26	Glenside & Cloverdale (Parki*	0	33	23
Daily Totals		44	87	

Route 28

Route 28 provides express service between downtown and Richmond International Airport with a stop at the Fair Oaks Park-and-Ride in eastern Henrico County. For Route 28, passenger loads are highest for the segment of the trip between the airport park-and-ride and downtown. Corresponding to this express-route ridership pattern, the first stop in each direction generated the highest boardings and the last stop experienced the highest number of alightings. The eastbound route averaged five boardings per trip and the three boardings per trip on the westbound route. The 4:31 p.m. trip for the eastbound route had the highest load of 10 passengers. The westbound route had a maximum load of 9 passengers at 7:23 a.m.

Figure 51: Route 28

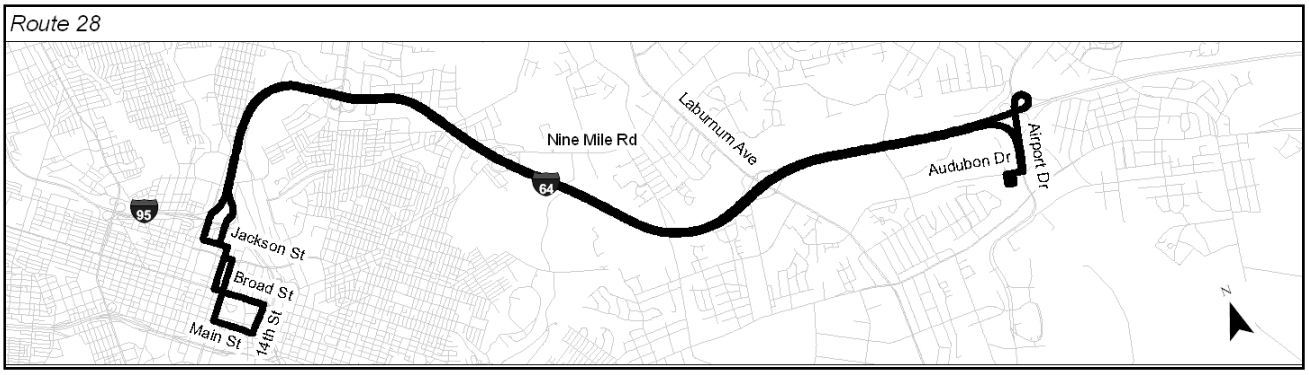


Table 62: 28 Eastbound and Westbound Daily Ridership

Order	Eastbound Stop Description	Ons	Offs	Loads
1	Broad Street at 9th Street	6	0	9
2	Broad & 10th	1	0	10
3	Broad & 11th	1	0	11
4	Broad & 12th	1	0	12
5	Broad & Old 14th	0	0	12
6	14th & Franklin St	0	0	12
7	Main & 13th	1	0	13
8	Main & 11th	0	0	13
9	Main & 10th	4	0	17
10	9th & Main	1	0	18
11	9th & Marshall (Mid-block bet*	2	0	20
12	9th Street at Marshall Street	4	0	24
13	Jackson & 7th	0	0	24
14	Airport Park & Ride Lot	0	22	2
Daily Totals		21	22	

Order	Westbound Stop Description	Ons	Offs	Loads
1	Airport Park & Ride Lot	10	2	10
2	Marshall & 7th	0	0	10
3	Broad Street at 9th Street	0	3	7
Daily Totals		10	5	

Route 29

Route 29 provides express service to downtown from the Gaskins Park-and Ride in western Henrico County. Route 29 has its highest passenger loads for the trip between the Gaskins Park-and-Ride and downtown. The highest boarding and alighting activity takes place at either end of the route, primarily in the park-and-ride lot and at Broad & 9th. The eastbound route averaged ten boardings per trip while the westbound route averaged nine boardings per route. A maximum load of 38 passengers was observed at 8:25 a.m. for the eastbound route. The southbound route had its highest load of 30 passengers on the 4:52 p.m. trip.

Figure 52: Route 29

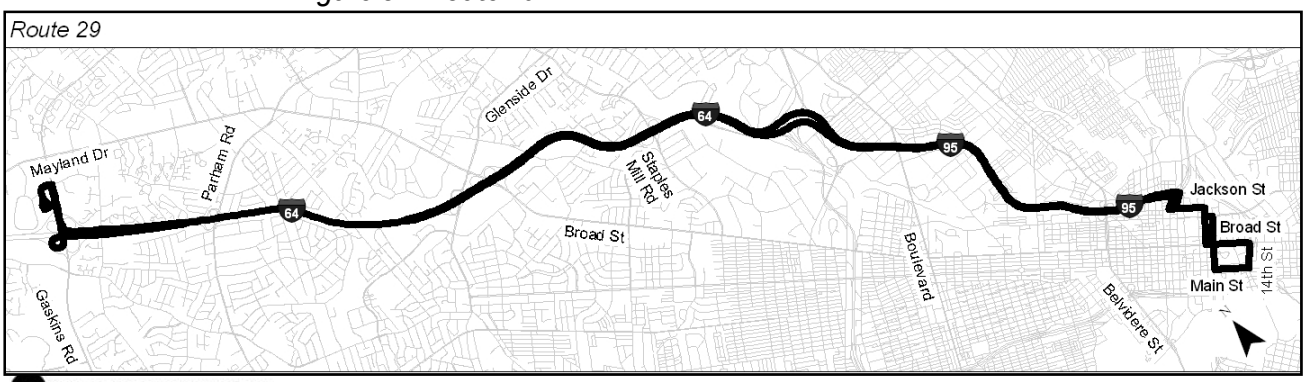


Table 63: 29 Eastbound and Westbound Daily Ridership

Order	Eastbound Stop Description	Ons	Offs	Loads
1	Gaskins & Mayland (Parking L*	72	0	95
2	Jackson & 4th	33	0	128
3	8th & Clay	5	12	121
4	Broad Street at 9th Street	0	14	107
Daily Totals		110	26	

Order	Westbound Stop Description	Ons	Offs	Loads
5	Broad Street at 9th Street	5	25	91
6	Broad & 10th	1	10	79
7	Broad & 11th	5	5	79
8	Broad & 12th	5	14	70
9	Broad & Old 14th	11	13	68
10	14th & Franklin St	4	7	65
11	Main & 13th	5	6	64
12	Main & 11th	6	4	66
13	Main & 10th	9	15	60
14	9th & Main	15	6	69
15	9th & Marshall (Mid-block bet*	16	1	84
16	9th Street at Marshall Street	17	1	81
17	Leigh Street at 8th Street	10	1	88
18	4th & Jackson	1	4	106
19	Gaskins & Mayland (Parking L*	22	93	35
Daily Totals		132	205	

Route 64

Route 64 offers more bus stops throughout its route than many other GRTC express routes. With service primarily along Forrest Hills Ave, the major stops include Stony Point Shopping Center and Huguenot High School. Although there are more opportunities to board and alight, passenger loads are highest as the bus travels across the James River between downtown and the area south of the river. The most popular bus stops fall on either side of the river. In the northbound direction the most people board and Forest Hill & Choctaw and alight at 7th & Main. In the southbound direction, the Broad & 8th stop registers the most boardings and Huguenot & Westgate has the most alightings. The average number of boardings per trip in the northbound direction was nine boardings. The westbound route recorded an average of 15 boardings per trip. A maximum load of 30 passengers was observed at 7:28 a.m. for the northbound route. Both the 3:40 p.m. and 4:35 p.m. trips had the highest load of 26 passengers for the southbound route.

Figure 53: Route 64

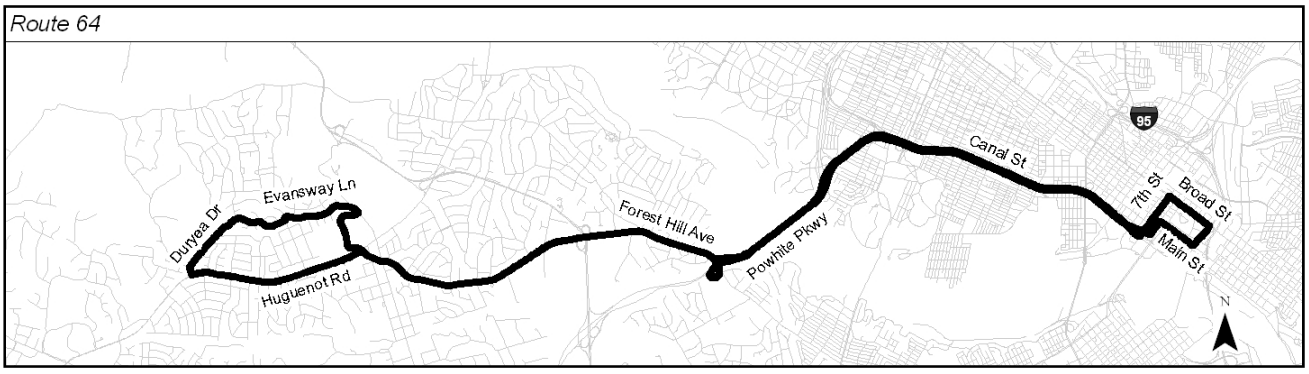


Table 64: 64 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	Duryea & United Methodist Chu*	12	0	25
2	Duryea & Merrigan	2	0	23
3	Duryea & Margate	1	0	24
4	Duryea & Oldfield	0	0	24
5	Oldfield & Westgate	4	3	25
6	Evansway Lane & Ragsdale	0	0	25
7	Evansway Lane & Domino	1	0	26
8	Forest Hill & Stoney Point Me*	13	0	39
9	Forest Hill & Lake Village	0	0	39
10	Forest Hill & Stony Lake	1	0	40
11	Forest Hill & driveway to Sto*	0	0	40
12	Forest Hill & Choctaw	17	1	52
13	Forest Hill Ave. at Anwell Dr.	0	0	52
14	Forest Hill & 8133 driveway	6	0	72
15	Forest Hill & Huguenot School	2	0	74
16	Forest Hill & Thompson School	3	1	76
17	Forest Hill & Kenmore	4	0	80
18	Forest Hill & Sheila Lane	3	0	83
19	Forest Hill & 7047	0	0	83
20	Forest Hill & Cherokee	3	0	86
21	Forest Hill & Hathaway	9	0	95
22	Forest Hill & Melborne	5	0	101
23	Forest Hill & Woodberry La	0	0	100
24	Forest Hill & Retig	0	0	101
25	7th & Cary	0	10	91
26	7th & Main	1	19	70
Daily Totals		87	34	

Order	Southbound Stop Description	Ons	Offs	Loads
27	7th & Main	12	15	67
28	7th & Franklin	1	2	66
29	Broad Street at 9th Street	21	14	70
30	Broad & 10th	0	6	64
31	Broad & 11th	11	5	70
32	Broad & 12th	12	12	70
33	Broad & Old 14th	12	10	72
34	14th & Franklin St	4	0	76
35	Main & 13th	10	0	84
36	Main & 11th	5	0	89
37	Main & 10th	4	0	93
38	8th & Cary	8	0	101
39	8th & Canal	3	0	104
40	Forest Hill & Windsor View	0	3	101
41	Forest Hill & 6750	0	7	94
42	Forest Hill & Hathaway	0	6	88
43	Forest Hill & Cherokee	0	0	88
44	Forest Hill & 7038	0	0	88
45	Forest Hill & 7314	0	0	88
46	Forest Hill & Grantwood	0	5	83
47	Forest Hill & Kenmore	0	0	83
48	Forest Hill & Thompson School	0	0	83
49	Forest Hill & Lansdale	0	1	82
50	Forest Hill & Professional	0	0	82
51	Forest Hill Ave. at Anwell Dr.	0	0	82
52	Forest Hill & Choctaw	0	7	75
53	Forest Hill & McRae	0	16	59
54	Huguenot & Westgate	0	33	26
55	Huguenot & Scarborough	0	0	26
56	Huguenot & Shoreham	0	4	22
57	Huguenot Road at Monteith	0	0	22
58	Duryea & United Methodist Chu*	0	15	7
Daily Totals		103	161	

Route 65

Route 65 provides express service along Powhite Pkwy and Chippenham Pkwy from downtown to Stony Point Fashion Park, Stony Point Medical center and the VCU Health Center. Passenger loads on Route 65 remain relatively consistent throughout the route. The Stony Point Fashion Park is responsible for generating much of the demand on this route for boardings and alightings. Route 65 northbound averaged less than one passenger boarding per trip and the southbound direction averaged one boarding per trip. The 9:50 a.m. trip for the northbound route had the highest load with six passengers. The southbound route had a maximum load of five passengers at 2:30 P.M. and 3:30 p.m.

Figure 54: Route 65

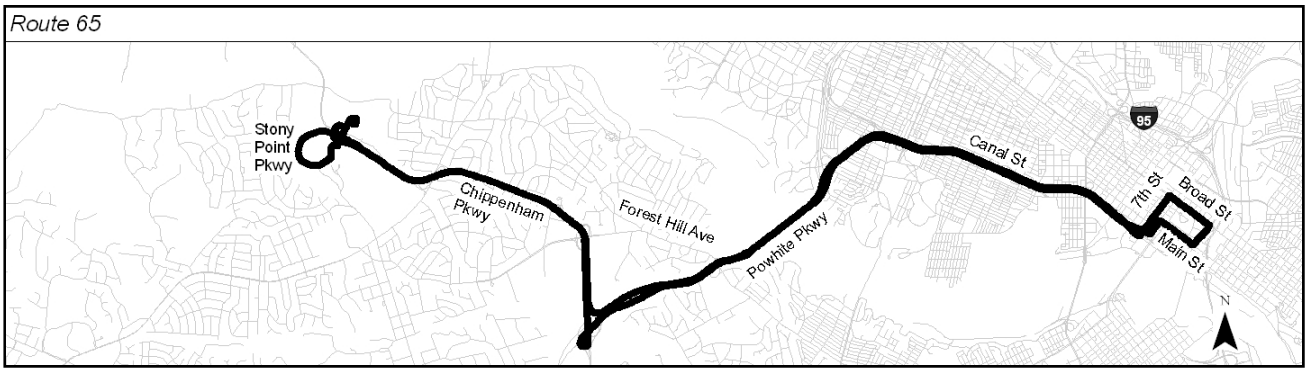


Table 65: 65 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	Stony Point Fashion Park at D*	0	0	13
2	Chippenham Parkway & Weyburn	1	0	14
3	Chippenham Parkway & Stratford	0	0	14
4	Chippenham Parkway & Custis	1	0	15
5	Chippenham Parkway & Grantwood	1	0	16
6	7th & Cary	0	2	14
7	7th & Main	0	1	11
Daily Totals		3	3	

Order	Southbound Stop Description	Ons	Offs	Loads
21	Chippenham Parkway & Ingalls	0	2	9
22	Chippenham Parkway & Custis	1	0	10
23	Chippenham Parkway & Stratford	0	1	9
24	Chippenham Parkway & Weyburn	0	0	9
25	VCU Health System at Stony Po*	1	0	11
26	Stony Point Pkwy at VCU Medic*	1	1	11
27	Stony Point Fashion Park at S*	1	2	9
28	Stony Point Fashion Park at D*	10	7	13
Daily Totals		14	13	

Route 66

Route 66 provides express service from downtown to the southside K-mart on Midlothian Turnpike. Passenger loads for Route 66 are relatively consistent throughout the route, but are slightly higher during the transition between downtown and the area south of the James River. In the northbound direction, the Broad & 9th stop is the most popular for boardings and alightings, a function of the loop at the downtown end of the route. In the southbound direction, the Forest Hill & Willow Oaks stop recorded the most boardings and the stop at the K-Mart store at the end of the line had the most alightings. The northbound route averaged ten boardings per trip while the southbound route averaged four boardings per trip. The northbound 7:44 a.m. trip yielded the highest load of 18 passengers. The southbound route had its highest load of 16 passengers at 5:08 p.m.

Figure 55: Route 66

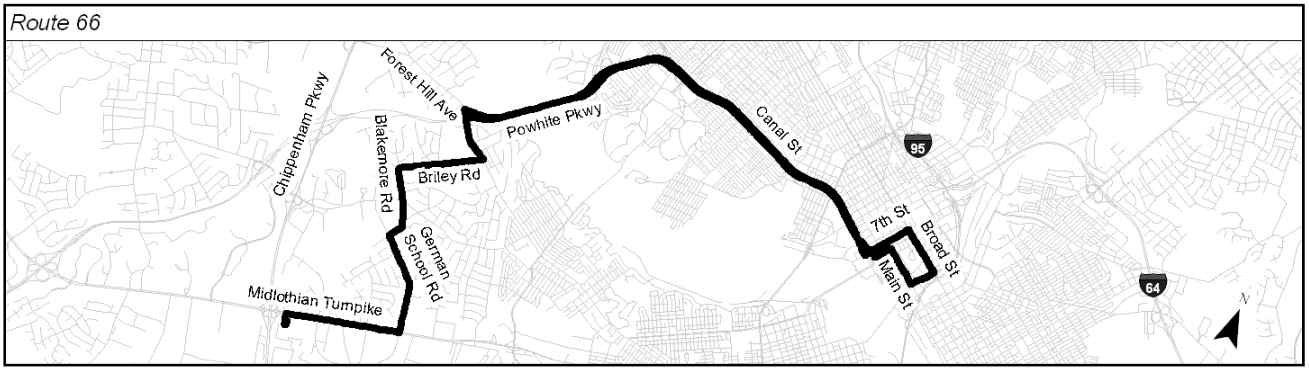


Table 66: 66 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	K-Mart Store End of Line (Rou*	4	0	18
2	Midlothian Pike & Carnation	4	0	22
3	Midlothian Pike & Warwick	0	0	22
4	Midlothian Pike & Goodwill	0	0	22
5	Midlothian Pike & Labrook	0	0	22
6	German School & Midlothian Pi*	0	0	22
7	German School & 121	3	0	25
8	German School & German School*	0	0	25
9	German School & Seaman	1	0	26
10	German School & Deter	3	0	28
11	German School & Glenway	0	0	29
12	Glenway Dr. at Glenway Ct.	1	0	30
13	Blakemore & Janhke	2	0	32
14	Blakemore & Debora	3	0	35
15	Bliley & Whitelane	0	0	35
16	Bliley & Cedarhurst	2	0	41
17	Bliley & Willow Oaks	0	0	37
18	Bliley & Forest Hill	0	0	37
19	Forest Hill & N Riverside	0	0	37
20	Forest Hill & Pineway	0	0	41
21	Forest Hill & Fairlee	0	0	37
22	7th & Cary	0	2	39
23	7th & Main	3	7	35
24	7th & Franklin	0	2	33
25	Broad Street at 9th Street	10	11	32
26	Broad & 10th	5	1	30
27	Broad & 11th	3	5	28
28	Broad & 12th	1	2	27
29	Broad & Old 14th	3	1	40
30	14th & Franklin St	3	1	28
Daily Totals		51	32	

Order	Southbound Stop Description	Ons	Offs	Loads
31	14th & Franklin St	0	0	28
32	Main & 13th	2	0	30
33	Main & 11th	0	0	29
34	Main & 10th	0	0	29
35	8th & Cary	1	0	31
36	Forest Hill & Willow Oaks	7	0	38
37	Forest Hill & Bliley	0	1	30
38	Bliley & Willow Oaks	0	0	37
39	Bliley & Cedarhurst	0	2	35
40	Bliley & Netherwood	0	1	34
41	Bliley & Blakemore	0	0	27
42	Blakemore & Debora	0	0	27
43	Blakemore & Jahnke	5	0	32
44	Blakemore & Renaissance Apts	0	11	28
45	Glenway & Glenway Court	3	1	30
46	Glenway & German School	0	0	30
47	German School & Deter	2	2	30
48	German School & Seaman	2	1	31
49	German School & Westover Vill*	0	3	28
50	German School & 200	0	0	28
51	German School & Midlothian Pi*	0	0	28
52	Midlothian at Overland Tranpo*	0	0	28
53	Midlothian Pike & Beaufont Hi*	0	1	27
54	Midlothian Pike & Warwick	0	0	27
55	Midlothian Pike & Carnation	0	0	27
56	K-Mart Store End of Line (Rou*	0	13	14
Daily Totals		22	36	

Route 69

Route 69 provides express service between downtown and the southside primarily via Forrest Hill Ave and Huguenot Rd. Major destinations on the south end of this route include Chesterfield Towne Center, Lowe's and Huguenot High School. Route 69 conforms to the typical express route ridership patterns. Passenger loads are highest as the bus travels from the outlying region to the downtown core. Once again, the southbound passenger load is highest at the first stop because the end of the route is a loop. The southbound passenger load peaks again before the bus leaves the city. The most popular places to board and alight this route are at the ends of the route. For the inbound trip, most people board at the first stop and alight at the last stop. The reverse pattern is true of the outbound trip, with most people boarding as the bus circulates through downtown and alighting at that last stop. The northbound route averaged 15 boardings per trip and the southbound route averaged 5 boardings per trip. The highest northbound observed passenger load of 31 passengers occurred on the 6:40 a.m. trip. The 5:05 p.m. southbound trip had the highest load of 27 passengers.

Figure 56: Route 69

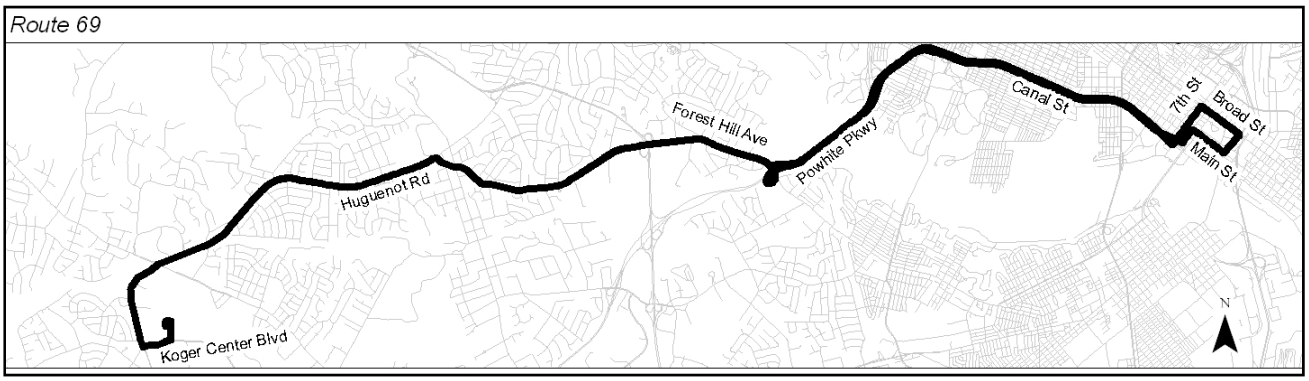


Table 67: 69 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	Lowe's Parking Lot	38	0	40
2	Forest Hill & Choctaw	1	0	41
3	Forest Hill Ave. at Anwell Dr.	0	0	41
4	Forest Hill & 8133 driveway	0	0	54
5	Forest Hill & Huguenot School	0	0	54
6	Forest Hill & Thompson School	0	0	54
7	Forest Hill & Kenmore	0	0	41
8	Forest Hill & Chippenham Vill*	0	0	54
9	Forest Hill & Sheila Lane	0	0	54
10	Forest Hill & 7047	0	0	54
11	Forest Hill & Cherokee	0	0	54
12	Forest Hill & Hathaway	0	0	54
13	Forest Hill & Melborne	0	0	56
14	Forest Hill & Woodberry La	0	0	56
15	Forest Hill & Retig	1	0	58
16	7th & Cary	0	2	56
17	7th & Main	3	12	43
18	7th & Franklin	1	1	43
19	Broad Street at 9th Street	14	15	42
Daily Totals		58	30	

Order	Southbound Stop Description	Ons	Offs	Loads
20	Broad Street at 9th Street	3	0	40
21	Broad & 10th	3	8	30
22	Broad & 11th	0	0	32
23	Broad & 12th	1	6	27
24	Broad & Old 14th	5	1	31
25	14th & Franklin St	2	9	22
26	Main & 13th	0	1	19
27	Main & 11th	2	0	25
28	Main & 10th	0	0	19
29	8th & Cary	3	0	29
30	Forest Hill & Windsor View	0	0	37
31	Forest Hill & 6750	0	2	35
32	Forest Hill & Hathaway	0	0	28
33	Forest Hill & Cherokee	0	0	28
34	Forest Hill & 7038	0	0	35
35	Forest Hill & 7314	0	0	35
36	Forest Hill & Kenmore	0	0	28
37	Forest Hill & Lansdale	0	1	27
38	Forest Hill & Professional	0	0	34
39	Forest Hill Ave. at Anwell Dr.	0	0	27
40	Forest Hill & Choctaw	0	5	22
41	Forest Hill & McRae	0	0	22
42	Huguenot & Westgate	0	0	27
43	Huguenot & Scarborough	0	0	21
44	Huguenot & Shoreham	0	0	21
45	Huguenot Road at Monteith	0	0	21
46	Lowe's Parking Lot	0	21	0
Daily Totals		19	54	

Route 82

Route 82 provides express service from the Winterpock Rd Park-and-Ride and the Commonwealth Centre Park-and-Ride along Powhite Pkwy to downtown. Route 82 exhibits the typical characteristics of an express route. The majority of riders board the bus at outlying park-and-rides for the morning commute into downtown and

alight at one of the multiple downtown stops. In the evening, riders board downtown and travel back to one of the two outlying park-and-ride lots. Passenger loads are highest between these two general destination areas. On average, the northbound direction had an average of 13 boardings per trip. In the southbound direction, there was an average of 24 boardings per trip. The 6:35 a.m. trip for the northbound route had the highest load of 33 passengers while the southbound route had its highest load of 45 passengers during the 4:05 p.m. trip.

Figure 57: Route 82

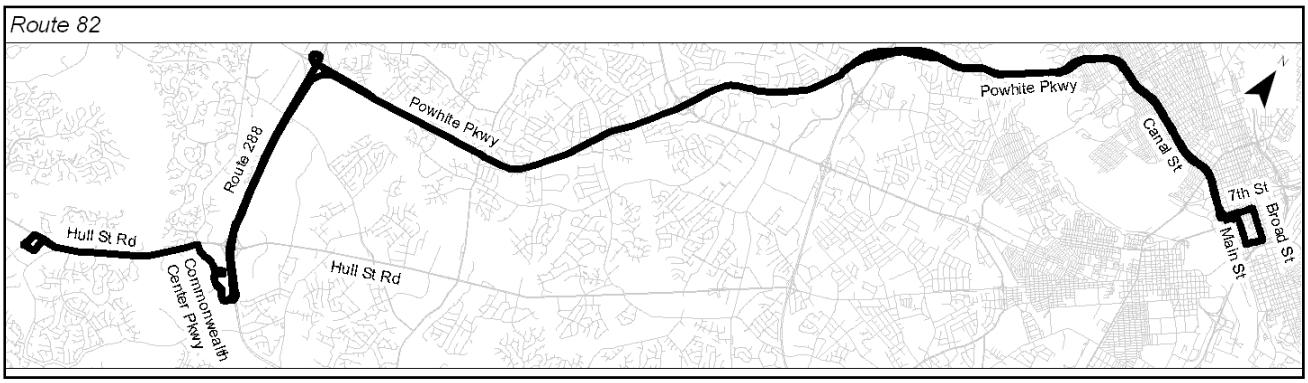


Table 68: 82 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	Hull Street at Winterpock	27	0	27
2	Commonwealth 20	39	0	66
3	7th & Cary	0	5	61
4	7th & Main	0	13	48
5	7th & Franklin	0	6	42
6	7th & Grace	0	0	42
7	Broad Street at 9th Street	0	17	25
8	Broad & 10th	0	0	25
9	Broad St. & 11th St	0	16	9
10	Broad & 12th	0	1	8
11	Broad & Old 14th	0	5	3
12	14th & Franklin St	0	2	1
Daily Totals		66	65	

Order	Southbound Stop Description	Ons	Offs	Loads
13	7th & Main	18	0	18
14	7th & Franklin	2	0	20
15	7th & Grace	0	0	20
16	Broad Street at 9th Street	18	0	38
17	Broad & 10th	7	0	45
18	Broad St. & 11th St	8	0	53
19	Broad & 12th	9	0	62
20	Broad & Old 14th	11	0	73
21	14th & Franklin St	8	0	85
22	Main & 13th	4	0	89
23	Main & 11th	4	0	93
24	Main & 10th	2	0	95
25	8th & Cary	4	0	99
26	8th & Canal	2	0	101
27	Commonwealth 20	0	29	72
28	Hull Street at Winterpock	0	48	0
Daily Totals		97	77	

Route 95

Route 95 provides express bus service between downtown Richmond and Petersburg. Park-and-ride lots in Petersburg provide a collective point of origin for riders destined for Richmond. The route, which travels along I-95 includes a stop at John Tyler Community College. These lots at Tabb & Union generate many of the boardings and alightings seen on this route. Broad & 9th street is also a popular place to board and alight for the northbound trip. The northbound route experienced an average of 12 boardings per hour and the southbound route had an average of 7

boardings per trip. The 4:35 p.m. northbound trip had the highest load of 30 passengers. The southbound route had its maximum load of 20 passengers on the 5:37 a.m. trip.

Figure 58: Route 95

Route 95

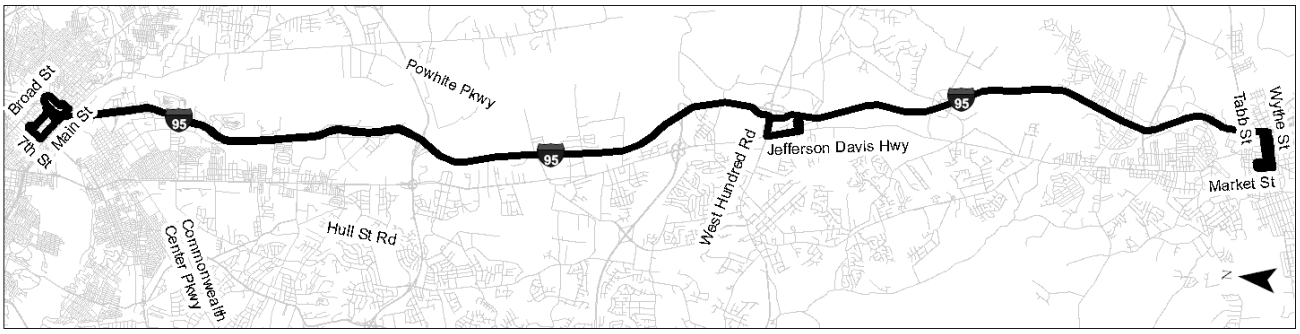


Table 69: 95 Northbound and Southbound Daily Ridership

Order	Northbound Stop Description	Ons	Offs	Loads
1	Union Street at Tabb Street	12	20	91
2	Tabb and Market Street	22	25	115
3	John Tyler Community College	7	5	68
4	17th & Marshall	13	6	123
5	Grace Street at 17th Street	0	0	94
6	18th & Main	1	5	90
7	Main & 17th	0	0	116
8	Main & 15th	0	8	107
9	Main & 13th	14	9	112
10	Main & 11th	2	2	92
11	Main & 10th	10	6	109
12	Main & 8th	2	8	103
13	7th & Franklin	8	10	88
14	7th & Broad	12	16	94
15	8th & Marshall	12	10	96
16	Broad Street at 9th Street	29	21	104
Daily Totals		144	151	

Order	Southbound Stop Description	Ons	Offs	Loads
17	Broad Street at 9th Street	0	0	44
18	Broad & 10th	11	1	71
19	Broad & 12th	14	9	76
20	Broad & Old 14th	18	1	123
21	John Tyler Community College	5	17	74
22	Union Street at Tabb Street	29	60	43
Daily Totals		77	88	

Conclusion

The observed ridership patterns for the GRTC routes generally conform to the expectations associated with a hub-and-spoke bus system. In a hub-and-spoke bus system, routes radiate out from downtown to collect riders and bring them downtown or vice versa. The express bus routes are an extreme and simplified version of this service. The local routes also provide service making it possible to travel by transit downtown and to a lesser extent in the adjacent counties. At the tips of the spokes, buses serve less low-density areas and then travel to the hub located in the high-density urban core. As the population and development intensity increases, so do the number of riders on board the bus. Generally, passenger loads for individual routes hit their highs just before the bus enters or leaves downtown.

Since the routes generally are involved in bringing people downtown, it is the central segment of most routes that displays the highest ridership. Even though the downtown has the highest population and employment density and likely generates the most trips, ridership drops once the buses arrive in the central business district. One reason for the comparatively lower ridership around downtown on any one route is that there are multiple routes serving similar areas. In the outlying region of the service area, there is generally only one convenient bus traveling downtown from any point of origin. Once riders get downtown, there are multiple options, causing ridership to spread out among the many available routes or switch to a different transportation mode.

Another important factor influencing passenger loads is the placement of bus stops. For many routes, a disproportionate share of riders originates or ends their trip in one of a few major stops. These stops are associated with the most popular destinations in the region, such as living centers, employment centers, shopping centers, park-and-rides, and bus transfer stations. It is essential to serve these major stops and reduce travel time between them as much as possible. To the extent that routes or route segments are not used, they should be investigated for possible improvements. In the case where there is genuinely no demand for transit service, the resources should be allocated to a more effective route in the system. Ridership helps demonstrate where a transit system succeeds at meeting the transportation needs of local residents, but it is also a diagnostic tool that plays an important role in evaluating and improving the system.

Weekend Ridership

For transit systems, weekend ridership trends generally differ slightly from weekday ridership trends. In many cases, regular weekday riders have different transportation needs on the weekends, causing them to travel to different destinations and to use different transportation modes. The largest difference between weekday and weekend ridership is the loss of commuters traveling to a few concentrated employment centers on the weekends. Despite the anticipated decline in weekend ridership, maintaining weekend bus service is essential to ensuring that residents throughout a metropolitan area without other transportation options have access to jobs and the goods and services they need every day of the week.

GRTC generally operates the same service patterns on weekends as it does during the week. Providing weekend service on its extensive route network ensures that residents will be able to access destinations throughout the metropolitan every day. GRTC addresses the decline in ridership on weekends, not by limiting its weekend routes, but by adjusting the service frequency of the routes in operation. Generally, the same routes operate on weekends, but many of the routes run less frequently than during the week because there is less ridership demand to meet. This balance between service coverage and service frequency meets the needs of weekend riders while maintaining an efficient service.

Maintaining the efficiency of the GRTC system requires continuous monitoring of the differences between weekday and weekend ridership. To identify current differences in ridership patterns, an evaluation was conducted comparing ridership by route on a typical weekday to ridership on a typical Saturday and typical Sunday (Table 70). GRTC provided ridership information for each route for three sample days: Thursday, October, 12, 2006; Saturday, October 14, 2006; and Sunday, October 15, 2006.

Weekend Ridership by Route

As Table 70 shows, total ridership for each route declines significantly from weekdays to Saturday and then declines further on Sunday. This ridership pattern is expected and common to many transit systems. It highlights the important need to regulate the appropriate amount of weekend service through service frequency if the weekday route patterns are maintained on the weekends. In other words, the system can remain efficient from both an operational and financial standpoint by limiting service in other ways despite the decline in ridership and extensive system coverage.

Table 70: Ridership Comparison by Route

Route	Trips				
	Typical Weekday*	Typical Saturday**	Percent of Weekday	Typical Sunday***	Percent of Weekday
1	1,940	885	45.6%	400	20.6%
2	680	160	23.5%	175	25.7%
3	2,060	1,630	79.1%	955	46.4%
4	2,170	970	44.7%	355	16.4%
6	4,030	2,270	56.3%	1,110	27.5%
10	2,310	1,160	50.2%	725	31.4%
11	125	20	16.0%	-	-
13	300	135	45.0%	-	-
16	730	175	24.0%	100	13.7%
20	45	15	33.3%	-	-
22	310	90	29.0%	90	29.0%
24	610	220	36.1%	105	17.2%
32	2,585	1,445	55.9%	740	28.6%
34	1,825	975	53.4%	605	33.2%
37	2,295	1,175	51.2%	665	29.0%
61	-	55	-	35	-
62	1,910	1,100	57.6%	425	22.3%
63	1,415	605	42.8%	375	26.5%
65	55	20	36.4%	5	9.1%
70	720	565	78.5%	315	43.8%
71	700	140	20.0%	180	25.7%
73	1,260	615	48.8%	420	33.3%
74	1,040	645	62.0%	340	32.7%

* One day sample on Thursday, October 12, 2006.

** One day sample on Saturday, October 14, 2006.

*** One day sample on Sunday, October 15, 2006.

Although ridership declines on Saturday and Sunday for numerous reasons, many GRTC routes still manage to attract a significant number of riders. On Saturday, the two best performing routes—Route 3 and Route 70—serve between 75 to 80 percent of the ridership they serve during the week (see Table 71). These same two routes are also the best performers on Sunday, serving between 40 and 50 percent of the ridership they serve during the week. Route 3 and Route 70 serve many residential areas, downtown, regional shopping facilities, and recreation areas, which helps to explain their weekend popularity. On Saturday, the majority of routes attract upwards of 40 percent of the ridership they attract during the week. Sundays tend to have slightly lower ridership than Saturday, but almost all routes attract at least 20 percent of their weekday ridership.

Table 71: Percent of Weekday Ridership by Route

Percent of Weekday Ridership	Saturday		Sunday	
	Number	Routes	Number	Routes
100% to 80%	0	-	0	-
79% to 60%	3	3, 70, 74	0	-
59% to 40%	11	1, 4, 6, 10, 13, 32, 34, 37, 62, 63, 73	2	3, 70
39% to 20%	8	2, 11, 16, 20, 22, 24, 65, 71	13	1, 2, 6, 10, 22, 32, 34, 37, 62, 63, 71, 73, 74
19% to 0%	0	-	4	4, 16, 24, 65
N/A	1	61	4	11, 13, 20, 61

Conclusion

This analysis demonstrates that weekend bus service is an essential part of the GRTC system. Many residents rely on the bus for weekend travel and GRTC appears to have been meeting the needs of these riders. Although ridership is significantly less than during the week, the service is well used on both weekend days, with some routes posting ridership numbers almost as high as during the week. The routes that perform the best on the weekends may be candidates for weekend service increases whereas those routes with low ridership numbers may be over serving the region. The needs of weekend riders will be an important consideration in determining how the GRTC system should develop in the future.

On-Board Survey

GRTC has developed a strong, stable ridership over the years. Since FY 2004, GRTC has consistently posted higher ridership numbers than the previous year. These signs of ridership growth suggest that GRTC is successfully meeting the needs of its riders and adjusting service to make it attractive to more people and for more purposes. Further success with riders will depend on continuous reevaluation of GRTC service. Ridership numbers provide a general indication of the ability of a transit system to

meet the needs of its riders, but a more revealing measure of how patrons regard a transit service is an on-board survey.

An on-board survey is conducted on-board buses, capturing demographic and trip information from bus riders as they travel. This survey method ensures a broad, random sample of residents that are guaranteed GRTC customers. On-board survey findings reveal riders' demographic characteristics, the types of trips made through the system, and detailed travel behaviors. This information will enable GRTC to use its improved knowledge of riders to reinforce the ridership gains it has made in recent years as well as attract new users. The survey results also identify potential ways to improve the system that will better align service to the needs of riders, which can result in increased use by existing and new riders.

Survey Methodology

The GRTC on-board survey was conducted in November 2006, on all of GRTC's 39 regular and express bus routes (excluding VCU routes, the lunch-time express route, and the Fredericksburg express route). Routes were surveyed on weekdays from November 9, 2006, until November 17, 2006. During this period, trips operating between the start of service and 2:00 p.m. were randomly selected to be surveyed. Over the course of the week, 640 hours of bus service were surveyed.

Each randomly selected trip was staffed by a surveyor equipped with a handheld computer loaded with a customized application that was used to enter respondents' answers directly into an electronic format. This method contributes to the collection of high-quality data because a trained surveyor enters the data and is available to explain questions and answers in case of confusion. Since this time-intensive method requires each surveyor to guide a respondent through the full survey, surveyors are limited in the number of responses they can collect. In instances where willing customers did not have time to participate while on board the bus, they were provided with printed, postage-paid versions of the survey. Hardcopies of the survey were also handed out on express routes where the handheld devices were not viable. The survey questionnaire is provided in Appendix B.

This collection effort resulted in 654 surveys completed using the handheld computers and an additional 229 surveys returned via the United States Postal Service. Of these 883 surveys, 763 contained the appropriate time and route data to be factored and included in the following analysis. To account for the larger GRTC ridership, these survey responses were factored based on the trip, time, and route the survey was collected.

The ridership counts were used as the basis for factoring the survey responses to represent the full ridership on board each surveyed route. Ridership counts were collected for each trip in the GRTC system. These counts were used to factor the surveys collected on each trip to account for the total number of riders on the trip in which the surveys were collected, the ridership during the survey period (until 2:00 p.m.), and the total daily ridership of the route. By applying this factor to the survey

results, the responses are expanded to reflect a larger riding population. These factored results provide an estimate of the characteristics and trip patterns of all GRTC riders on surveyed routes. The results presented below represent these factored responses.

Survey Factors

The factoring method requires employing a three-part factor for each route by direction:

- Trip – total observed trip boardings/surveys returned on that trip
- Survey Period – total observed boardings from start of service until 2pm/total observed boardings on surveyed trips
- Day – total observed daily boardings/total observed boardings from start of service until 2pm

To calculate a single factor, each of these subfactors is multiplied together for each trip and then multiplied by the number of surveys collected on that trip. Once these factors have been applied to each trip, the sum of the weighted responses for a route direction equals the total observed daily boardings for that route direction. Finally, to apply the factors to the survey results in the database, each survey record is multiplied by the trip factor divided by the number of surveys collected on that trip.

In addition, a fourth factor would need to be applied to account for the behaviors of the entire GRTC ridership. An on-board survey has a greater probability of surveying riders who ride five days week than those who ride only one day a week. Therefore, the factoring process described above yields a representation of average daily ridership, but not of average weekly ridership. To determine characteristics for weekly ridership, each survey response is factored based on each respondent's frequency of GRTC use as follows:

- 1 day a week – factor by 5
- 2 days a week – factor by 5/2
- 3 days a week – factor by 5/3
- 4 days a week – factor by 5/4
- 5 days a week – factor by 1
- 6 days a week – factor by 1
- 7 days a week – factor by 1
- Occasionally – factor by 10
- 2 times per month – factor by 15
- 1 time per month – factor by 30

Survey Results

The on-board survey questionnaire was designed to identify two primary categories of information: rider characteristics and trip characteristics. Questions related to characteristics of riders and their households provide an understanding of the

market currently using GRTC service. Questions related to trip characteristics indicate how current riders use the service.

Personal Characteristics

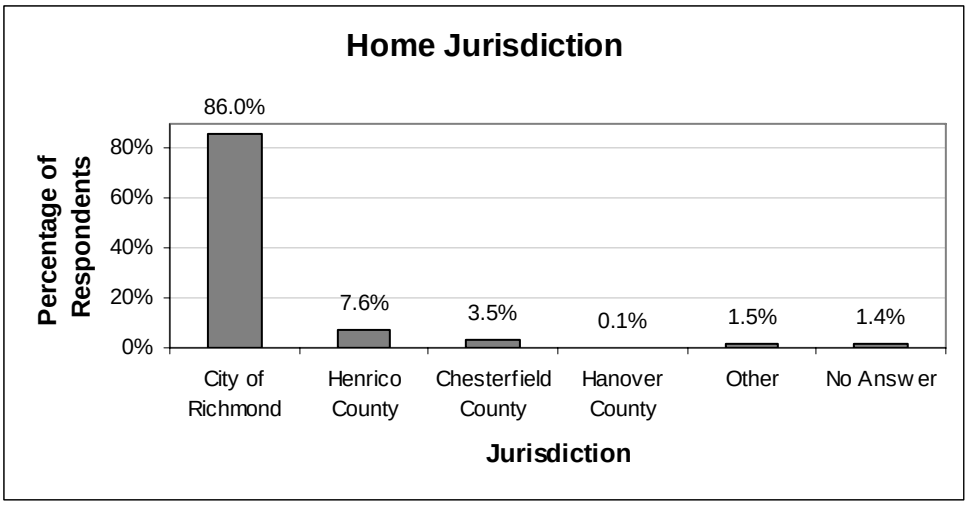
The demographic information collected through the on-board survey helps paint a picture of the type of residents within the region making use of the service. This information tells two stories. Most explicitly, the demograhic survey data reveal what type of resident the GRTC service most appeals to. But in learning who is already on board, the demographic data also hint at the type of residents not using the service. Based on these findings, GRTC can improve its service to better accommodate the needs of current riders as well as identify opportunities to expand its ridership. GRTC riders have many similar personal characteristics. The typical GRTC rider:

- Is female
- Is African-American
- Lives in the City of Richmond
- Is between 25 and 44 years old
- Has a valid drivers' license
- Lives in a household with:
    - No working cars
    - Two working adults
    - Annual income of $25,000 to $49,999

The vast majority (86 percent) of respondents live in the City of Richmond (see Figure 59). As the center of the metropolitan region, Richmond contains the type of dense urban development and grid street network most suited for transit use. There are large concentrations of people, jobs, and services, making it possible to access the city's opportunities through a combination of transit and pedestrian travel. Residents with limited transportation options will likely select to live in Richmond where transit service is the most extensive and they can survive without a private vehicle. The needs of city residents combined with the abundant transit service offered within the City of Richmond suggests these regional residents benefit most from the transit system, as was found through the survey.

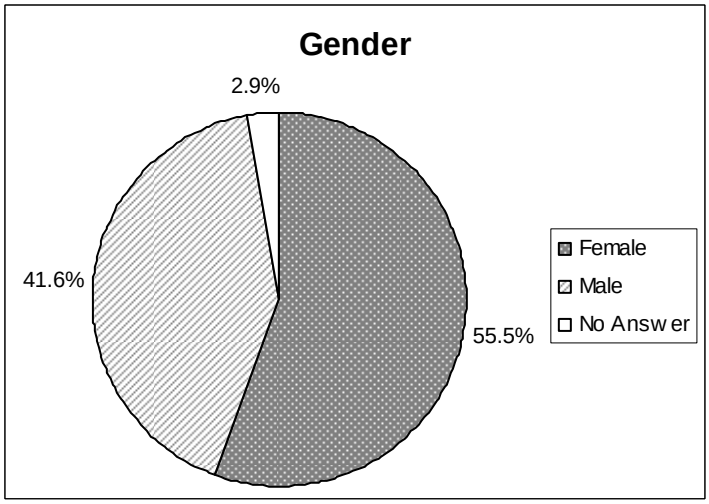
As the development pattern changes moving out from the city center, transit use by residents declines. In the more suburban counties of Henrico and Chesterfield—located adjacent to Richmond—there are is a greater need to use a personal vehicle to meet daily transportation needs. In these areas, transit use is frequently limited to downtown commute trips. Therefore, it is likely that the intensity and variety of transit use by residents outside Richmond will be limited.

Figure 59: Home Jurisdiction



The survey responses indicate that transit service is used slightly more by women than men (see Figure 60). This finding suggests that transit may play an especially important role in meeting the transportation needs of many female residents. Although more women responded to the on-board surveys, men also constituted a large share of the respondents.

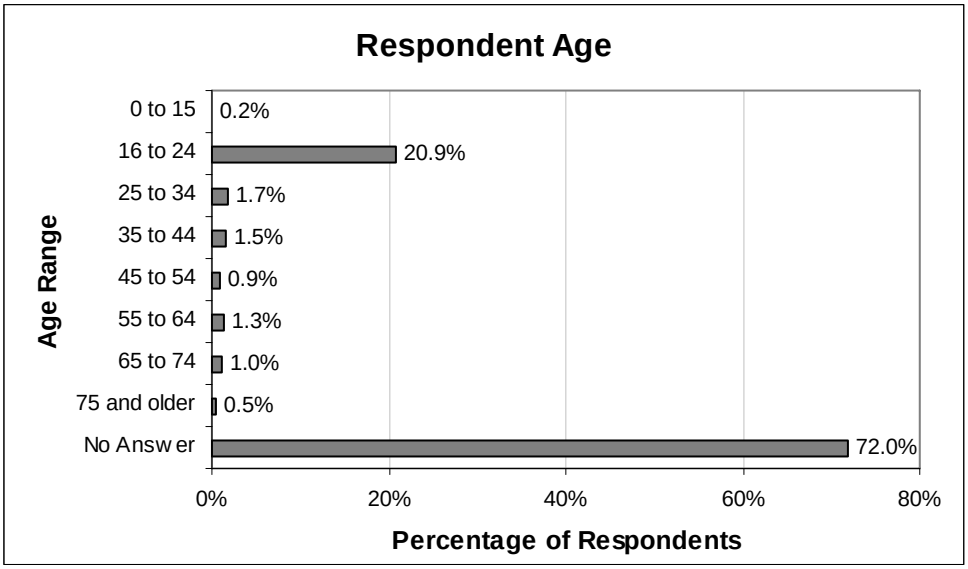
Figure 60: Respondent Gender



Few respondents were willing to share their age range with surveyors. While this is frequently a sensitive question with respondents, the loss of anonymity by telling the surveyor one's age in a public space may have contributed to the poor response rate for this particular question (see Figure 61). Respondents who were most willing to communicate their age fell in the range of 16 to 24. Although there are very few conclusions that can be drawn from the collected data, it does appear that there is strong ridership from relatively young residents. Approximately 21 percent of respondents were in the age range of 16 to 24. This age range provides a strong market for transit use, especially in Richmond. Young residents are likely to seek

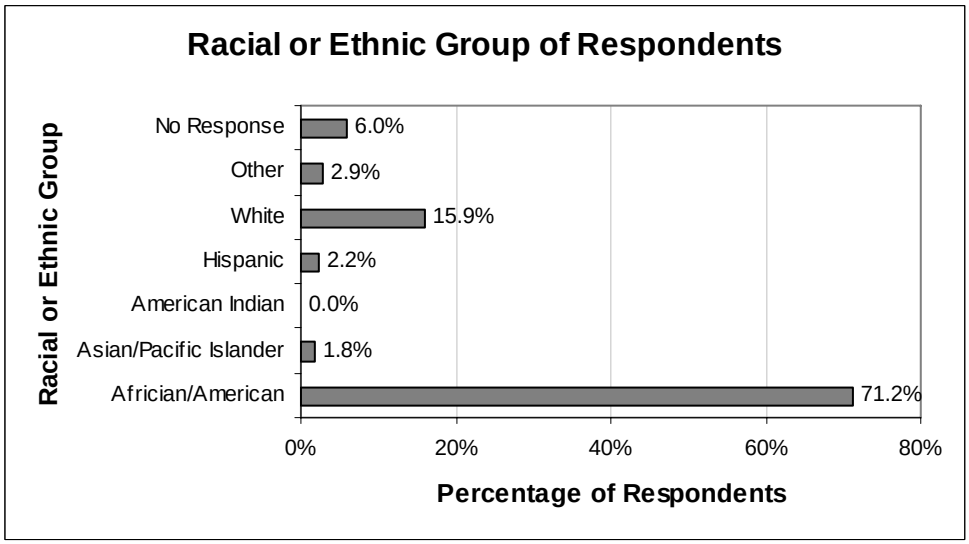
living in a more urban environment. Additionally, Richmond is the home of two large universities: Virginia Commonwealth University and University of Richmond. Many of these younger residents will also rely on public transportation until they can afford a car.

Figure 61: Respondent Age



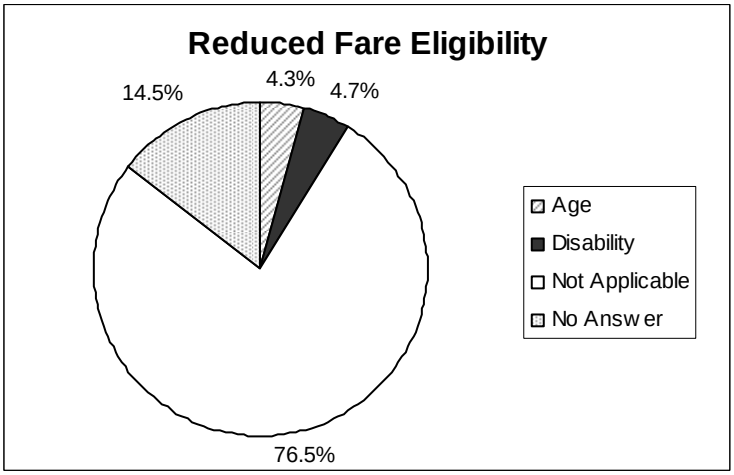
GRTC appears to be signifiantly constituted of African-American riders (see Figure 62). **Approximately 71 percent of respondents self-identified as African-American when asked about their racial or ethnic group.** The second largest racial or ethnic group represented on board were respondents who self-identified as white (16 percent). Even though Richmond is majority African-American, it is a far more diverse place than a typical city bus. This finding suggests that GRTC is most successful at meeting the transportation needs of the African-American community. While it is important to build on these services, there may also be opportunities to make the ridership more diverse. In part, this can be accomplished by offering more service to the outlying counties, which are predominantely white. But outreach and service enhancements that can attract residents representing the full Richmond population will also be important components of future service.

Figure 62: Race or Ethnicity Identity of Respondent



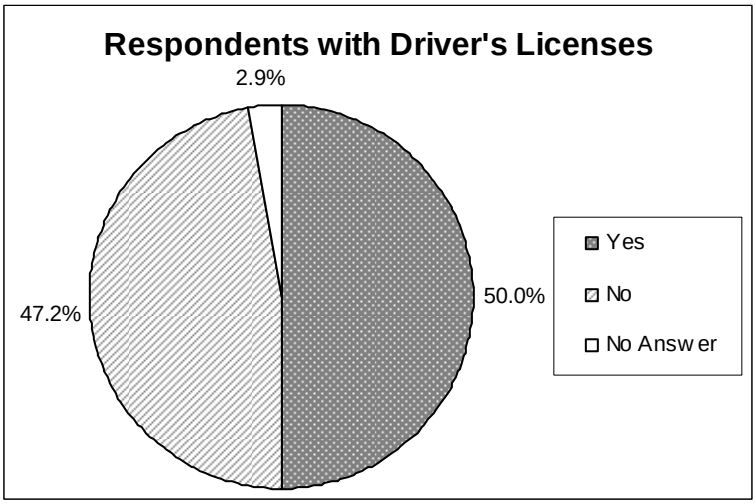
Approximately 9 percent of respondents were eligible for the reduced fare (see Figure 63). Respondents who do receive fare reductions are approximately evenly split between reductions for disability and age. Since the region contains more potential candidates to receive fare reductions based on age than disability, there may be room to increase ridership among seniors through marketing the fare break in conjunction with GRTC service.

Figure 63: Reduced Fare Eligibility



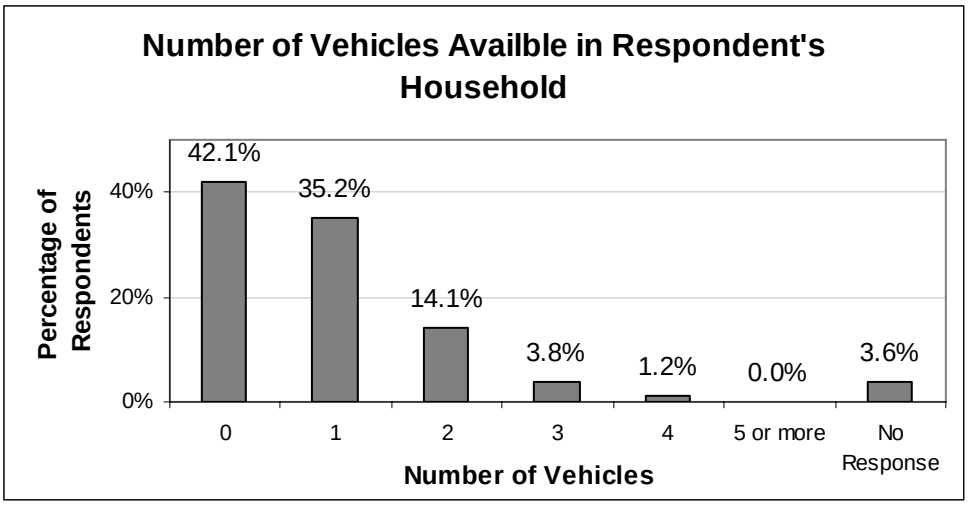
Almost half of survey respondents do not have a valid driver's license (see Figure 64). The 47 percent of respondents who cannot legally drive must rely on forms of transportation other than driving a personal automobile. This finding suggests that at least half of respondents are likely transit dependent. These riders will have few if any other reliable transportation choices other than a GRTC bus to travel throughout the region. Since so many residents rely on transit as a means to satisfy their basic needs, it is important that service is available for the full range of potential trips, including service coverage, hours of operation, and service frequency.

Figure 64: Driver's license



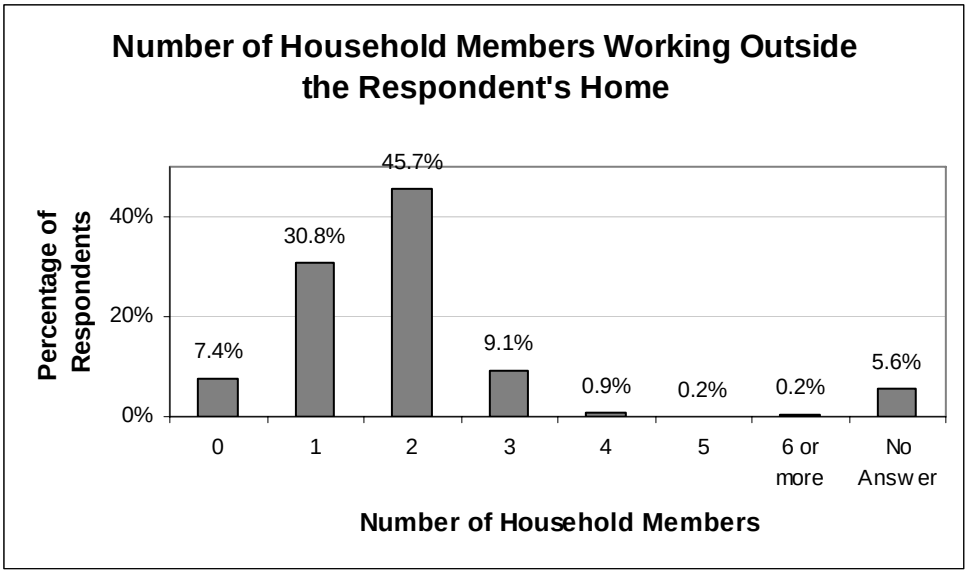
Corresponding to the large percentage of respondents without driver's licenses, **approximately 42 percent of respondents live in households with no vehicles available** (see Figure 65). Once again, respondents without access to a private vehicle will likely be dependent on transit. Even households with just one vehicle will frequently have members who depend on transit when that vehicle is unavailable. The presence of a small percentage of respondents living in multiple-vehicle households suggests that GRTC is also attracting choice riders—those riders who could make their trip by a personal vehicle if they chose. These choice riders are likely commuters looking to avoid traffic congestion and downtown parking hassles.

Figure 65: Working Vehicles Available in Household



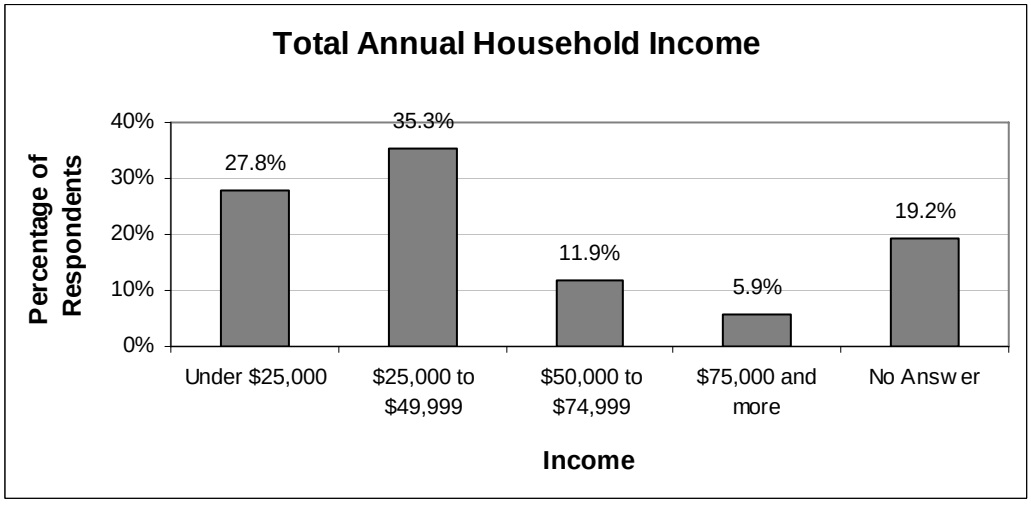
The number of household members employed outside of the home indicates the daily demand for transportation resources. Each household member employed outside the home will likely make at least two trips per day: one to work and one from work. Furthermore, when compared to the number of vehicles a household has, it is possible to discern how many respondents live in households where at least one member has to find a means other than driving to get to and from work. **Approximately 56 percent of respondents live in households where there was not a vehicle available to every member of the household employed outside the home**. This question also reveals that approximately seven percent of respondents were unemployed, and may depend on transit as an inexpensive form of transportation.

Figure 66: Household Members Employed Outside the Home



Unlike many of the other demographic indicators, respondents' total annual household income is distributed fairly well throughout a broad income range (see Figure 67). Although 28 percent of respondents fell into the lowest income range—a demographic finding consistent with transit dependence—the largest share of respondents live in households earning between $25,000 and $49,999 per year. Eighteen percent of respondents made over $50,000 per year. This finding suggests that although the bus ridership appears to attract a similar type of rider, there is also some diversity in economic advantage among riders. Attracting riders from both ends of the income spectrum suggests GRTC is meeting the needs of many different types of riders, includig both transit-dependent and choice riders. Although there is representation on board buses of different economic classes, it is important to note that majority of respondents fall in the lower income ranges. Additionally, almost 20 percent of respondents did not answer the question. If it were possible to allocate this 20 percent of respondents into the data, the results could be significantly swayed one way or the other.

Figure 67: Total Annual Household Income



Conclusion

In many ways, GRTC appears to attract a remarkably similar ridership base. Eighty-six percent of riders live in the City of Richmond and 72 percent identify as African-American. These demographic characteristics are largely a function of the demographic composition of Richmond and the location of transit service in the region. By focusing transit operations in the city, it is likely that the majority of riders will identify as African-American. But the survey respondents disproportionately derive from this racial group even when accounting for the racial makeup of the city. This suggests that there are opportunities to attract a more diverse group of residents to the service. Improving transit service in the outlying counties would be one strategy for accomplishing this goal.

Based on the survey findings, GRTC seems to be most successful at serving the transportation needs of transit-dependent residents. Several of the demographic characteristics suggest that GRTC users do not have other reliable forms of regional transportation available, such as a personal vehicle. Almost half of survey respondents did not have a driver's license and just over 40 percent lived in a household that had no vehicles available. Additionally, 56 percent of respondents lived in a household where there were not enough vehicles for each member working outside the home. These characteristics suggest that many riders rely on transit to execute basic daily tasks, such as work and accessing essential services. Although GRTC appears to be successfully meeting many of the needs of transit-dependent residents, the survey findings underscore the vulnerability of these riders. Without GRTC, it would be extremely difficult for transit-dependent residents to meet the needs of daily life. On the other side, each service improvement or expansion potentially opens the door for these riders to access a new opportunity available in the region.

GRTC has also been successful at attracting choice riders onto its buses. These riders tend to be wealthier with greater transportation resources. These riders are the most difficult to attract and retain. Choice riders often require a higher quality of service than transit-dependent riders before they get on board. This group also offers the greatest potential for ridership expansion opportunities.

Trip Characteristic

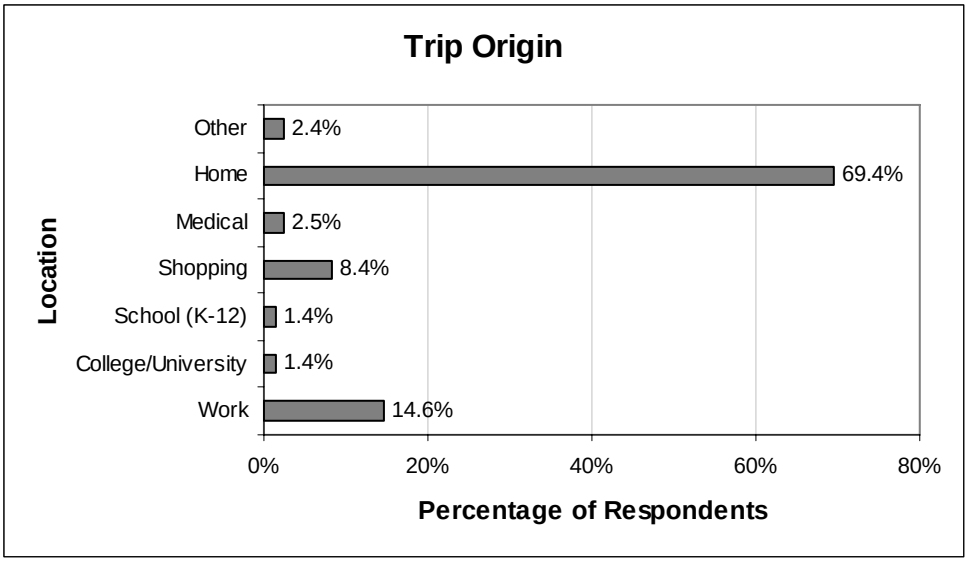
Survey data collected regarding trip characteristics and travel behaviors help demonstrate how GRTC service is used. Once again, this information not only reveals the transportation needs the service is currently being used to meet, but also suggests the types of trips that residents are not turning to GRTC to make. Therefore, the survey results can offer suggestions on what type of service is most valuable to residents and what type of new service could potentially benefit the region. A rider making a typical trip on the GRTC system:

- Is traveling between home and work
- Makes the same trip at least 5 days per week
- Walk one block to access the bus and one block to reach their final destination
- Does not have a car available for their transit trip
- Does not use GRTC service on the weekends

The majority of respondents' trips originated at their homes distantly followed by their places of employment (see Figure 68). These two places were also the most popular destinations identified by respondents (see Figure 69). In total, **approximately 51 percent of surveyed trips were being made between work and home**. Using GRTC bus service for commute trips was the most common type of trip made by respondents.

As the demographic survey analysis suggests, many GRTC riders are dependent on transit as their primary mode of transportation. These riders need to use GRTC for a wider variety of reasons than just commuting. The reported trip origins and destinations reflect his variety of trip purposes. Thirty percent of respondents were traveling to destinations for school, shopping, and medical appointments.[9] The greater variety in trip destinations than trip origins is likely a reflection of the survey period, which ran from the start of service until 2:00 p.m. when people were first leaving their home for the day.

Figure 68: Place of Trip Origin



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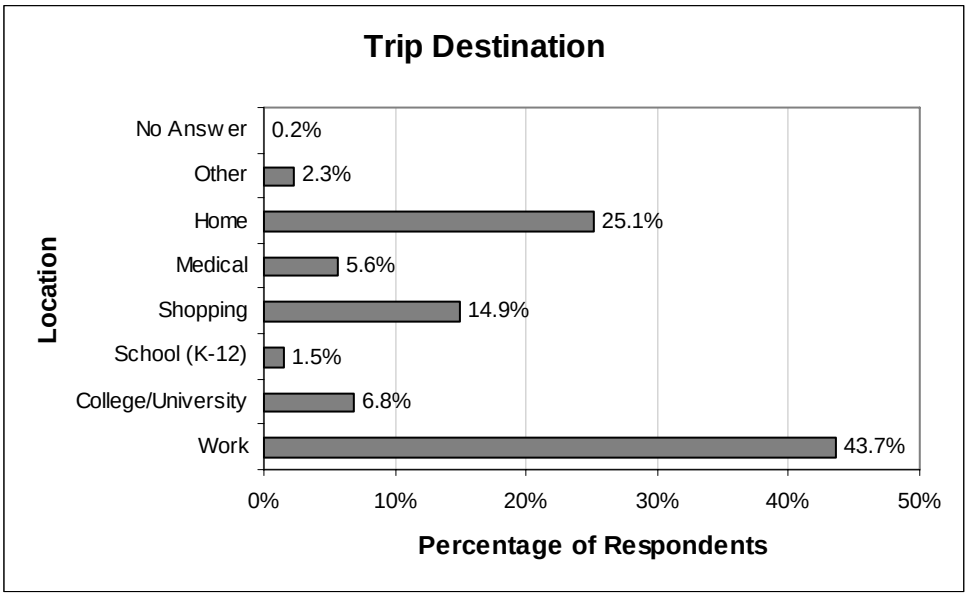
9 Surveys were not conducted on VCU routes operated by GRTC.

Figure 69: Place of Trip Destination



The vast majority of respondents walked to (85 percent) and from (94 percent) a GRTC bus while traveling between their point of origin and destination (see Figure 70and Figure 71). This means of accessing bus service follows from the intensity of use within the urban core, where walking is the easiest mode of transportation to supplement transit. It also reflects that many respondents do not have other transportation options besides walking. Since walking is the primary method of traveling to and from the bus, the pedestrian network will contribute to the success of the transit system. Service is most accessible in pedestrian friendly areas. Therefore, service planning should take into account factors beyond just stops, routes, and vehicles. Working to maintain a well-connected and safe pedestrian network will reduce obstacles to transit use.

Although small in number, respondents also used other modes of transportation to travel to and from the bus. Transportation to a bus facility in a personal vehicle—either driving or being dropped off—accounted for a 12 percent share of trips to the bus. This finding suggests that the service is attracting residents from less urban areas who are commuting into downtown. This travel pattern would also explain why there are a higher percentage of walk trips from the bus than to it. People drive or get rides to bus facilities in the parts of the region where they are not easily accessible on foot and then continue their trip by walking once they reach downtown.

Based on farebox data provided by GRTC, the frequency of transferring to and from buses was likely underreported by survey respondents. A one-day sample of farebox receipts from April 24, 2007, identified that approximately 22 percent of trips were transfers. Since the vast majority of respondents indicated that their mode of transportation to and from the bus was walking, it is likely that many riders making transfers responded as walkers. The skewed survey findings may have resulted from

respondents' confusion regarding walking versus transferring, since all transfers require walking at least some distance.

Figure 70: Travel Mode to Bus

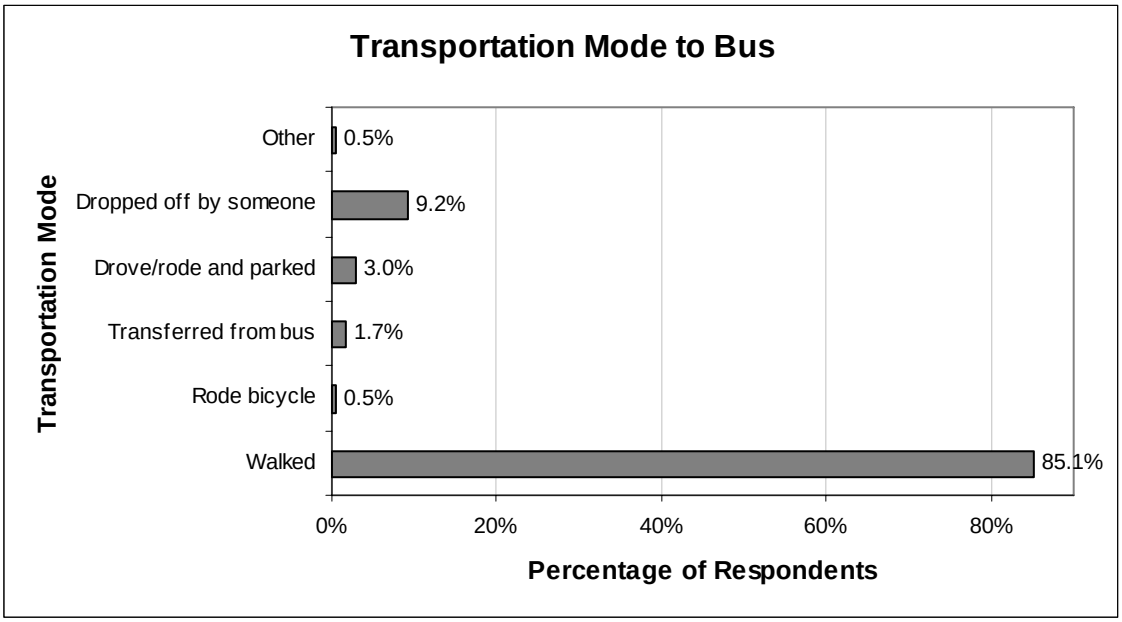


Figure 71: Travel Mode from Bus

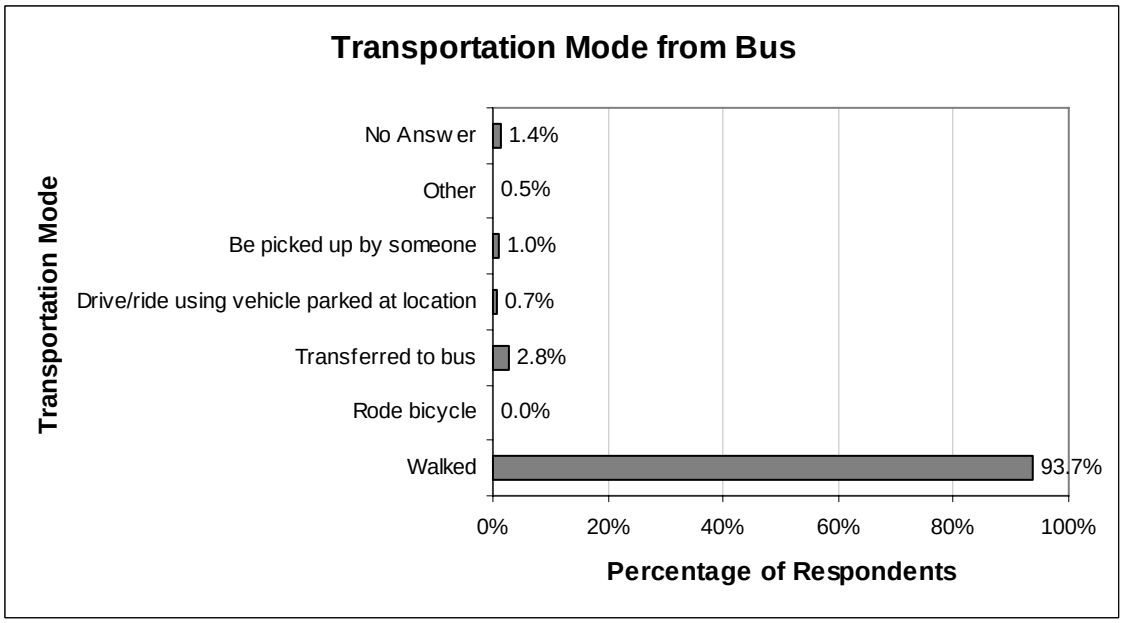
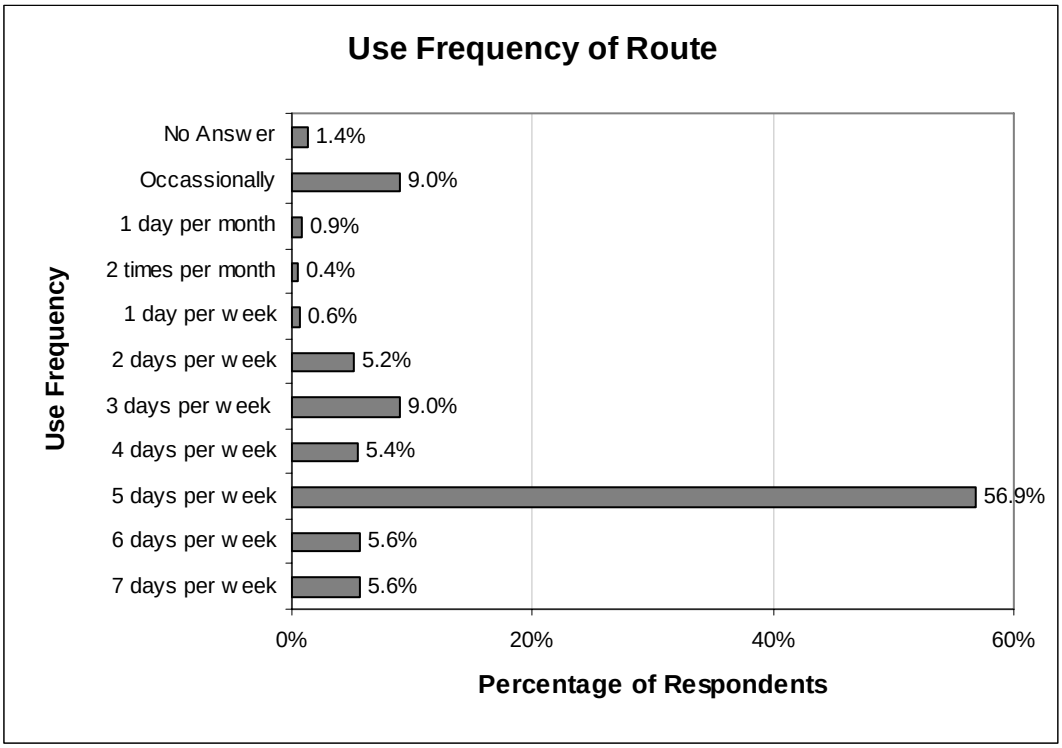


Figure 72 shows that **approximately 68 percent of respondents used the GRTC route they were on at the time of the survey 5 days or more per week**. This frequency of use of the same route correlates to the high percentage of respondents commuting to work. This finding suggests that there is a strong base of riders who rely on GRTC everyday of the work week to get to and from their place of

employment. In addition to compulsory work trips, it is important to provide convenient service that can satisfy other trip purposes. If bus transportation is too difficult for non-commute trips, residents will minimize the amount of auxiliary trips they make.

Although most riders use the same route with a high degree of frequency, 9 percent of respondents indicated that they use the route they were on only occasionally. The presence of occasional riders on board suggests that GRTC frequently supplements residents' normal travel patterns. Occasional use of a route could be either a daily transit rider using the service to conduct an infrequent trip or someone who does not normally use transit relying on the service when it is convenient or necessary. In either case, GRTC appears to successfully supplement typical travel patterns for many residents. Riders who use transit only occasionally are a potential source for developing new regular riders.

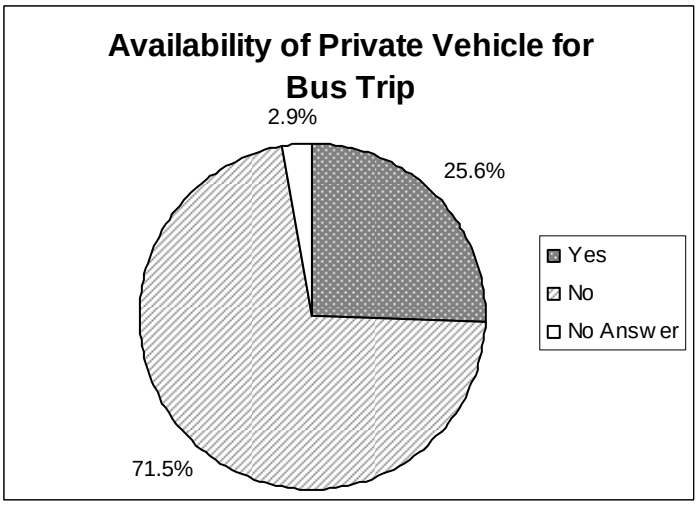
Figure 72: Use Frequency of Route



Approximately 72 percent of respondents did not have a private vehicle available to make the trip for which they were on the bus (see Figure 73). This finding demonstrates that almost three-quarters of respondents can be defined as transit-dependent. Twenty-six percent of respondents were choice riders. It is expected that a transit agency can attract transit-dependent riders, but it is a sign of success and the quality of service when they can also attract choice riders. Improving and expanding service can help increase ridership in both groups. Higher quality service will expand the transportation opportunities available to transit-dependent riders

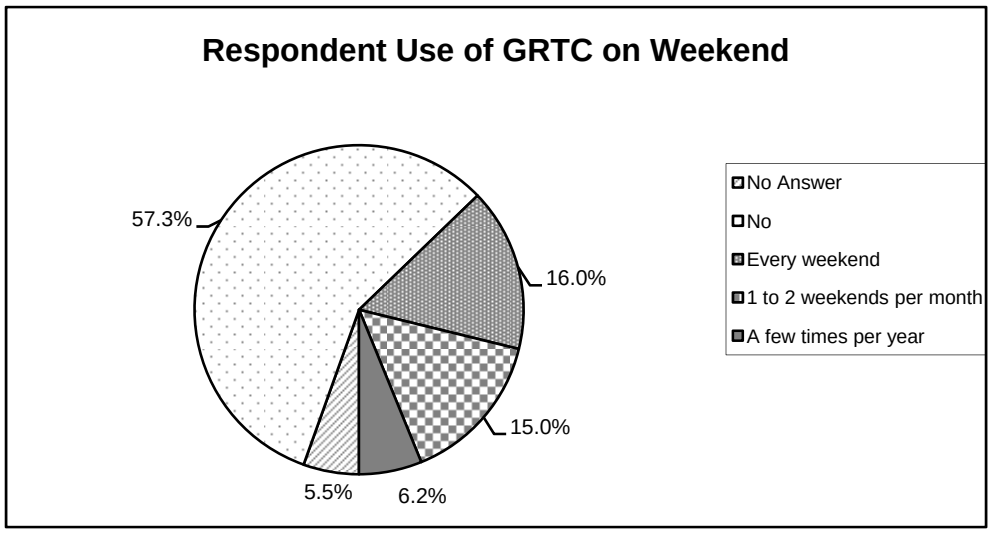
increasing use intensity and it will get choice riders on board increasing the ridership base.

Figure 73: Private Vehicle Availability for Bus Trip



Corresponding to the heavy use of the system for commute trips, only 37 percent of respondents also use transit service on the weekends. In general transit ridership declines during the weekends since residents have fewer trips they need to make. Transit-dependent riders will still use the service, whereas choice riders will revert to a more convenient mode of transportation.

Figure 74: Frequency of GRTC Use on Weekends



Conclusion

Similar to attracting a certain type of resident, the GRTC bus system appears the most successful at serving a certain type of trip. Approximately half of all trips are commute trips made between home and work. These trips are generally supplemented by walking from the point of origin and to the point of destination. As

commute trips, they are made repeatedly throughout the week. This is the type of trip that the GRTC system is best designed to accommodate. As a hub-and-spoke system, buses are designed to collect people throughout the region and bring them downtown as well as making the opposite trip. Additionally, service is most extensive in the urban core, where employment and population density is highest. Since this is the type of trip that has been best served by transit, GRTC should continue to improve service catering to commuters, especially choice commuters in the outlying counties.

GRTC also attracts many other types of trips. The service has the appropriate coverage, frequency, and hours of operation to accommodate almost any type of trip, especially trips within Richmond. Because of this extensive service, residents use the bus system for a wide variety of trip purposes. Furthermore, most of the system's riders are transit dependent and have to rely on GRTC to make all of their trips.

The survey findings demonstrate that although there are similarities among riders and trip patterns, the system has to be able to accommodate a much broader variety of trips and markets. Trying to accommodate all of these different trip purposes runs the risk of pulling the transit system in too many different directions. GRTC has built a successful service through years of refinement. Improving the service to enhance the majority of trips currently served will benefit the riders with the most need. Additionally, GRTC should begin to improve and introduce service aimed at pulling more choice riders on board. Continuing the success of GRTC will require distributing the benefits of a high-quality transit system throughout the region.

3

Route Diagnostics

Introduction

While the ridership analysis provides information on the existing demand for GRTC bus service, a route analysis will explore the service GRTC supplies to meet the riders' needs. In particular, the route analysis will focus on the quality of the service provided by GRTC. To successfully identify issues within the larger system, each route will be evaluated individually. Since each route operates under unique conditions and attracts different riders, each route is also going to face different issues when it comes to its capacity and reliability.

It is important to isolate and address issues with individual routes for several reasons. First, it will improve the usefulness of the bus route for current users. Second, it will attract new riders who avoided an unreliable and crowded bus route. And third, it will improve the overall perception of the bus service. For example, even if reliability issues are isolated to one route, everyone who has a bad experience on that route will project that experience onto the entire system, which will dissuade them from using buses for other trips. Issues with service, no matter how isolated, will potentially weigh down the entire system, making it especially difficult to attract choice riders and expand service into new markets.

Identifying ways to improve the match between the areas within the region that have a greater demand for transit service and the GRTC bus route service area was the first step in evaluating the GRTC bus system. Turning focus to the quality of the service will identify any issues that may cause problems for riders even if they have access to routes. Looking specifically at route loads—which measure how many riders are onboard a bus at any given time—will reveal any routes that do not have large enough vehicles or frequent enough service to meet current demand. Not adequately meeting demand will either turn people away because there is no room on the bus or the bus will be crowded and uncomfortable, which will make it difficult to attract choice riders. Additionally, evaluating the on-time performance of the route will reveal any unreliable routes. Unreliable routes will make it difficult for riders to make it to their destinations on time and will make the bus system unattractive to choice riders. Addressing any identified issues will improve the

service for those who depend on it, help attract new riders, and build a positive perception of transit in the Richmond region.

This route diagnostic analysis documents the evaluation of each bus route operated by the Greater Richmond Transit Corporation (GRTC) that is available to the general public within and in the vicinity of the City of Richmond. It includes 26 local and 10 express routes, which comprise the regular route system. The analysis presents overall statistics and different performance results (e.g., farebox recovery and productivity). The focus of this evaluation is to delineate the characteristics of the GRTC Transit System bus routes utilizing several analytical techniques. With these approaches, each bus route is treated as an individual operating entity. The performance characteristics of each bus route are compared to the other bus routes as well as to the overall system. In some cases, bus routes are assigned to specific categories to contrast performance for different criteria. The route level analysis is quantitative and focuses on financial and productivity measures. The examination also ranks the bus routes, thus reflecting the competitive nature of allocating limited transit resources. The analysis was performed for a one-year period, representative of conditions during Fall 2006.

Analysis Overview

The analysis was conducted based on recent conditions at current service levels. Accordingly, data were gathered for the past one year along with system conditions during the past Fall since it is a useful and recent benchmark to assess performance by individual bus route. Utilizing this information, the results presented in this evaluation are for a recent one year period. As noted previously, all 36 regular routes were included in the analysis. Because of the unique nature of the service operated under contract to Virginia Commonwealth University (VCU), these routes have been excluded from this review.

Data Assembly

The route level analysis requires considerable information regarding operating, financial, and patronage statistics. Five statistics were input to the process: vehicle miles, vehicle hours, peak vehicles assigned, farebox revenue, and boardings. For the most part, detailed information was available since GRTC compiles some of the data for its operation, although some manipulation was required to establish a recent one year period. Presented below is a brief description of the key information that was compiled by service type and route.

Vehicle Miles - Information on vehicle miles by individual route is not routinely reported and accumulated by GRTC. Instead, the current data collection procedures record vehicle miles by route for each service day -- Weekday, Saturday and Sunday. Daily results were obtained for typical days in October, 2006. The daily results for

each day were multiplied by the appropriate number of operating days during the year -- 255 weekdays, 52 Saturdays and 58 Sundays/Holidays. The resulting annual values by route were summed to yield annual vehicle miles.

Vehicle Hours - The results for this operating statistic were computed in a similar manner to that utilized for vehicle miles. Route values for each service day were multiplied by the appropriate number of days and then summed.

Peak Vehicles - As the name implies, this statistic reflects the number of buses or vehicles in service during a typical day. It is derived from the number of vehicles operated during the afternoon peak service period on weekdays. The afternoon peak period has more buses in service than during the morning peak period. With the exception of one route, it represents the maximum number of vehicles assigned to each route during the afternoon peak period. The route level data for peak vehicles was taken directly from schedule information provided by GRTC.

Passengers - GRTC registering fareboxes record passenger boardings as part of their routine monitoring of the bus system. Part of the drivers' normal responsibilities is to press the appropriate buttons on the registering farebox which indicates the type of fare and identifies specific bus trips by route. Farebox data by route for each month were summarized for January through December of 2006.

Revenue - As noted above, drivers record ridership by fare category. Revenues by route were determined by summarizing data for the 12 months ending December 31, 2006.

The five data items were compiled for each route over a recent one year period that is representative of current bus operations. One concluding point is that the route level database relies on information from a variety of sources. It is recognized that there may be some anomalies with some of the information. Nonetheless, it provides a reasonable basis to assess the performance of individual bus routes.

Diagnostic Techniques

The discussion above provides an overview of the necessary data assembly and manipulation. Five procedures were utilized to assess current route performance and provide different perspectives of gauging route level efficiency and effectiveness, as summarized below:

Cost Centers - This technique establishes the revenue, cost, and resulting deficit of each bus route. Emphasis is placed on farebox recovery, which is the percentage of operating costs that is covered by passenger fares. A major element of this effort is the development of a financial model that relates operating costs to service levels. In the current analysis, a three-variable cost model was used in which the cost of a bus route was related to vehicle hours, vehicle miles, and peak vehicles.

Contribution Analysis - This procedure also places emphasis on the financial results of each bus route. The deficit is examined in terms of both relative amounts (i.e., farebox recovery) and absolute amounts (i.e., each route's contribution to the system deficit). This method allows each route to be assigned to one of four categories which reflect the route's performance in each measure and whether it is better or worse than the system average.

Strategic Planning - This analysis procedure gauges route performance for two criteria. The first measure is deficit per passenger, which indicates the extent of route subsidy for each boarding passenger. The second factor is the market share of each route, which has been defined as the ratio of each route's passengers to the average route for the system. Values greater than one denote routes with relatively large market shares, while values lower than one indicate routes with relatively small market shares.

Ordinal Ranking - This bus route evaluation procedure numerically ranks all bus routes from best to worst for five performance indices. Two measures relate to productivity while another three present deficit relative to operating and passenger statistics. In turn, these results are combined for each group of criteria to arrive at a combined score and overall rank.

Supply and Demand Review - The concluding analytical technique is a review of the relative balance between each route's supply of service and the resulting performance. The number of weekly bus trips (i.e., supply) operated is compared to two measures of performance (i.e., passengers per hour and farebox recovery). There should be a directly proportional relationship in that routes with better performance have more service while routes that have low performance operate less service.

The discussion above provides a brief summary of each technique that was employed in the route diagnostic analysis. As noted previously, the results are for a recent one year period that reflects the current route structure and service levels. Several points are worth noting at the outset. First, the techniques are diagnostic in that they indicate the need for more detailed analysis (e.g., a review of the ride check data) to remedy deficiencies and exploit opportunities. Second, they examine route level performance from a variety of perspectives to assure a comprehensive review of efficiency and effectiveness. Finally, the diagnostics review is only one input to the service development process, since issues such as need and equity must also be considered. Nonetheless, the current analysis provides an important resource in the preparation of service proposals.

Cost Centers

The primary objective of the cost centers analysis approach is that bus system operating, patronage, revenue and cost statistics can be disaggregated by individual

route. Utilizing these statistics, deficit and various measures (e.g., farebox recovery) can be computed. With the exception of cost, all necessary data items can be obtained from GRTC's records, data collection efforts and manipulation activities, as noted previously. On the other hand, route-by-route costs are more difficult to ascertain. Transit expenditures are recorded by expense accounts that "track" costs for the entire bus system.

To convert system-wide expenses to individual routes, a two-step process is required. First, a cost allocation model is quantified based on operating and financial experience. In the case of the bus system, this results in a three-variable formula that relates the cost of providing bus service to the vehicle hours, vehicle miles, and peak vehicles. Second, each operating statistic for each bus route is multiplied by the appropriate unit cost to determine route operating costs.

Cost Allocation Model

The basic concept underlying the cost allocation model is that each operating expense is influenced or driven by one or more operating statistics or resource levels. Consideration of the nature of various operating expenses identified three major resources that "drive" each particular expense item. These resources are: (1) vehicle hours; (2) vehicle miles; and (3) peak vehicles. The "three variable" model is preferred over a more complex formula including numerous other variables since it is easier to develop and apply while still maintaining a high degree of accuracy. Also, the three variable model is superior to a single unit cost factor since it provides more accurate results and is sensitive to the different characteristics of each route. This is particularly important at GRTC where local and express bus lines mean that operating speed and vehicle utilization can vary widely by route.

The model proposed for analyzing the bus system is termed a fully allocated cost formula. The method receives its name since all costs for bus service are included in the model's development. No distinction is made between fixed and variable expenditures. This is consistent with the objective of the analysis, which is to compare financial performance by route. Most costs allocated to peak vehicles are typically fixed expenses that do not vary by the amount of service provided.

The fully allocated formula for the bus system could be readily converted to variable costs by eliminating those expenses allocated to peak vehicles. In turn, this would then result in a variable cost model with only two resource levels - vehicle hours and vehicle miles. This formula can be used to estimate the incremental costs of service changes.

Model Calibration

The primary source of data for the cost allocation model was the GRTC National Transit Data Base submission to the Federal Transit Administration for FY 2006, which ended June 30, 2006. The form, which includes a description of expenses by function (e.g., vehicle operations) and object (e.g., wages), accounts for each mode operated by GRTC. It provides the most recent and comprehensive presentation of

cost by mode since expenditures are identified separately for bus, paratransit and vanpool. While FY 2006 is not the same time period as the ridership and revenue data, it does reflect current cost levels since escalation during the past few months has been modest. During this period, GRTC incurred costs of about 30.7 million dollars which covers the cost of the entire bus system (i.e., the local, express, and VCU routes). The cost formula is calibrated by performing the following three tasks:

- Assign each individual expense in the system financial statement to one of the three selected resources that influence costs.

- Sum the costs assigned to each resource to obtain the overall cost allocated to the resource.

- Divide the overall resource cost by the quantity of the resource used by the system. These calculations produce the unit cost of each resource, which are the coefficients of the cost model.

The allocation of each expense item is made on the basis of judgment, although the relationship between the expense item and variable is typically quite evident. It should be noted that some statistical analyses have been performed on the data from other transit systems that confirm the allocation process. This cost allocation process also reflects the prevailing practice within the industry where it is applied.

For example, operators' wages are allocated to vehicle hours since bus operators are hourly employees. The operating expense of their wages and fringe benefits was also assigned to vehicle hours. Some costs, such as mechanics' compensation, fuel and replacement parts are a direct function of vehicle miles operated. In addition, vehicle insurance costs are a function of accident exposure in terms of miles of service. Many of the expense accounts do not vary as a function of either vehicle hours or vehicle miles. For example, the cost resulting from providing an operating base and vehicle storage is determined by the number of peak vehicles in service. Also, administrative expenses vary based on the system scale as measured by the number of vehicles required to operate the bus system.

The results of this allocation process for the GRTC bus system are presented below:

Table 72: Fully Allocated Cost Model

Basis For Allocation	Amount (Dollars)	Percent	Operating Statistic	Unit Cost (Dollars)
Vehicle Hours	14,700,500	47.9	470,200	31.27
Vehicle Miles	8,782,800	28.6	5,203,200	1.69
Peak Vehicles	7,230,500	23.5	138	52,394.53
Total	*30,713,800*	*100.0*		

Approximately one-half of all bus system expenses were assigned to vehicle hours. This is logical since drivers' wages and fringe benefits account for a substantial

portion of bus system costs. This clearly underscores the labor intensive nature of public transportation. Vehicle miles account for about 29 percent of all of the bus system expenses, with peak vehicles assigned about 23 percent of all costs. The costs attributable to vehicle hours result in a cost of $31.27 per vehicle hour. The cost allocated to vehicle miles of operation yields a unit cost of $1.69 per vehicle mile, while the costs attributable to each peak vehicle over the course of a year produced a unit cost of $52,394.53.

Using the three-variable analysis results in the following cost allocation formula for the GRTC bus system:

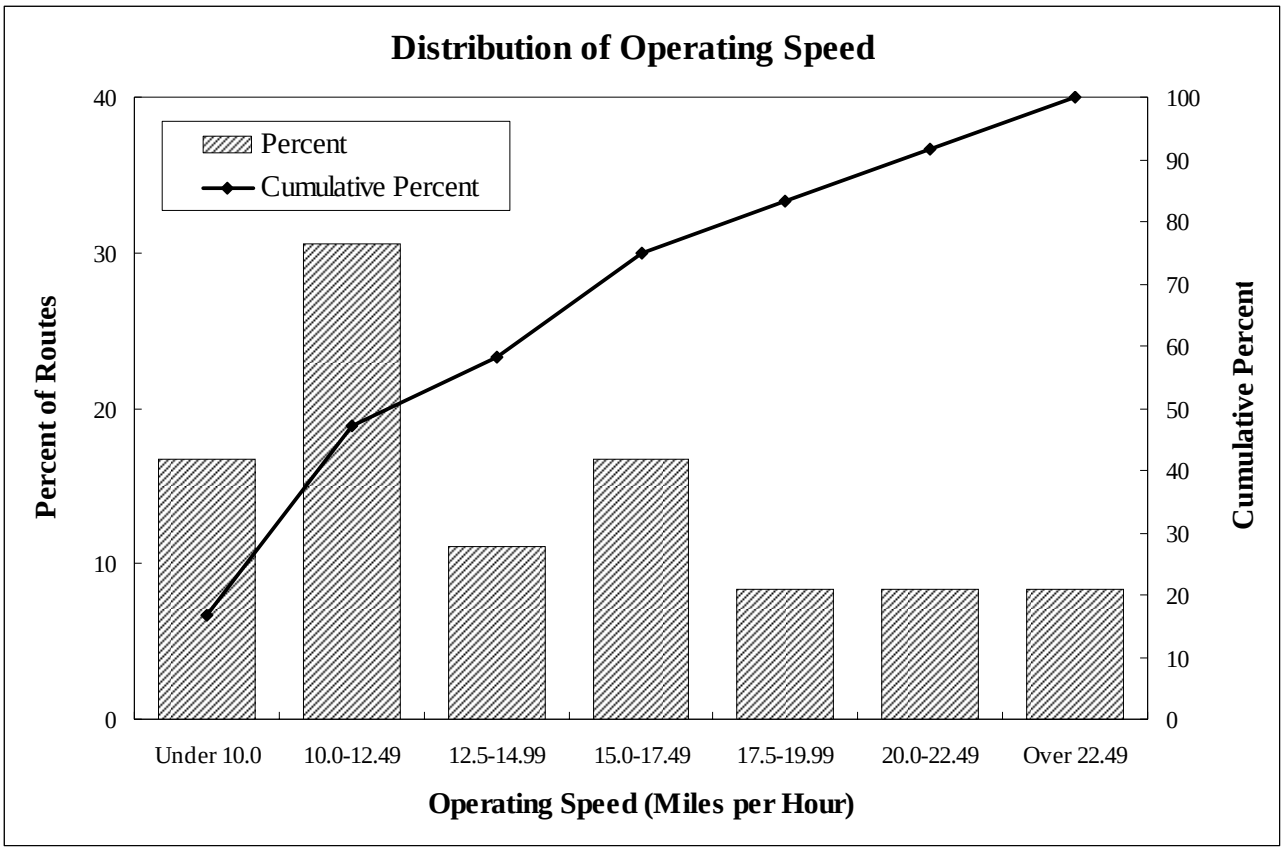
$$C = 31.27 * H + 1.69 * M + 52,395 * V$$

where:

C = Cost
H = Vehicle Hours
M = Vehicle Miles
V = Peak Vehicles

The calibrated three variable cost formula differs substantially from the traditional transit industry yardstick for measuring cost. This traditional approach is to compute a simple cost per mile or hour statistic. For the fiscal year, system-wide average unit costs for GRTC of approximately $65.32 per vehicle hour or $5.90 per vehicle mile. The use of both vehicle hours and vehicle miles permits the cost allocation model to be sensitive to operating speed. As shown in Figure 75, there is a wide range of operating speeds on GRTC bus routes. This is consistent with the different characteristics of the service types, streets traversed, and development patterns operated through by each of the routes. For example, the local and express bus routes have average speeds of 11.0 and 22.7 miles per hour, respectively. Individual route speeds range from a low of 9.0 to a high of 32.7 miles per hour with a system average of about twelve miles per hour, excluding the VCU contract bus routes. Similar variations are noted for measures such as vehicle miles and vehicle hours per peak vehicle, which suggests the need for the three-variable approach.

Figure 75: Distribution of Operating Speed



Route Financial Performance

The previous sections described the data collection procedures for establishing a database of route information and the calibration of a three-variable cost model. The next step was to apply the cost model to the route level operating statistics to establish the cost of each bus route. To indicate the different characteristics of the 24 local and 10 express service buses, the financial results were summed below:

Table 73: Financial Summary by Service Type

Service Type	Amount (Dollars)			Farebox Recovery (%)
	Revenue	Cost	Deficit (Surplus)	
Local	7,315,000	24,673,800	17,358,800	29.65
Express	625,700	4,545,500	3,919,800	13.77
Total	*7,940,700*	*29,219,300*	*21,278,600*	*27.18*

Not surprisingly, the farebox recovery of the express routes is about half of that achieved by the local bus routes. This reflects the nature of the two services in that the local routes have riders boarding and alighting over the entire length of the route. This results in a higher turnover of seats and productivity (e.g., passengers per hour). In contrast, the express bus routes collect passengers at one end of the route and then

operate non-stop to the other end where riders are dropped off. Somewhat offsetting the lower productivity of the express routes are the higher average fares. These differences are helpful in understanding the individual route results.

The results of the cost centers analysis by individual route are presented in Table 74, which indicates the revenue, cost, and necessary subsidy for the one year analysis period. The first method used to rate bus routes and to categorize their financial performance is to examine their farebox recovery. Overall, the regular routes (i.e., local and express bus routes) achieve a farebox recovery of 27.18 percent, which implies a subsidy of $2.68 for each dollar paid in fares.

Table 74: Financial Results by Route

Route		Revenue	Cost	Deficit	Farebox Recovery (Percent)	Rank	Percent Better	Percent Worse
Local								
1-2-1	Church Hill/Patterson/Monument	634,600	2,614,400	1,979,800	24.27	12	--	10.68
3-4	Robinson-Fairmount	1,038,700	2,790,400	1,751,700	37.22	3	36.97	--
6	Broad/Main	943,000	2,511,300	1,568,300	37.55	2	38.17	--
7	Seven Pines	166,500	623,400	456,900	26.71	10	--	1.72
10	Riverview/Jefferson	532,500	1,505,000	972,500	35.38	5	30.19	--
11	Laurel/17th Street	29,100	206,300	177,200	14.11	21	--	48.10
13	Main Street/Church Hill	65,000	574,700	509,700	11.31	27	--	58.38
16	Westhampton	149,100	912,300	763,200	16.34	18	--	39.86
18	Henrico Shuttle	55,200	234,100	178,900	23.58	13	--	13.23
19	Pemberton	67,000	353,200	286,200	18.97	17	--	30.20
20	Northside-Dill Road/Willow Lawn	11,100	112,000	100,900	9.91	30	--	63.53
22	Hermitage-Westbrook/Downtown	59,100	592,300	533,200	9.98	29	--	63.28
24	Crestwood	122,900	642,000	519,100	19.14	15	--	29.56
32	Ginter Park	626,100	1,717,000	1,090,900	36.46	4	34.18	--
34	Highland Park	432,500	1,260,200	827,700	34.32	6	26.29	--
37	Chamberlayne	528,400	1,090,100	561,700	48.47	1	78.36	--
56	South Laburnum	16,000	218,000	202,000	7.34	32	--	72.99
60	Hickory Hill	1,300	133,100	131,800	0.98	35	--	96.41
61	Broad Rock Shuttle	5,400	68,200	62,800	7.92	31	--	70.86
62-63	Hull Street/Midlothian	831,000	2,517,200	1,686,200	33.01	7	21.48	--
67	Chippenham	37,700	369,900	332,200	10.19	28	--	62.50
68	Lunch Time Express	0	83,300	83,300	0.00	36	--	100.00
70-71	Forest Hill	323,600	1,326,200	1,002,600	24.40	11	--	10.21
72-73	Ruffin Road/Ampthill	354,800	1,145,300	790,500	30.98	8	13.99	--
74	Oak Grove	271,800	884,200	612,400	30.74	9	13.11	--
93	Azalea Connector	12,600	189,700	177,100	6.64	33	--	75.56
Express								
26	Parham	101,700	677,400	575,700	15.01	20	--	44.76
27	Glenside	70,700	575,700	505,000	12.28	25	--	54.81
28	Fair Oaks	23,800	172,200	148,400	13.82	22	--	49.14
29	Gaskins	118,100	609,400	491,300	19.38	14	--	28.69

Route		Revenue	Cost	Deficit	Farebox Recovery (Percent)	Rank	Percent Better	Percent Worse
64	Stony Point	49,100	393,900	344,800	12.47	24	--	54.13
65	Stony Point Fashion Park/VCU Health	27,100	540,500	513,400	5.01	34	--	81.55
66	Kmart	25,400	219,500	194,100	11.57	26	--	57.42
69	Huguenot	43,800	230,300	186,500	19.02	16	--	30.02
82	Winterpock/Lowe's/Commonwealth 20	78,900	485,000	406,100	16.27	19	--	40.14
95	Richmond/Petersburg	87,100	641,600	554,500	13.58	23	--	50.05
Total		*7,940,700*	*29,219,300*	*21,278,600*	*27.18*			

As with many of the analyses presented here there is a wide disparity between the individual GRTC bus lines. Route 37: Chamberlayne has the highest farebox recovery of 48.47 percent while Route 68: Lunch Time Express has the lowest since it does not charge a fare. The next lowest route is Route 60: Hickory Hill, which recovers less than one percent of its costs from the farebox. Nine routes exceed the regular route system average, with 27 routes below the average. One concluding point is that the comparison of individual route performance relative to the system average is a common feature of the diagnostic techniques, although the criteria and measures differ.

Contribution Analysis

The next method used to rate the system's bus routes and to categorize their financial performance is to examine both their farebox recovery and deficit amounts in combination. As can be seen in Figure 76, the system deficit grows larger as each bus route's operating cost and revenue are accounted for. By considering the bus routes in descending order of farebox recovery, the system's operating cost continues to increase but aggregate revenue begins to "flatten out," thus contributing to a mounting deficit.

Each bus route was rated relative to the system average. For example, as shown in Table 75, the farebox recovery rates of all of the bus routes were indicated as being either "better" or "worse" than the system average. In a similar manner, the 36 bus routes were rated with respect to their contribution to the deficit. For ease of presentation, the deficit amounts have been calculated relative to each route contributing 1/36th of the deficit. On average each bus route should contribute about 2.8 percent of the system deficit, or $591,100. For example, Route 16-Westhampton had a deficit of $763,200, which is 1.29 times greater than the average. However, whether a route actually contributes more or less to the cumulative deficit is reflected in Table 75.

Figure 76: Cumulative Effect of Farebox Recovery on Deficit

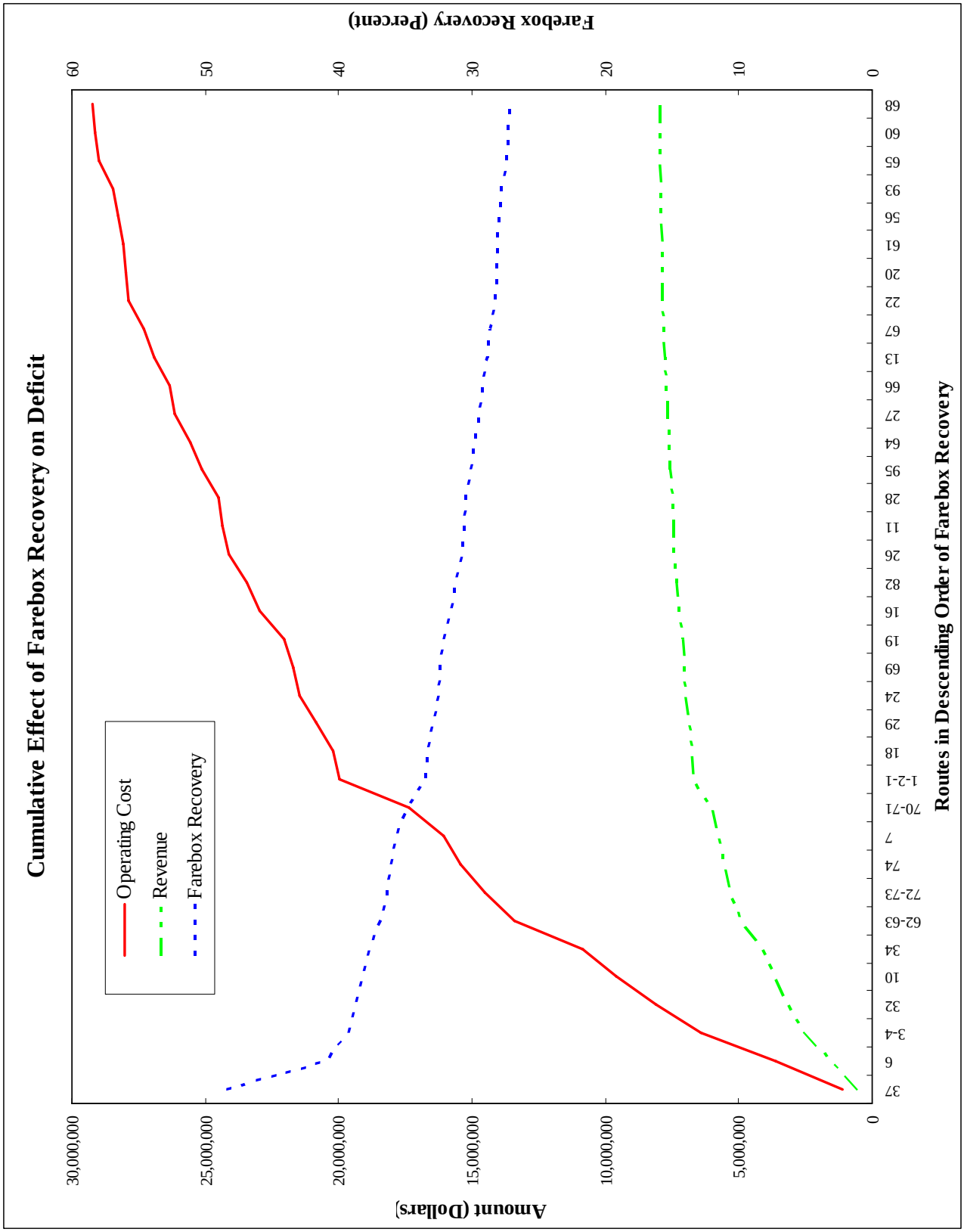


Table 75: Farebox Recovery and Contribution to Deficit

Route		Farebox Recovery (%)		Contribution To Deficit		Category
		Value	Rating	Value	Rating	
Local						
1-2-1	Church Hill/Patterson/Monument	24.27	Worse	3.35	Worse	4
3-4	Robinson-Fairmount	37.22	Better	2.96	Worse	3
6	Broad/Main	37.55	Better	2.65	Worse	3
7	Seven Pines	26.71	Worse	0.77	Better	2
10	Riverview/Jefferson	35.38	Better	1.65	Worse	3
11	Laurel/17th Street	14.11	Worse	0.30	Better	2
13	Main Street/Church Hill	11.31	Worse	0.86	Better	2
16	Westhampton	16.34	Worse	1.29	Worse	4
18	Henrico Shuttle	23.58	Worse	0.30	Better	2
19	Pemberton	18.97	Worse	0.48	Better	2
20	Northside-Dill Road/Willow Lawn	9.91	Worse	0.17	Better	2
22	Hermitage-Westbrook/Downtown	9.98	Worse	0.90	Better	2
24	Crestwood	19.14	Worse	0.88	Better	2
32	Ginter Park	36.46	Better	1.85	Worse	3
34	Highland Park	34.32	Better	1.40	Worse	3
37	Chamberlayne	48.47	Better	0.95	Better	1
56	South Laburnum	7.34	Worse	0.34	Better	2
60	Hickory Hill	0.98	Worse	0.22	Better	2
61	Broad Rock Shuttle	7.92	Worse	0.11	Better	2
62-63	Hull Street/Midlothian	33.01	Better	2.85	Worse	3
67	Chippenham	10.19	Worse	0.56	Better	2
68	Lunch Time Express	0.00	Worse	0.14	Better	2
70-71	Forest Hill	24.40	Worse	1.70	Worse	4
72-73	Ruffin Road/Ampthill	30.98	Better	1.34	Worse	3
74	Oak Grove	30.74	Better	1.04	Worse	3
93	Azalea Connector	6.64	Worse	0.30	Better	2
Express						
26	Parham	15.01	Worse	0.97	Better	2
27	Glenside	12.28	Worse	0.85	Better	2
28	Fair Oaks	13.82	Worse	0.25	Better	2
29	Gaskins	19.38	Worse	0.83	Better	2
64	Stony Point	12.47	Worse	0.58	Better	2
65	Stony Point Fashion Park/VCU Health	5.01	Worse	0.87	Better	2
66	Kmart	11.57	Worse	0.33	Better	2
69	Huguenot	19.02	Worse	0.32	Better	2
82	Winterpock/Lowe's/Commonwealth 20	16.27	Worse	0.69	Better	2
95	Richmond/Petersburg	13.58	Worse	0.94	Better	2
Average		27.18		1.00		

All 36 regular bus routes have been rated relative to their deficit contribution and farebox recovery. By utilizing this two-way stratification, four route categories were determined as follows:

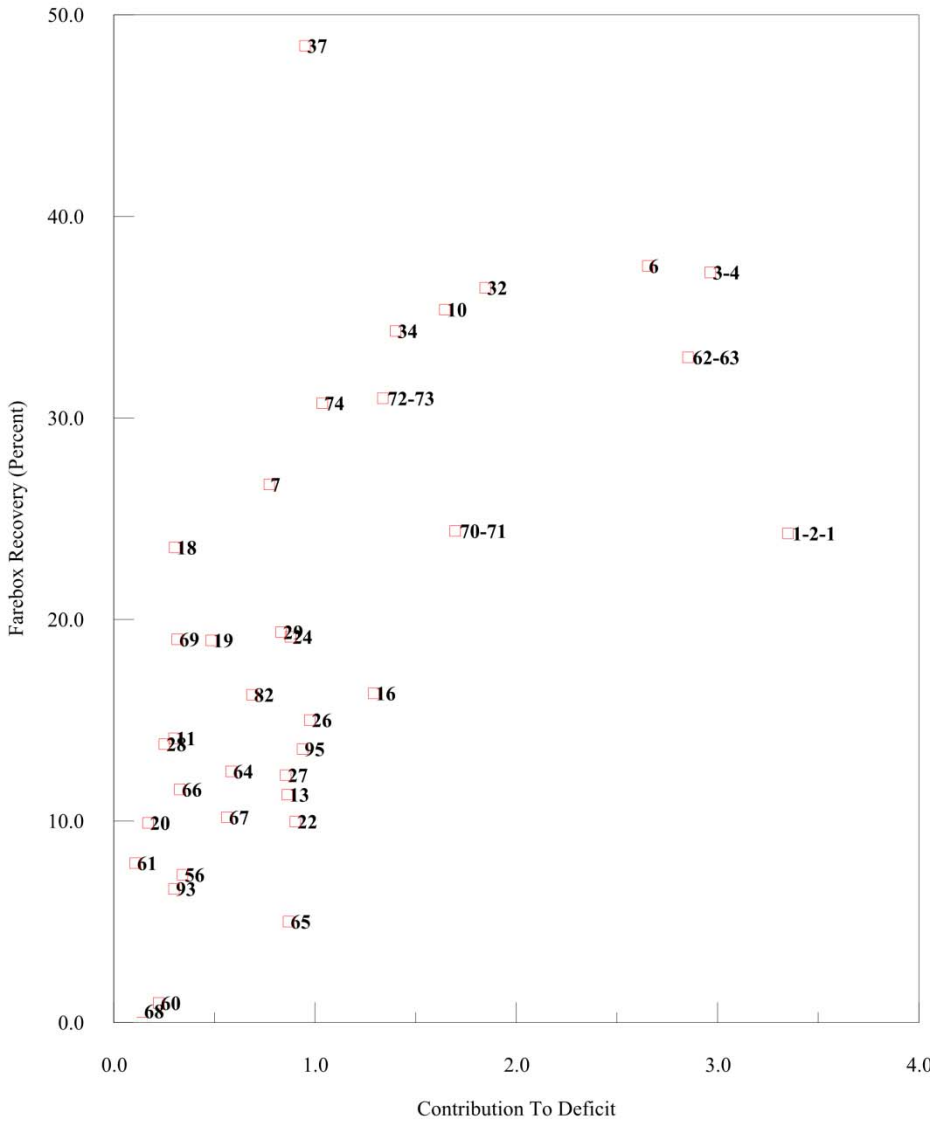
Table 76: Stratification System

Farebox Recovery	Contribution to Deficit	Category	Number of Routes
Better	Better	1	1
Worse	Better	2	24
Better	Worse	3	8
Worse	Worse	4	3

Placed in the first category are those bus routes that have a superior rating in terms of both relative and absolute measures of deficit (Figure 77). Only Route 37: Chamberlayne falls in this category. On the other hand, the three bus routes which fall into the fourth category attain poor ratings for both measures. For these bus routes, consideration should be given to changes which can more closely balance the supply and demand characteristics of the service. It should be recognized that the results are influenced by the fact that only nine routes have high farebox recovery values, which results in 27 routes worse than the average.

The other two categories reflect mixed results. For example, Category 2 routes have relatively low farebox recovery values, but only contribute a modest amount to the deficit. This would suggest limited service. These 24 routes include two-thirds of all bus lines, and all express routes fall in this category. The results for the third category are reversed from those for the second group. While the farebox recovery is favorable, the deficit contribution is relatively high, with eight bus lines falling in this category. These routes exhibit superior performance on a rate basis, but are larger routes which contribute significantly to the system deficit. The results, as graphically depicted in Figure 77, would seem to suggest a wide disparity in performance for both financial measures and the need to examine financial performance in terms of both rate (i.e., farebox recovery) and aggregate (i.e., contribution) measures.

Figure 77: Relationship between Farebox Recovery and Contribution to Deficit



Strategic Planning

This diagnostic tool examines each route on the basis of its deficit per passenger and each route's share of the system ridership. This is a transit adaptation of strategic planning in the private sector. As noted above, one criterion used in the analysis is route deficit on a per passenger basis. The importance of this statistic is that it represents the subsidy provided each boarding passenger. It reflects the level of service and the resulting costs as well as patronage and the present fare structure.

Similar to the previous analysis, routes have been classified for two performance criteria (i.e., deficit and ridership levels) relative to the system average. The former uses deficit per passenger relative to the system-wide average deficit per passenger.

This ratio indicates how well a route is performing in comparison to other routes. For example, Route 19: Pemberton has a deficit per passenger of $4.59 while the system average was $2.24, or a ratio of 2.05. Routes with ratios less than one have a low deficit per passenger rating, while routes with values in excess of one have a higher deficit per passenger rating.

To define a relative measure of ridership, market share has been used. It represents the ratio of each route's ridership to the average route ridership for the system. A value greater than one indicates high relative ridership while a value less than one denotes low ridership.

The need for a ridership measure is apparent from the cumulative distribution of riders by route. Ridership levels typically vary between routes, and therefore this distribution is not uniform. It would suggest that portions of the bus system reflect the desire to provide service where the demand alone would not warrant these levels of service. This analytical technique attempts to classify routes in terms of ridership levels and the subsidy attributed to each patron. As shown in Table 77, all routes have been rated relative to deficit per passenger and market share.

Table 77: Deficit and Ridership Levels

Route		Deficit Per Passenger		Market Share		Category
		Value ($)	Rating	Value	Rating	
Local						
1-2-1	Church Hill/Patterson/Monument	2.57	1.15	769,600	2.91	1
3-4	Robinson-Fairmount	1.37	0.61	1,278,300	4.83	2
6	Broad/Main	1.30	0.58	1,207,800	4.57	2
7	Seven Pines	2.37	1.06	193,000	0.73	3
10	Riverview/Jefferson	1.47	0.66	661,200	2.50	2
11	Laurel/17th Street	4.80	2.15	36,900	0.14	3
13	Main Street/Church Hill	5.92	2.65	86,100	0.33	3
16	Westhampton	4.33	1.93	176,500	0.67	3
18	Henrico Shuttle	2.62	1.17	68,300	0.26	3
19	Pemberton	4.59	2.05	62,400	0.24	3
20	Northside-Dill Road/Willow Lawn	7.95	3.55	12,700	0.05	3
22	Hermitage-Westbrook/Downtown	6.56	2.93	81,300	0.31	3
24	Crestwood	3.09	1.38	168,100	0.64	3
32	Ginter Park	1.38	0.62	791,600	2.99	2
34	Highland Park	1.51	0.68	547,000	2.07	2
37	Chamberlayne	0.87	0.39	645,300	2.44	2
56	South Laburnum	10.52	4.71	19,200	0.07	3
60	Hickory Hill	81.16	36.31	1,600	0.01	3
61	Broad Rock Shuttle	11.42	5.11	5,500	0.02	3
62-63	Hull Street/Midlothian	1.66	0.74	1,017,300	3.85	2
67	Chippenham	8.81	3.94	37,700	0.14	3
68	Lunch Time Express	6.74	3.01	12,400	0.05	3
70-71	Forest Hill	2.48	1.11	404,300	1.53	1
72-73	Ruffin Road/Ampthill	1.79	0.80	441,900	1.67	2
74	Oak Grove	1.86	0.83	328,600	1.24	2
93	Azalea Connector	12.12	5.42	14,600	0.06	3
Express						
26	Parham	8.07	3.61	71,400	0.27	3
27	Glenside	9.87	4.41	51,200	0.19	3
28	Fair Oaks	7.60	3.40	19,500	0.07	3
29	Gaskins	5.91	2.65	83,100	0.31	3
64	Stony Point	9.90	4.43	34,800	0.13	3
65	Stony Point Fashion Park/VCU Health	22.93	10.26	22,400	0.08	3
66	Kmart	10.71	4.79	18,100	0.07	3
69	Huguenot	5.99	2.68	31,100	0.12	3
82	Winterpock/Lowe's/Commonwealth 20	7.41	3.32	54,800	0.21	3
95	Richmond/Petersburg	8.74	3.91	63,400	0.24	3
System Average		*2.24*	*1.00*	*591,100*	*1.00*	

Based on this two-way stratification system, four route categories were determined as follows:

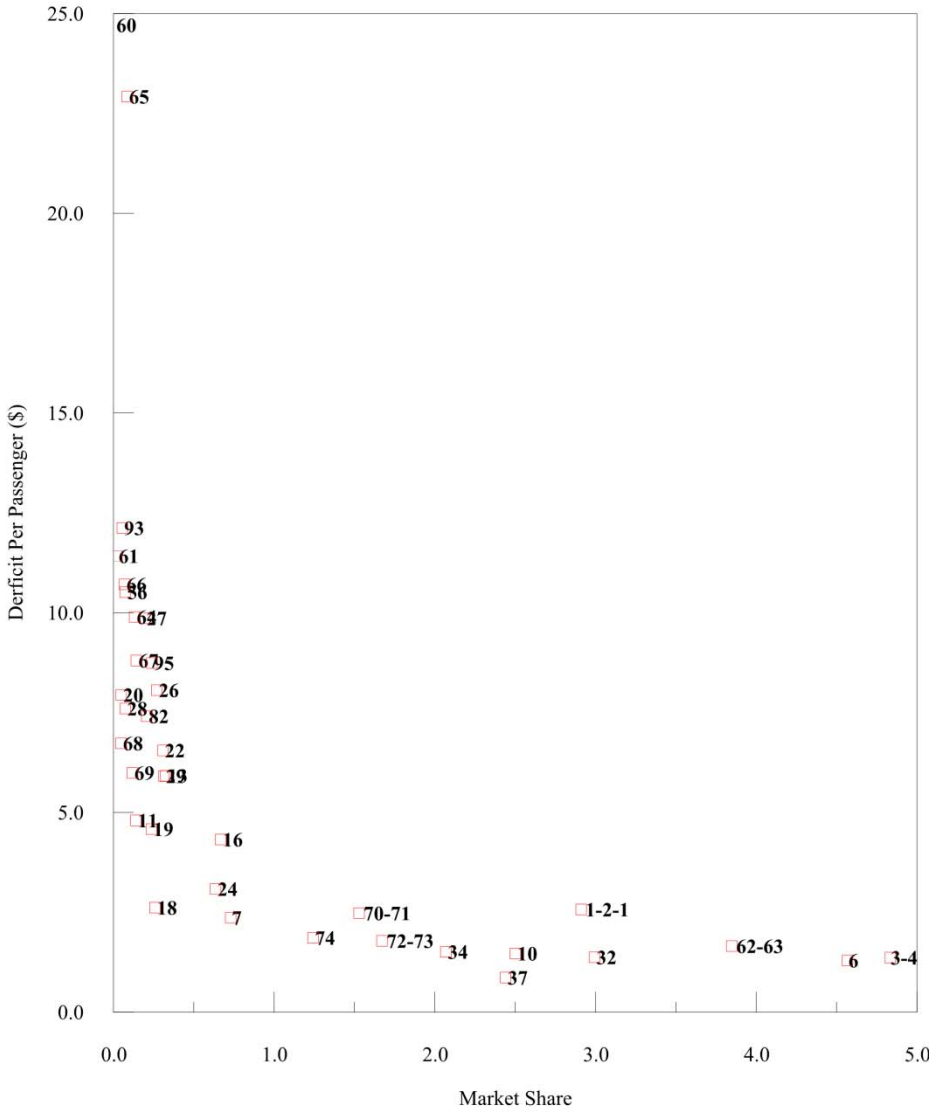
Table 78: Stratification System

Deficit per Passenger	Market Share	Category	Number of Routes
High	High	1	2
Low	High	2	9
High	Low	3	25
Low	Low	4	0

Category 1 bus routes are those which have high relative ridership levels and yet incur a large deficit for each passenger carried. The net impact is typically a large deficit to operate the route. Only two bus lines, Route 1-2-1: Church Hill/Patterson/Monument and Route 70-71: Forest Hill falls into this less desirable category. A preferred situation is Category 2, where route ridership is high, but the deficit per passenger is low. Nine bus lines fall into this category. The third category exhibits high deficit per passenger, but the level of service and number of passengers is low. These different performance levels offset one another. This situation may not necessarily place a significant financial burden on the transit system. Twenty-five bus routes, or about two-thirds of the system's bus lines, fall into this classification category. All the express bus routes fall in Category 3. Category 4 bus routes also do not place a significant financial burden on the transit system. Deficit per passenger and route ridership levels are both relatively low. None of the GRTC bus routes fall into this category.

The route classification is graphically depicted in Figure 78. As with the other classification system, the two-way stratification provides a framework for gauging performance. The results show a desirable inverse relationship between market share and deficit per passenger. Service is concentrated on those routes where deficit per passenger is relatively low.

Figure 78: Relationship between Deficit per Passenger and Market Share



Ordinal Ranking

Another type of evaluation procedure is termed ordinal ranking since all 36 bus routes are ranked from best to worst for several performance indices. In turn, these results are combined to provide an overall assessment of route performance. The application of this route evaluation technique consists of three sequential steps. The first is the selection of measures or criteria to gauge each bus route's performance. In the current analysis, these indices have been grouped into two broad categories to assess productivity and deficit.

In all cases, the criteria are specified as rates in that they compare ridership and deficit relative to various operating statistics. This definition of each evaluation yardstick permits routes with different service levels and requirements to be readily compared. As with other evaluation measures, these results are informative and useful inputs to the planning process.

The next step in the route diagnostic process is to rank the routes from best to worst performance for each of the five evaluation criteria. In the case of the productivity (passenger) measures, higher route values indicate favorable performance, with these routes assigned low rankings (the route with the best productivity would be ranked 1st). The route with the highest productivity value and exhibiting the best performance would be assigned a rank of one.

Conversely, routes that exhibit relatively low productivity results would denote deficient performance. For example, the route with the lowest productivity value would exhibit the worst performance and therefore would be ranked 36th. In a similar fashion, each of the routes comprising the bus system was ranked for three deficit measures. One difference is that for these measures, low values indicate better relative performance and high values denote relatively poor performance.

The concluding step in the ordinal ranking process is to combine results for the individual criteria into aggregate ratings for productivity and deficit requirements. For the two productivity measures, the ranks for each route were summed to determine a score. In turn, this score was used to establish an overall ranking for each route for both productivity measures. Similarly, scores and ranks were computed for the three deficit indices.

Productivity Results

Two distinct measures were specified that relate the ability of each route to attract patrons relative to the resources necessary to provide bus service. Consistent with factors that influence costs, productivity measures used were passengers per vehicle hour and vehicle mile.

As seen in Table 79, both measures were calculated and each bus route was ranked. Table 79 also illustrates how the rankings were then combined to generate an overall score, which itself was ranked. In terms of passenger productivity, the most productive route appears to be Route 37: Chamberlayne with the least productive route being Route 60: Hickory Hill.

Table 79: Passenger Productivity Score and Rank

Route		Passengers/Vehicle Mile		Passengers/Vehicle Hour		Combined	
		Value	Rank	Value	Rank	Score	Rank
Local							
1-2-1	Church Hill/Patterson/Monument	1.67	11	18.32	14	25	11
3-4	Robinson-Fairmount	3.05	2	27.49	5	7	3
6	Broad/Main	2.92	3	29.30	2	5	2
7	Seven Pines	1.51	12	24.13	9	21	10
10	Riverview/Jefferson	2.72	5	24.82	8	13	6
11	Laurel/17th Street	1.22	16	11.20	25	41	17
13	Main Street/Church Hill	0.78	25	9.53	29	54	28
16	Westhampton	1.01	17	12.02	24	41	17
18	Henrico Shuttle	1.44	14	21.01	11	25	11
19	Pemberton	1.32	15	16.76	15	30	15
20	Northside-Dill Road/Willow Lawn	0.90	19	11.09	26	45	23
22	Hermitage-Westbrook/Downtown	0.83	20	9.42	30	50	25
24	Crestwood	1.72	10	16.45	16	26	14
32	Ginter Park	2.77	4	28.54	3	7	3
34	Highland Park	2.68	6	26.16	6	12	5
37	Chamberlayne	3.61	1	38.31	1	2	1
56	South Laburnum	0.56	29	10.78	27	56	29
60	Hickory Hill	0.10	36	0.98	36	72	36
61	Broad Rock Shuttle	0.29	34	4.75	35	69	34
62-63	Hull Street/Midlothian	2.31	7	25.48	7	14	8
67	Chippenham	0.83	21	14.09	22	43	21
68	Lunch Time Express	0.72	27	7.10	32	59	31
70-71	Forest Hill	1.48	13	20.97	12	25	11
72-73	Ruffin Road/Ampthill	1.89	9	28.32	4	13	6
74	Oak Grove	2.00	8	22.88	10	18	9
93	Azalea Connector	0.40	32	6.03	33	65	33
Express							
26	Parham	0.58	28	14.30	21	49	24
27	Glenside	0.82	22	15.46	20	42	20
28	Fair Oaks	0.96	18	18.38	13	31	16
29	Gaskins	0.74	26	16.44	17	43	21
64	Stony Point	0.79	24	9.96	28	52	27
65	Stony Point Fashion Park/VCU Health	0.26	35	5.24	34	69	34
66	Kmart	0.56	30	9.37	31	61	32
69	Huguenot	0.79	23	16.42	18	41	17
82	Winterpock/Lowe's/Commonwealth 20	0.55	31	15.80	19	50	25
95	Richmond/Petersburg	0.39	33	12.70	23	56	29
Regular Routes		*1.90*		*22.72*			

Table 80 illustrates the range of results, which vary substantially.

Table 80: Productivity Results by Route

Measure	Best	Worst
Passengers Per Vehicle Mile	3.61	0.10
Passengers Per Vehicle Hour	38.31	0.98

The results show a fairly consistent pattern in route level productivity regardless of the performance measure. Some differences are noted, which are attributable to different speeds and vehicle utilization. Substantial differences are also noted by service type, with the express bus routes having lower productivity which reflects the nature of this service.

Deficit Results

In a similar fashion, three subsidy measures were specified (Table 81). The first three record the deficit—or amount of tax subsidy—by operating statistic in which performance is related to vehicle mile and vehicle hour. The third criterion is the ratio of subsidy (or deficit) per passenger. It should be recognized that the subsidy per passenger not only relates to route performance but also measures the equity in distributing funds to support the bus system. Consistent with the previous analyses, each route is ranked relative to each other and the results summed to attain a score that is subsequently the basis for an overall deficit ranking.

Table 81: Deficit Score and Rank

Route		Deficit/Vehicle Mile		Deficit/Vehicle Hour		Deficit/Passenger		Combined	
		Value	Rank	Value	Rank	Value	Rank	Score	Rank
Local									
1-2-1	Church Hill/Patterson/Monument	4.30	16	47.14	9	2.573	12	37	12
3-4	Robinson-Fairmount	4.18	15	37.67	3	1.370	3	21	5
6	Broad/Main	3.79	9	38.04	4	1.299	2	15	2
7	Seven Pines	3.57	5	57.12	19	2.367	10	34	11
10	Riverview/Jefferson	4.00	12	36.51	2	1.471	5	19	3
11	Laurel/17th Street	5.87	26	53.81	15	4.804	17	58	19
13	Main Street/Church Hill	4.59	19	56.42	18	5.921	19	56	18
16	Westhampton	4.35	17	52.00	13	4.325	15	45	14
18	Henrico Shuttle	3.77	8	55.03	17	2.619	13	38	13
19	Pemberton	6.07	30	76.87	22	4.586	16	68	24
20	Northside-Dill Road/Willow Lawn	7.14	31	88.12	24	7.946	25	80	28
22	Hermitage-Westbrook/Downtown	5.45	25	61.74	20	6.556	21	66	22
24	Crestwood	5.30	24	50.80	12	3.088	14	50	15
32	Ginter Park	3.81	10	39.33	5	1.378	4	19	3
34	Highland Park	4.06	13	39.58	6	1.513	6	25	8
37	Chamberlayne	3.15	1	33.35	1	0.870	1	3	1
56	South Laburnum	5.93	27	113.36	30	10.518	31	88	29
60	Hickory Hill	7.71	34	79.49	23	81.158	36	93	33
61	Broad Rock Shuttle	3.31	2	54.23	16	11.424	33	51	16
62-63	Hull Street/Midlothian	3.82	11	42.23	7	1.657	7	25	8
67	Chippenham	7.32	32	124.05	34	8.806	28	94	34
68	Lunch Time Express	4.88	23	47.82	10	6.735	22	55	17
70-71	Forest Hill	3.67	6	52.01	14	2.480	11	31	10
72-73	Ruffin Road/Ampthill	3.37	3	50.66	11	1.789	8	22	6
74	Oak Grove	3.72	7	42.64	8	1.864	9	24	7
93	Azalea Connector	4.86	22	73.09	21	12.123	34	77	26
Express									
26	Parham	4.69	20	115.37	31	8.065	26	77	26
27	Glenside	8.08	36	152.57	36	9.866	29	101	36
28	Fair Oaks	7.32	33	139.74	35	7.604	24	92	31
29	Gaskins	4.38	18	97.21	25	5.915	18	61	21
64	Stony Point	7.77	35	98.54	27	9.896	30	92	31
65	Stony Point Fashion Park/VCU Health	5.98	28	120.21	33	22.926	35	96	35
66	Kmart	6.04	29	100.41	28	10.714	32	89	30
69	Huguenot	4.75	21	98.42	26	5.993	20	67	23
82	Winterpock/Lowe's/Commonwealth 20	4.10	14	117.10	32	7.411	23	69	25
95	Richmond/Petersburg	3.39	4	111.06	29	8.743	27	60	20
Regular Routes		4.24		50.79		2.235			

As shown in Table 82, and similar to the results exhibited for productivity, route performance varies substantially. Typically, routes receive similar results for many deficit measures; although some significant differences are noted.

Table 82: Deficit Results by Route

Measure (Dollars)	Best	Worst
Deficit Per Vehicle Mile	3.15	8.08
Deficit Per Vehicle Hour	33.35	152.57
Deficit Per Passenger	0.87	81.16

In the aggregate, a generally consistent pattern of route performance emerges, although some differences are noted and the results are about as uniform as with the productivity measures. Typically, routes that attain a particular rating in terms of productivity achieve a similar performance level for the deficit measures. Differences are attributable to different speeds, vehicle utilization, and average fare.

Supply and Demand Review

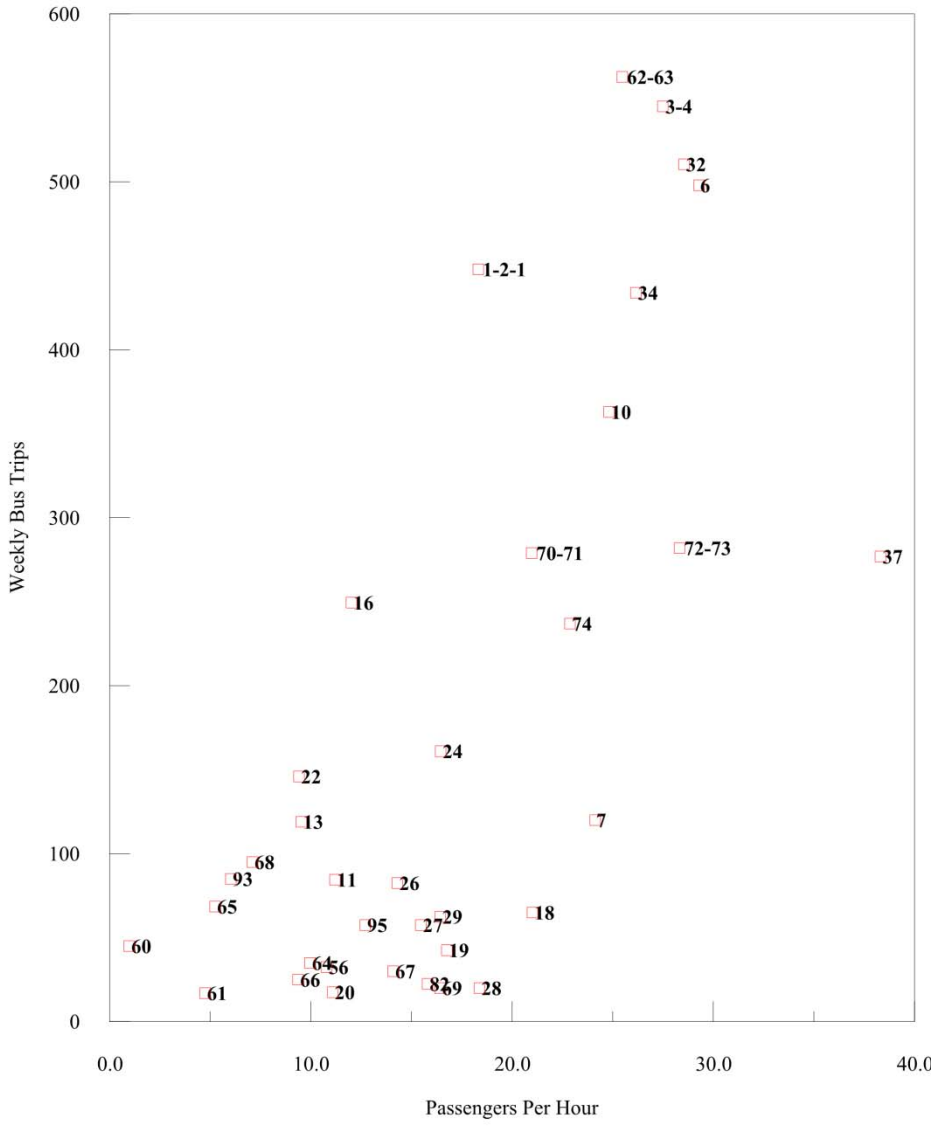
The concluding analytical technique is a review of the relative balance between the bus service provided on each route relative to its performance for certain key measures. The analysis compares the number of weekly bus trips to two performance measures: passengers per vehicle hour and farebox recovery. A ratio is computed that is merely the quotient of weekly trips and either productivity or farebox recovery. This ratio or rating is shown in Table 83 for both measures. In addition, each route was assigned to one of three categories depending on the system average. Routes with ratios less than two-thirds of the system average are rated low while routes that are one-third greater than the average are rated high. Routes with ratios that are within one-third of the system average are rated medium.

Table 83: Service Supply Characteristics

Route		Passengers Per Hour		Farebox Recovery	
		Ratio	Rating	Ratio	Rating
Local					
1-2-1	Church Hill/Patterson/Monument	24.45	High	18.46	High
3-4	Robinson-Fairmount	19.83	High	14.64	High
6	Broad/Main	17.00	High	13.26	High
7	Seven Pines	4.97	Low	4.49	Low
10	Riverview/Jefferson	14.62	High	10.26	Medium
11	Laurel/17th Street	7.54	Medium	5.99	Medium
13	Main Street/Church Hill	12.49	Medium	10.52	Medium
16	Westhampton	20.75	High	15.27	High
18	Henrico Shuttle	3.09	Low	2.76	Low
19	Pemberton	2.54	Low	2.24	Low
20	Northside-Dill Road/Willow Lawn	1.58	Low	1.77	Low
22	Hermitage-Westbrook/Downtown	15.50	High	14.63	High
24	Crestwood	9.79	Medium	8.41	Medium
32	Ginter Park	17.88	High	14.00	High
34	Highland Park	16.59	High	12.65	High
37	Chamberlayne	7.23	Medium	5.71	Medium
56	South Laburnum	3.02	Low	4.43	Low
60	Hickory Hill	45.94	High	46.07	High
61	Broad Rock Shuttle	3.58	Low	2.15	Low
62-63	Hull Street/Midlothian	22.08	High	17.04	High
67	Chippenham	2.13	Low	2.94	Low
68	Lunch Time Express	13.38	Medium	0.00	Low
70-71	Forest Hill	13.30	Medium	11.43	Medium
72-73	Ruffin Road/Ampthill	9.96	Medium	9.10	Medium
74	Oak Grove	10.36	Medium	7.71	Medium
93	Azalea Connector	14.10	High	12.80	High
Express					
26	Parham	5.77	Low	5.50	Low
27	Glenside	3.72	Low	4.68	Low
28	Fair Oaks	1.09	Low	1.45	Low
29	Gaskins	3.80	Low	3.23	Low
64	Stony Point	3.51	Low	2.81	Low
65	Stony Point Fashion Park/VCU Health	13.06	Medium	13.66	High
66	Kmart	2.67	Low	2.16	Low
69	Huguenot	1.22	Low	1.05	Low
82	Winterpock/Lowe's/Commonwealth 20	1.42	Low	1.38	Low
95	Richmond/Petersburg	4.53	Low	4.24	Low
System Average		*10.40*		*8.58*	

As shown in Figure 79, the weekly trips are reviewed in relation to passenger productivity in a graphical fashion. The most desirable pattern would be weekly trips directly proportional to passengers per hour. In essence, bus routes with high passengers per hour should have a relatively high number of weekly trips. Conversely, low passengers per hour should result in fewer numbers of weekly trips.

Figure 79: Service Supply Characteristics – Passengers per Hour

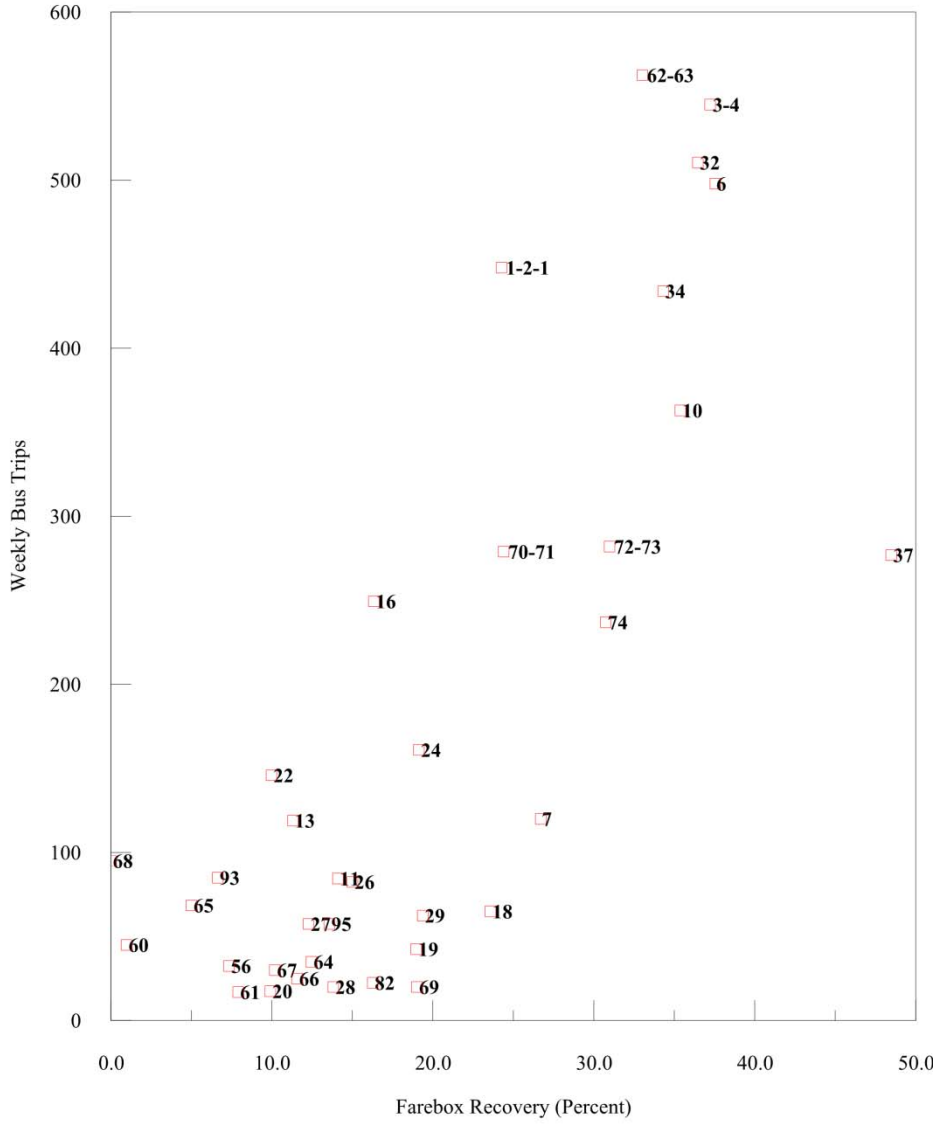


The routes exhibit a somewhat linear pattern, which indicates a less than strong relationship between the supply of service and the passenger productivity. Moreover, a regression analysis was performed that quantitatively establishes this pattern. This suggests that system supply and demand characteristics are balanced to an extent, but for several routes there is no directly proportional relationship between service levels and performance. It is recognized that service levels are

established not only in response to demand, but also with consideration of policy levels that indicate the need for service in numerous neighborhoods.

In a similar manner, the relationship between weekly trips and farebox recovery were plotted (Figure 80). This exhibit also confirms the relative balance between transit supply and demand. The regression analysis indicates a more linear relationship for farebox recovery than productivity. Routes with better financial performance are provided more service with lower performing routes having less frequent service.

Figure 80: Service Supply Characteristics – Farebox Recovery



Conclusion

This report has presented performance results for the 36 local and express bus routes operated by GRTC for a representative and recent one year period. A variety of analytical techniques have been used to present a "snapshot" of financial, productivity, and other types of performance. The techniques provide different perspectives of route performance. In the aggregate, the individual route performance is similar—but not identical—with the different techniques. The procedures are diagnostic in that they provide one input to subsequent service planning steps. Other information, such as that derived from the ride checks and passenger surveys will also influence service proposals. Other considerations, many of which are non-quantifiable (such as equity and need) will also influence transit decisions. Nonetheless, the range of techniques and the different performance measures will facilitate identification of both deficiencies and opportunities.

4

Choice Riders

Introduction

Even successful transit agencies have opportunities to expand their ridership by encouraging existing riders to increase their use as well as attracting new riders. In both cases, the key to expansion is creating a better fit between transit services and the transportation needs of residents. The evaluation already presented focused on the needs of riders currently on board GRTC buses. The focus of this analysis will be on a broader representation of regional residents, including many that have never set foot on a public bus. Many residents that do not use GRTC buses are potential choice riders, meaning that they have access to other modes of transportation, but could potentially choose to use transit service. Potential choice riders are fertile ground for increasing ridership because unlike many current users of the service, they do not already depend on GRTC to fulfill their transportation needs, but might use the service under the correct circumstances.

The vast majority of the regional population falls into the category of potential choice riders, and despite efforts to improve transit service, most of these people will likely remain potential choice riders. Choice riders are difficult to attract because they demand a high level of service that can cut down the time, costs, and hassles of traveling by other modes, namely private vehicles. Successfully competing for riders against automobile travel is no small challenge for a public bus system. There are obviously many advantages to traveling by cars, but there are also many advantages to using GRTC bus service. Cultivating the advantages of the bus system while reducing barriers to transit use will help to increase the number of choice riders using the bus system. Even if GRTC is able to attract a small percentage of all potential choice riders, those choice riders would represent a significant rider increase for GRTC.

Information on typical residents living in the metropolitan Richmond area was collected through a household phone survey. Randomly selected households in the metropolitan Richmond region—including households representing the City of Richmond, Henrico County, Chesterfield County, and Hanover County—were called to complete surveys in January 2006. These surveys aimed to collect information on the general public's travel behavior, demographic characteristics, and issues that may

prevent use of the system. This information provides insight into what kind of service could potentially attract new choice riders. By addressing these issues and better tailoring GRTC bus service to the needs of a broader slice of residents, the bus system will be attractive to more people and ridership will increase.

Household Survey

Household surveys regarding transit use, transportation behaviors, and demographic characteristics were conducted with 1,034 randomly selected households in the Richmond region between January 8 and 28, 2007. A Random Digit Dialing (RDD) telephone methodology was used to select households for participation. Telephone numbers were randomly generated to ensure that both listed and unlisted telephone households in the target areas were covered with roughly equal probability of selection. Survey calls were made were from 5 p.m. to 9 p.m. Monday through Friday and from 12:00 p.m. to 6:00 p.m. Saturday and Sunday. Additionally, callbacks were completed during other hours as requested by survey respondents. The survey produced a response rate of approximately 64 percent. The success of the survey ensures the characteristics, opinions, and travel behaviors of a large cross-section of households and individuals in the region are represented.

Telephone interviewing was conducted from a centralized telephone interviewing facility under conditions of strict quality control. A portion of each interviewer's work was silently monitored (using FCC approved equipment) to ensure that all procedures were followed and that each question was worded exactly as written in the survey questionnaire (see Appendix C). A Computer Assisted Telephone Interviewing (CATI) system (software by Sawtooth Software) was used to make dialing attempts, ensure accuracy in recording/skip patterns, and monitor overall telephone center performance.

An approximately equal number of surveys were collected from the four jurisdictions comprising the greater Richmond region: the City of Richmond, Hanover County, Henrico County, and Chesterfield County. Respondents from each of these four jurisdictions represent approximately a quarter of all household survey results (see Table 84). Collecting a large sample from each jurisdiction is necessary to determine if responses are statistically correlated to the home jurisdiction of respondents. A review of the survey results found that almost no responses were highly correlated to the home jurisdiction of respondents, meaning that respondents did not appear to be answering questions in similar ways based primarily on their geographical and municipal locations. A large sample from each jurisdiction also helps reduce bias for extrapolating the results for the entire regional population.

Table 84: Household Phone Survey Responses

Jurisdiction	Surveys Conducted	
	Surveys	Percent
Chesterfield County	254	24.6%
Henrico County	272	26.3%
Hanover County	255	24.7%
City of Richmond	253	24.5%
Total	*1,034*	*100.0%*

Since survey response rates do not correspond to the actual population sizes of each jurisdiction, it was necessary to factor survey responses to better represent the opinions and behaviors of the regional population. Without factoring, responses from Hanover County would be over represented in the sample and the other three jurisdictions would be under represented. Since Hanover County is the most rural jurisdiction and does not currently have transit service, the collected survey results would likely be slightly biased against transit use. The factored survey results account for the regional distribution of households by weighting the responses according to the number of households in each jurisdiction (see Table 85). Responses were factored based on household data taken from the 2005 American Community Survey (ACS) conducted by the Census Bureau. The factored results presented in the analysis below provide a more accurate picture of the characteristics, opinions, and transportation behaviors of the entire regional population. Survey results by jurisdiction are provided in Appendix D.

Table 85: Survey Results Factoring

Jurisdiction	2005 ACS Households	ACS Percentage	Households Surveyed	Survey Percentage	Factor	Factored Percentage
Chesterfield	105,808	31.2%	254	24.6%	416.6	31.9%
Hanover	35,211	10.4%	255	24.7%	138.1	10.6%
Henrico	115,999	34.2%	272	26.3%	426.5	32.7%
Richmond	82,199	24.2%	253	24.5%	324.9	24.9%
Total	339,217	100.0%	1034	100.0%		100.0%

Household Survey Key Findings

The household survey revealed several important findings regarding Richmond-area residents' transportation needs, especially how they currently use transit and their potential for using transit in the future. These findings will play an important role in informing the planning process for future GRTC service. By responding to the transportation needs of typical residents, GRTC will be able to grow its ridership and play an even more important role in the region's transportation network. Key findings of the household survey presented below suggest that many residents are willing and interested in using public transportation.

- Approximately 25 percent of respondents indicated that a member of their household has used some form of public transportation during the past three years
- 47 percent of respondents indicated they did not have transit service near their home. Of these 47 percent, 63 percent said they would like to have transit service available for use near their home.
- The majority of people surveyed likely think the closest bus stop is located too far away for regular use and approximately 26 percent of respondents did not know the location of the closest bus stop.
- Only approximately 38 percent of respondents' work or school destinations have GRTC service.
- Approximately 38 percent of respondents would consider using GRTC to commute whereas only seven percent of respondents currently commute by bus.
- For local bus service, GRTC charges a fare of $1.25. Just under a third of respondents seem willing to pay this approximate price or more.
- For express bus service, GRTC charges a fare of $1.75. Although many respondents did not put a value on express bus service, over a quarter of respondents appear willing to pay this approximate price or more.
- Nearly 75 percent of respondents indicated that they believe the government should provide financial support for transit.

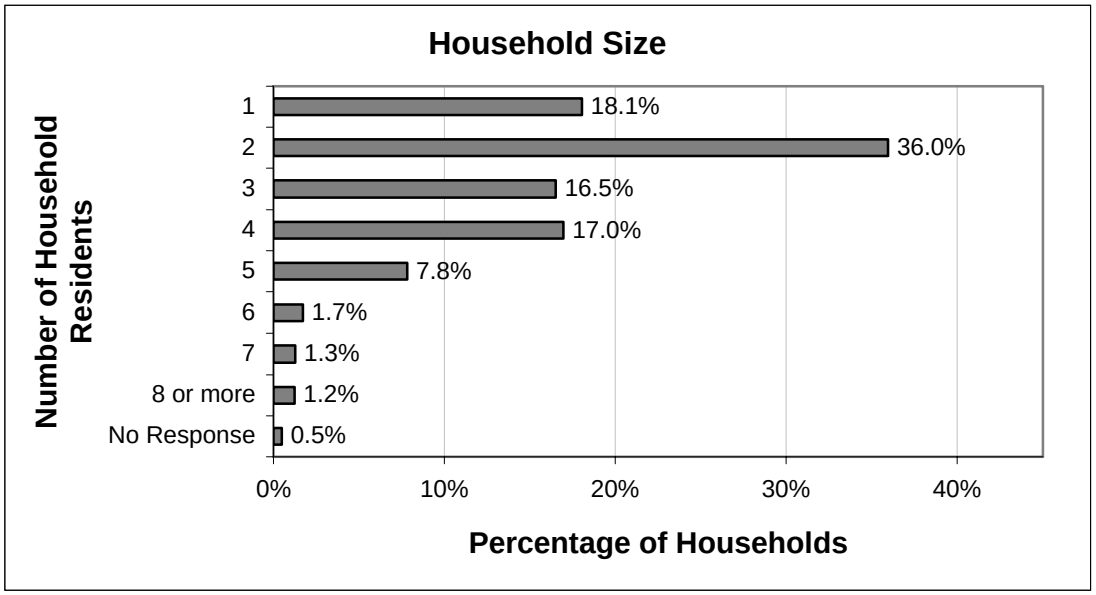
These and other findings are identified and supported in the full household survey analysis presented below.

Household Characteristics

Information collected regarding the characteristics of respondents' households helps provide a more complete picture of who lives in and near the GRTC service area. While demographic characteristics associated with respondents' households do not determine transit use, better understanding both the potential and existing market for transit use can help GRTC refine its service to better fit with the needs of the regional population. These household characteristics also provide a context for interpreting responses collected through the phone survey.

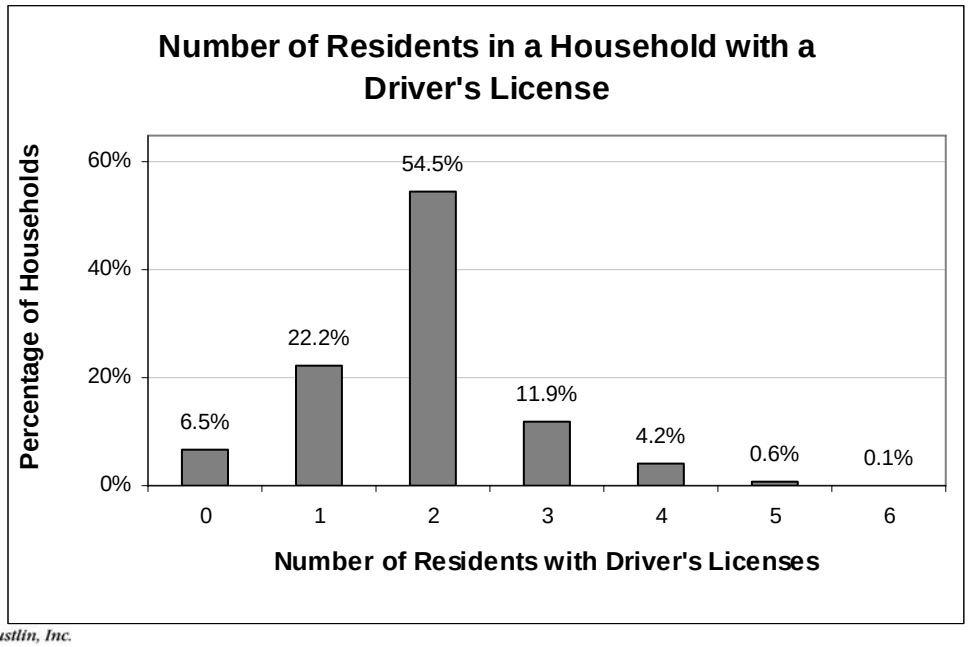
Figure 81 shows the size of households within the region. The vast majority of households have five or fewer residents and approximately 54 percent of households comprise only one or two residents. Household size can be an important consideration in planning transit service especially when coupled with vehicle ownership data. Large households with limited private vehicle availability may depend on transit service to meet the transportation needs of all household members.

Figure 81: Number of Persons Residing in Household



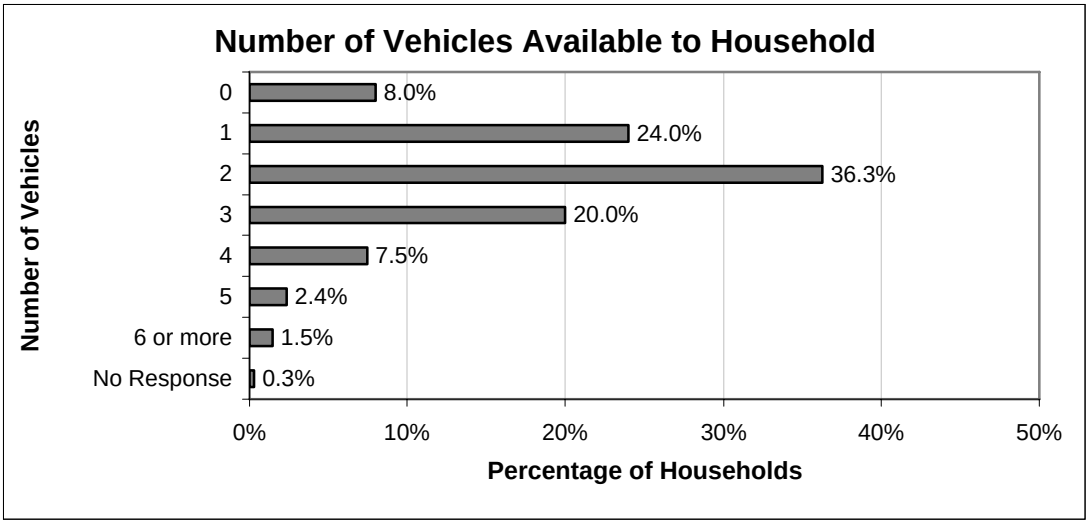
Households with members that do not have driver's licenses may also have a potential need for transit service. As Figure 82 shows, 6.5 percent of households in the region do not have a single member with a driver's license. Households without any licensed drivers will likely depend on transit at least some of the time for their transportation needs. The table also shows that the vast majority of households have only one or two members with driver's licenses. Compared to the table for household size, it appears that many households have several members that are not licensed drivers. While some of this discrepancy can be explained by the presence of children in the household who do not travel by themselves, there are also likely older children and senior citizens who do not have licenses but still need to make trips alone. Transit service can provide residents not capable of driving with independent transportation options.

Figure 82: Number of Household Residents with Driver's Licenses



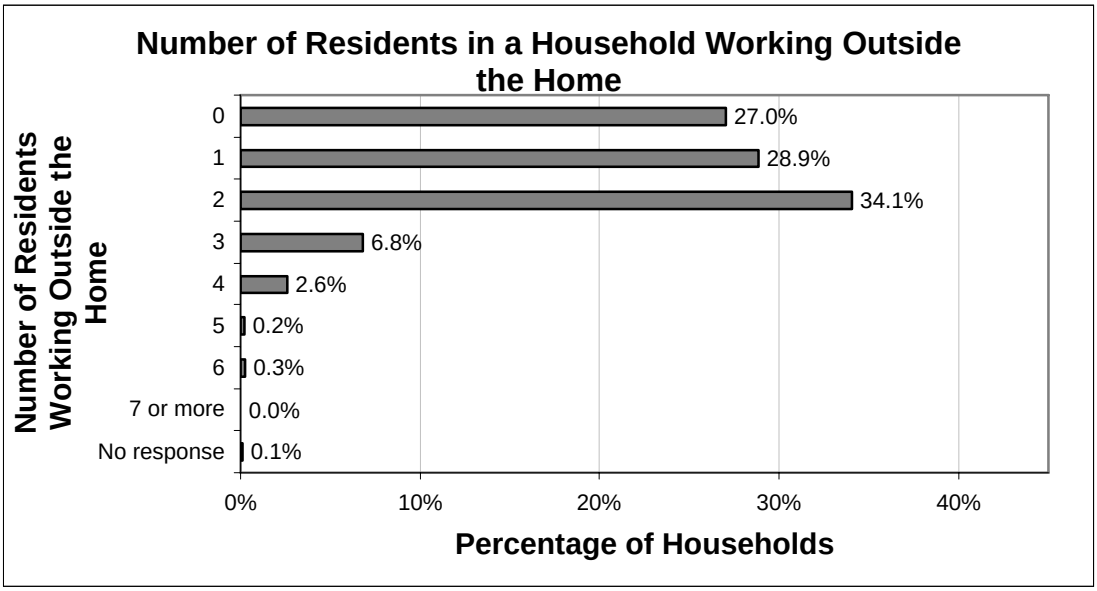
One of the greatest indicators of the need for potential transit service is a household with no or too few private vehicles (see Figure 83). Regardless of the number of licensed drivers residing in a household, if there are no cars available, those licensed drivers are going to need to find another mode of transportation. Approximately eight percent of households do not have a vehicle available. Additionally, another 13 percent of multi-person households (two or more members) have only one vehicle available. Combined, these two statistics suggest that as many as 20 percent of households might not have adequate access to private vehicles. At least some of the trips made by members of these households will or could be served by GRTC bus service.

Figure 83: Number of Vehicles Available to Household



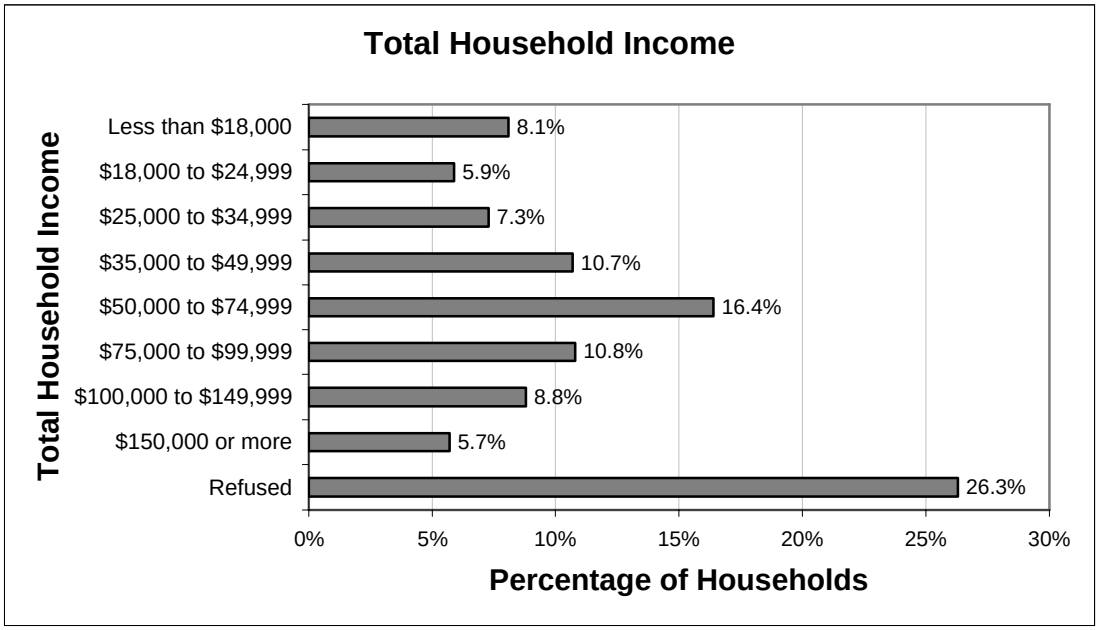
The number of household residents who are employed outside of the home provides an indication of the number of commute trips that households within the region will generate. Figure 84 reveals that approximately 53 percent of households have one or two members who work outside of the home. This percentage rate corresponds to typical household arrangements that contain one or two adults, either living on their own or with other dependent relatives. The region also appears to have a high percentage of households with no members working outside the home. Twenty-seven percent of households responded in the survey that no members leave for work. Households that do not generate commute trips likely have members who are unemployed, self-employed, retired, and telecommuters. The rate of households with no residents employed outside the home may be influenced by the response rate of senior citizens.

Figure 84: Number of Household Residents Employed Outside the Home



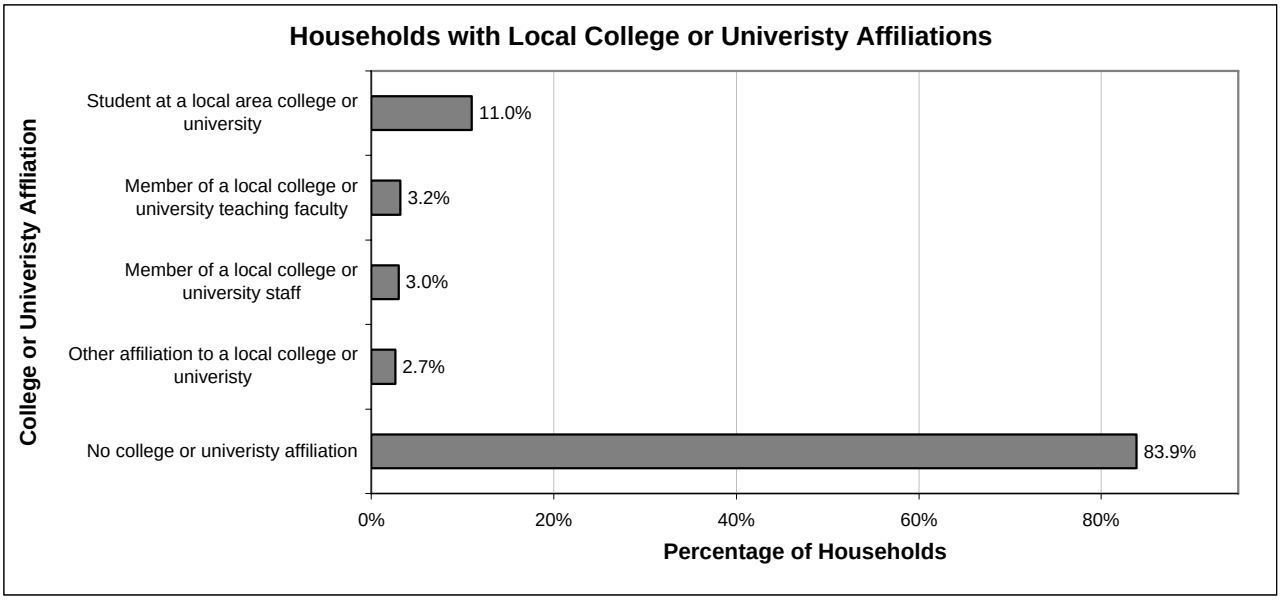
Low-income households are another potential group of residents who may depend on transit service. For the most part, respondents appeared to be financially stable based on reported total household incomes. Even though a quarter of respondents refused to answer the question, approximately 40 percent of households surveyed made over $50,000 per year (see Figure 85). Thirteen percent of households subside on $24,999 or less per year. Households with low incomes may not be able to afford private vehicles or automobile insurance, especially for large families or multiple adults within the same household. These households may rely on GRTC for at least some of their transportation needs. Since the incomes of 26 percent of households are unknown, there may be far more households with low-incomes in the region.

Figure 85: Respondent Household Total Income



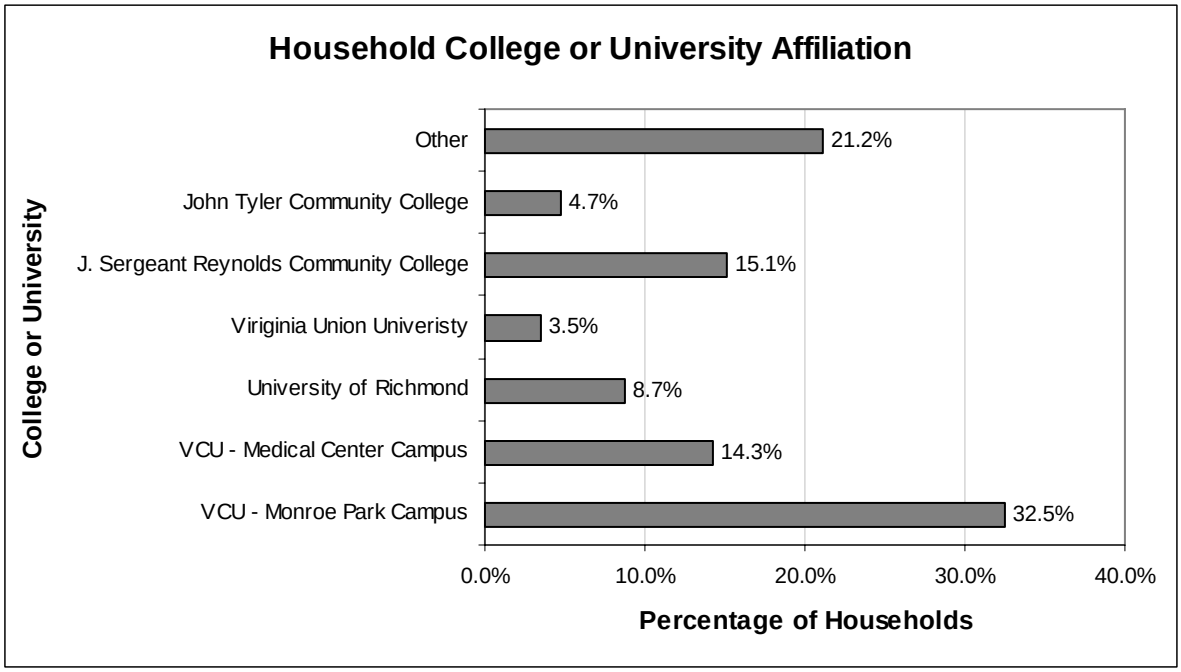
Affiliation with a local college or university is another source of information regarding residents' transportation needs. Members of university and college communities, especially students, frequently make multiple trips throughout the day rather than a two-trip, typical commute pattern. College students also may not yet have the financial resources to afford the purchase and maintenance of a private vehicle. Figure 86 shows that a significant percentage of households have members affiliated in some way with a local college or university. Eleven percent of households have at least one member attending a local college or university as a student. A smaller percentage of households (approximately 9 percent) are affiliated with local higher learning institutions in other ways, such as faculty or staff.

Figure 86: Household Affiliation with Local College or University



Not only does a household's affiliation with a local college or university reveal some information about that household's transportation needs, but the specific college or university with which the household is affiliated is also telling. Knowing which college or university members of a household are affiliated with provides information regarding the destination of some trips made from the household. Figure 87 shows the colleges and universities with which households are affiliated. Approximately 47 percent of households with connections to local colleges or universities are affiliated with one of the two Virginia Commonwealth University campuses located in downtown Richmond.

Figure 87: College or Universities with which Households are Affiliated

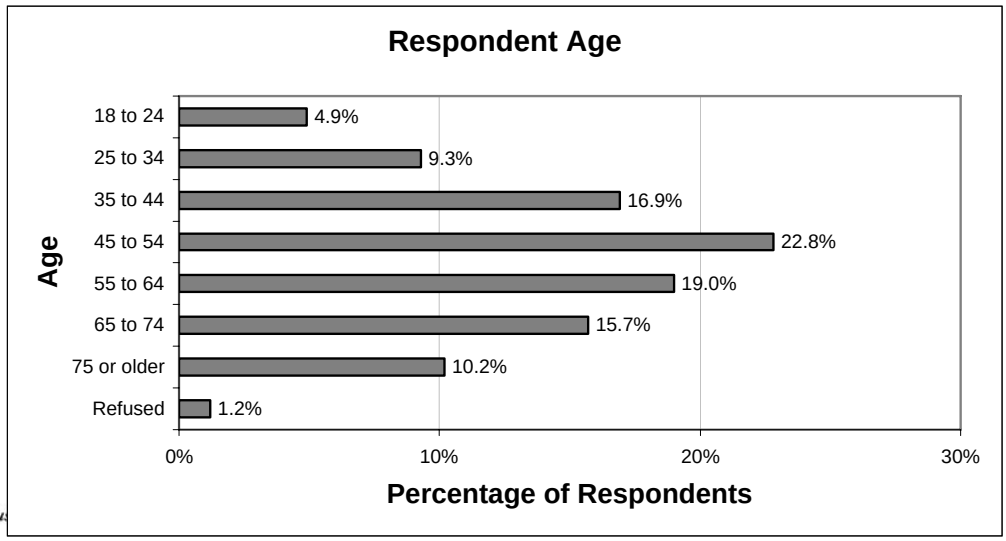


Personal Characteristics

In addition to the household characteristics, personal characteristics of respondents were collected as part of the household survey. These responses provide a snapshot of who was responding to the survey questions. Since several households did not participate in the study, it is important to understand who did answer survey questions and any possible bias in the results based on who did reply.

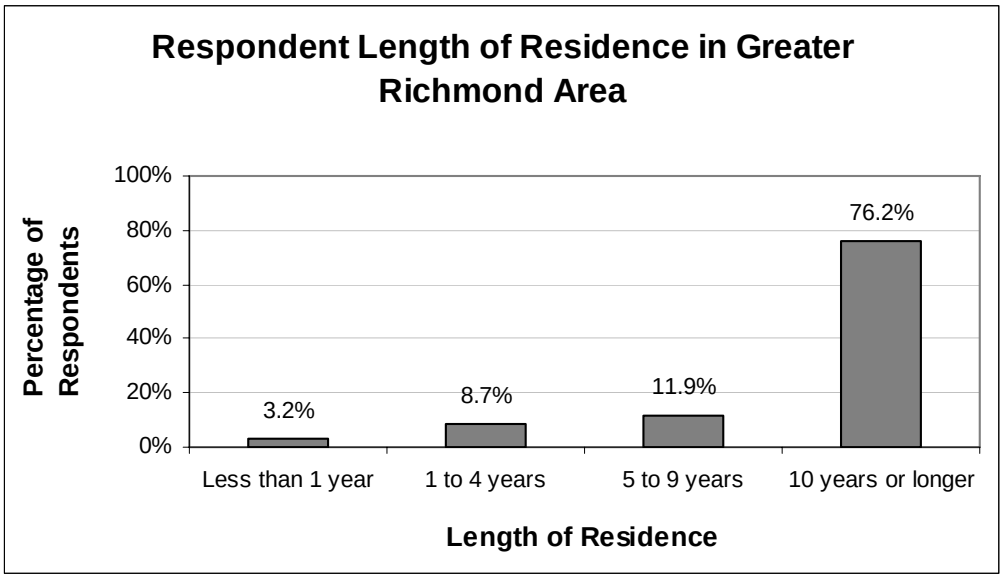
Only household members over the age of 18 were permitted to participate in the survey. Approximately 45 percent of respondents were age 55 or older (see Figure 88). The largest age range represented in the sample was age 45 to 54 (22 percent). Relatively young respondents comprise the smallest group of respondents; 14 percent of respondents were under the age of 35.

Figure 88: Respondent Age



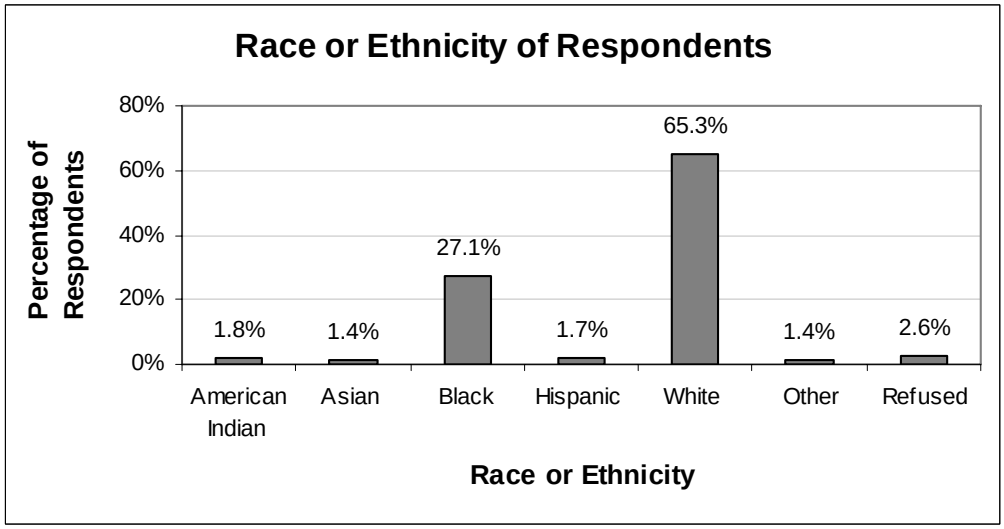
Over three quarters of respondents have lived in the greater Richmond area for 10 years or longer (see Figure 89). Eighty-eight of all respondents have lived in the region for at least five years. Therefore, almost all respondents have sufficient familiarity with the regional transportation network, including GRTC.

Figure 89: Respondent Length of Residence



Survey respondents were asked to indicate their racial or ethnic backgrounds. Since racial and ethnic groups overlap and respondents could indicate affiliation with more than one group, the categories presented in Figure 90 total more than 100 percent. The majority of respondents identified as white (65 percent). Respondents identifying as black comprised the second highest identity category in the sample (27 percent).

Figure 90: Respondent Racial or Ethnic Identity



Survey Demographics Compared to Census Demographics

The household and personal characteristics collected through the survey provide an important function: these results can be compared to data available from the Census Bureau to determine how accurately the household sample represents the regional population. In a household phone survey, it is difficult to garner a 100 percent response rate, which would be required to generate a truly random sample representing the entire regional population. A response rate of less than 100 percent—the household survey had a response rate of 65 percent—does not necessarily mean the sample cannot reveal something about the entire population. A lower response rate does mean that respondent characteristics should be checked against characteristics of the entire population to reveal any possible biases in the sample. In that case, any potential biases identified can be taken into account when interpreting survey results.

Compared to the 2000 Census, the household survey sample appears to be slightly skewed toward older respondents (see Figure 91 through Figure 94). For each of the jurisdictions, respondents represented older age ranges in disproportionate rates to what would be expected based on the 2000 Census data. A truly random sample should produce an age distribution very similar to the Census results, which has a nearly 100 percent response rate. One explanation for the discrepancy between the survey results and the 2000 Census data is a change in population age over the last seven years, possibly the reflecting aging baby-boomers and geographically mobile younger adults. Another plausible explanation is that older residents are more accessible to surveyors and more willing to participate in surveys. Older residents, especially retirees, are more likely to be at home and to have landlines, which makes it easier for surveyors to reach these residents. Younger residents are more likely to rely on cell phones as their primary phone line. Even though cell phone numbers were included in the random dial survey, it is easier for cell phone users to screen out calls from unknown callers. Therefore, it is reasonable to assume that the age distribution discrepancy is due to a slight sampling bias toward older residents. This bias could potentially favor suburban living and private vehicle use. Older residents, especially senior citizens, may also favor transit as an important replacement for driving a personal vehicle.

Figure 91: Comparison of Age Distribution in Richmond

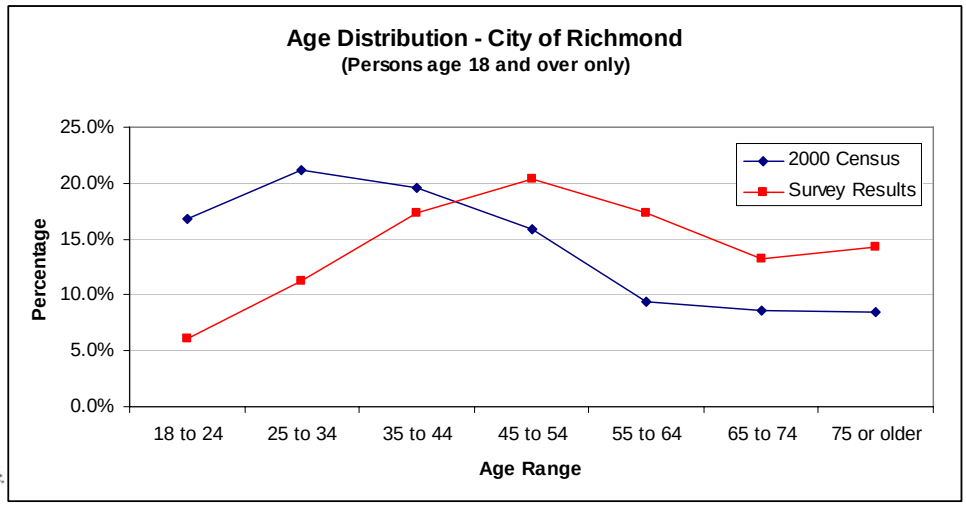


Figure 92: Comparison of Age Distribution in Hanover

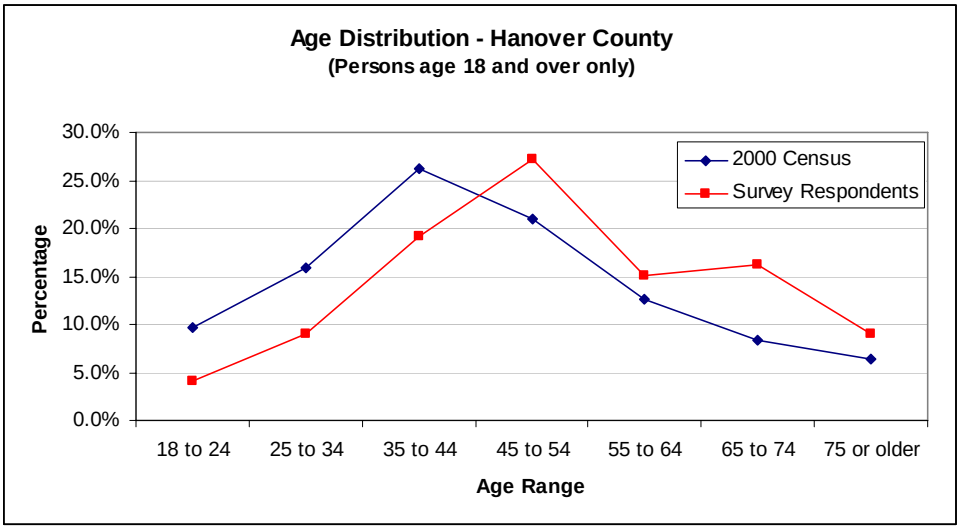


Figure 93: Comparison of Age Distribution in Henrico

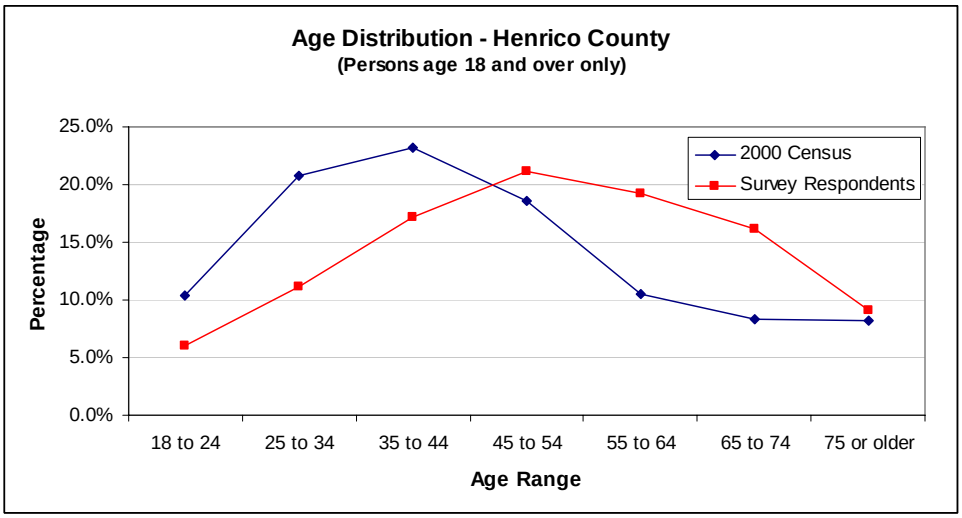
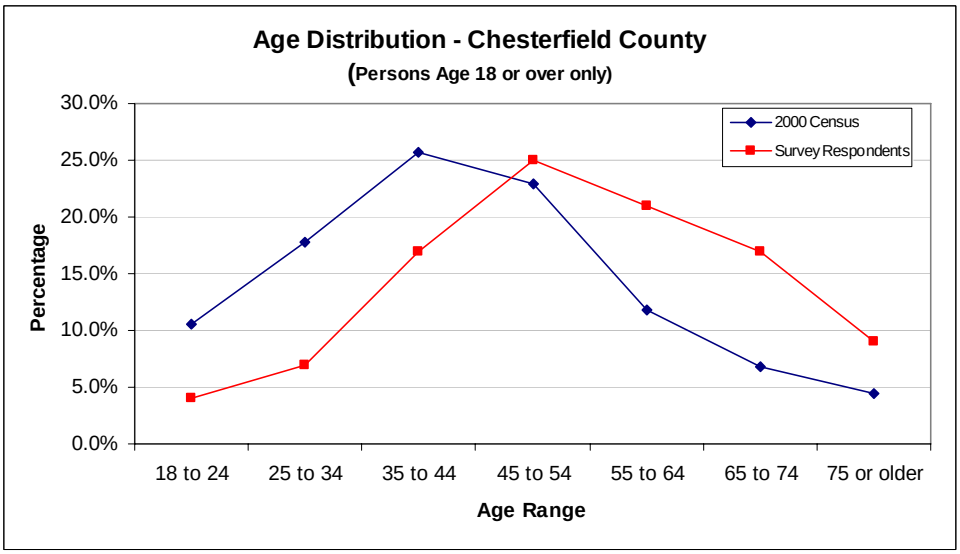


Figure 94: Comparison of Age Distribution in Chesterfield



The estimated mean household size of survey respondents appears to be slightly larger than would be expected based on the 2000 Census data, especially in Richmond and Henrico (see Table 86). The larger household sizes in the sample data may correlate to the disproportionate response of older residents, who likely have larger families with older members rather than young residents. Households with larger families and older members may appear to have greater transportation needs than typical families in the region. Therefore, questions regarding household use of transportation services may over represent the transportation needs of regional households.

Table 86: Estimated Mean Household Size Comparison

	2000 Census	Household Survey
Richmond	2.20	2.61
Hanover	2.71	2.79
Henrico	2.39	2.80
Chesterfield	2.73	2.82

Compared to the 2000 Census data, household survey respondents have higher incomes (see Table 87). Although the total household incomes of survey respondents are higher than the household incomes reported in the Census data, the buying power of the dollar has decreased between 1999 and 2007. Therefore, although survey respondents have higher mean incomes than reported for the entire population in 2000, they do not appear to be better off. Since inflation is region specific, it is difficult to determine exactly how 2007 incomes compare to 1999 incomes for the Richmond region. Based on the national consumer price index (CPI), it appears that the mean incomes of survey respondents may have even less buying power than the mean incomes of the entire population of households. Although it is difficult to compare these two sets of data, it does appear that the mean incomes found through the survey for each jurisdiction follow a similar pattern and distribution as in the 2000 Census, suggesting a fairly accurate inclusion of respondents from all income ranges.

Table 87: Estimated Mean Household Income Comparison

	2000 Census (1999 $)	Household Survey (2007 $)
Richmond	$44,667	$50,861
Hanover	$67,623	$75,577
Henrico	$60,296	$68,091
Chesterfield	$67,552	$74,474

Conclusion

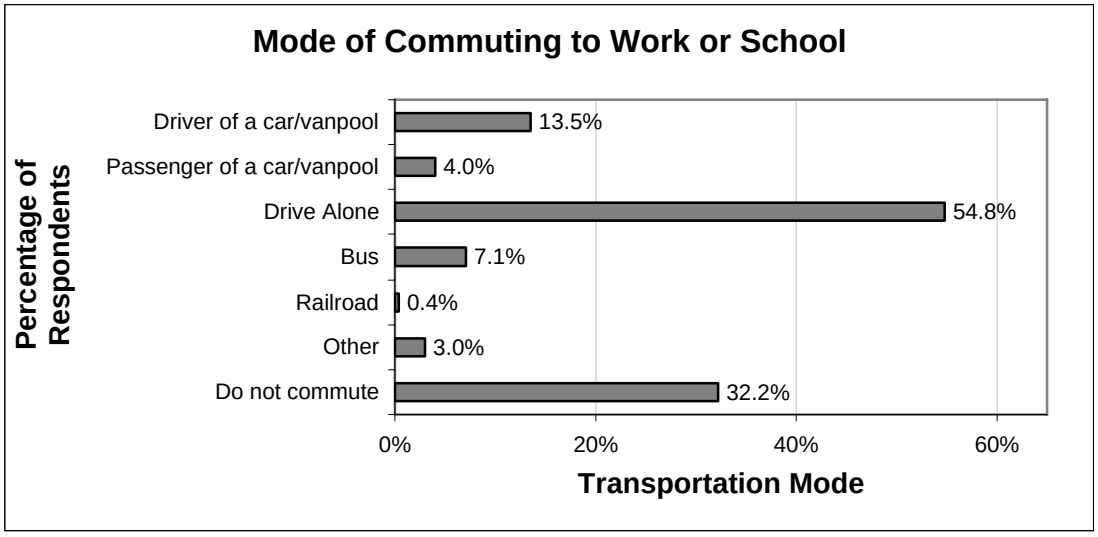
Comparing select household and personal characteristics from the survey sample to 2000 Census data shows that the survey sample is not a perfect reflection of the 2000 population. The difference between the survey respondent characteristics and those of the 2000 Census population may, in part, be attributable to changes in the composition of the regional population over the last seven years. At least some of the discrepancy is likely the result of a slight under representation of certain groups of residents in the sample, specifically younger residents and residents living in smaller households. Although the sample may not precisely reflect the regional population, it is difficult to know how this difference affects the survey responses. If opinions and travel behaviors are random throughout the population, then the results may still largely be an accurate representation of the region. Since some opinions and behaviors are likely correlated with age, it is reasonable to suspect a slight bias towards the opinions and behaviors of older residents. Since there is only a slight over representation of older residents and larger households, the survey results will still provide a very informative picture of how people travel in the region and what they think of transit service. Since there is no way to correct for any potential bias, it is important that all results are considered critically based on the characteristics of the respondents included in the sample.

Travel Behavior

Improving existing transit service requires GRTC to find ways to better match its bus service to the transportation needs of regional residents. The transportation needs of residents are in part revealed by their existing travel behaviors, such as how, when, and where they commute. By tailoring bus service to better accommodate these existing travel behaviors, GRTC can make bus service a more viable option for a larger portion of the population.

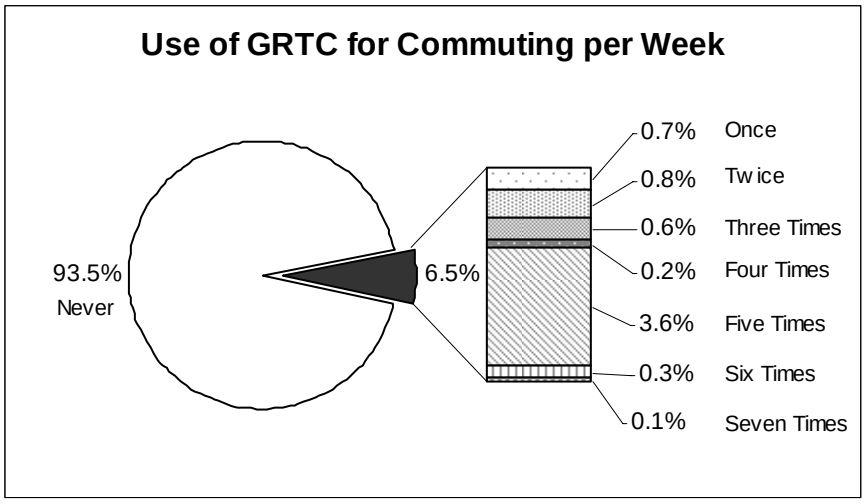
Like most mid-sized American cities, the majority of Richmond-region residents commute to work by driving alone (see Figure 95). Attracting drive-alone commuters out of their cars and onto public buses is a challenging task. GRTC will have to offer an extremely high level of service that can compete with the reliability and ease of a personal vehicle. Although these commuters may be difficult to attract, there are another group of commuters who may be more amenable to bus service: members of car/vanpools. Participants in car/vanpools have already shown a willingness to take advantage of alternative commute options, such as reduced costs. Therefore, members of car/vanpools might be more willing than a typical driver to join the seven percent of respondents already using transit service under the right circumstances.

Figure 95: Commute Mode



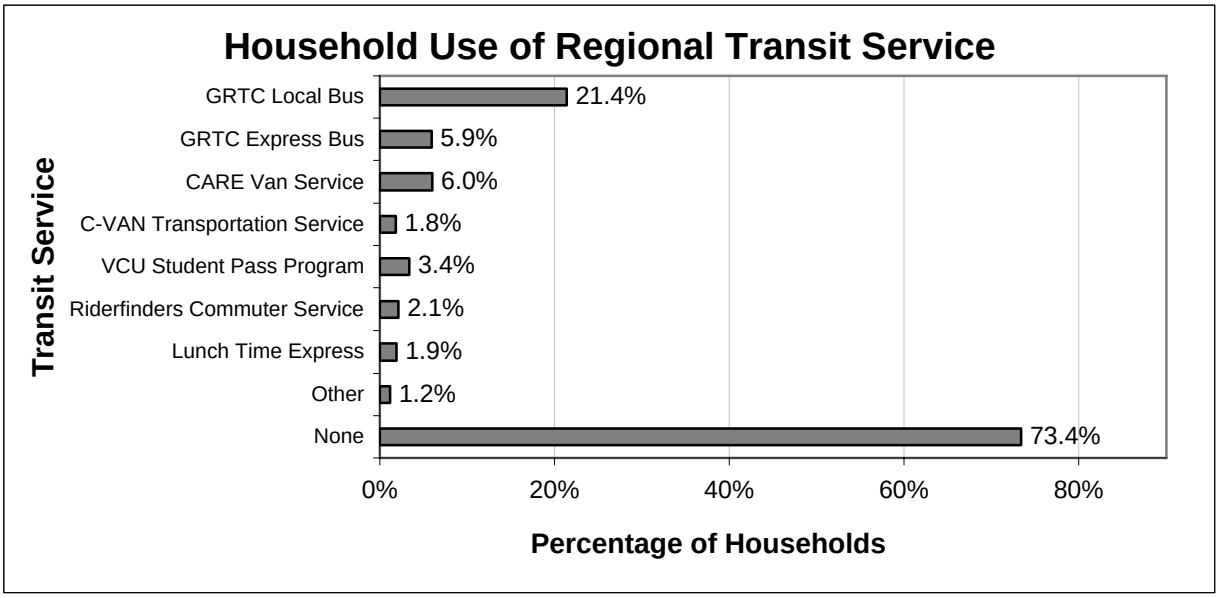
In addition to attracting new commuters, it is important to continue to meet the needs of the seven percent of the population already commuting by bus. Examining the GRTC use frequency of residents who commute by public transit reveals that the majority of these bus riders use the service five days a week, which corresponds to the typical five day work week (see Figure 96). There are also a significant number of commuters who use GRTC to commute four or fewer times per week. Although some of these respondents may not need to commute five times a week, others may only rely on the bus when other options fail. Attracting more use from current riders can improve GRTC's ridership by better meeting the needs of the existing ridership base.

Figure 96: GRTC Use Frequency for Commuting



Although only seven percent of respondents use GRTC service on a regular basis to commute, **a far larger percentage of the population has used some form of public transportation over the past three years (see Figure 97). Approximately a quarter of respondents indicated that a member of their household has used some form of public transportation during this period**. GRTC local bus service was the most commonly used transit service followed by GRTC express bus service and CARE paratransit service, three of GRTC's largest service offerings. The discrepancy between GRTC use reported for commuting and use reported for all trips in the last three years illustrates that the importance of GRTC to the community is greater than simply the number of daily riders. Residents rely on GRTC when they seek other transportation options. Also, there may be high turnover in GRTC riders, who use GRTC when seeking work but stop using the service when they find another mode of transportation or who rely on GRTC when another mode falls through. Residents without personal vehicles may have other arrangements for getting to work, but rely on transit for non-work trips. This finding suggests that a fairly large percentage of households have members familiar with GRTC service who use bus service under certain conditions and benefit from the availability of public transit.

Figure 97: Household Members' Transit Use over Past Three Years



The survey found that respondents' commute destinations largely correlate to the monocentric development pattern of the region. The urban core in the City of Richmond attracts the largest share of commute trips, approximately 43 percent (see Table 88). The two large, developing suburban counties adjacent to Richmond—

Henrico and Chesterfield—account for another 50 percent of commute trips.[10] Rural Hanover County attracts the smallest percentage of regional residents for employment purposes. The table also shows that for each jurisdiction, the largest percent of commute trips have destinations within the same jurisdiction where the trip originated.

Table 88: Commute Origins and Destinations

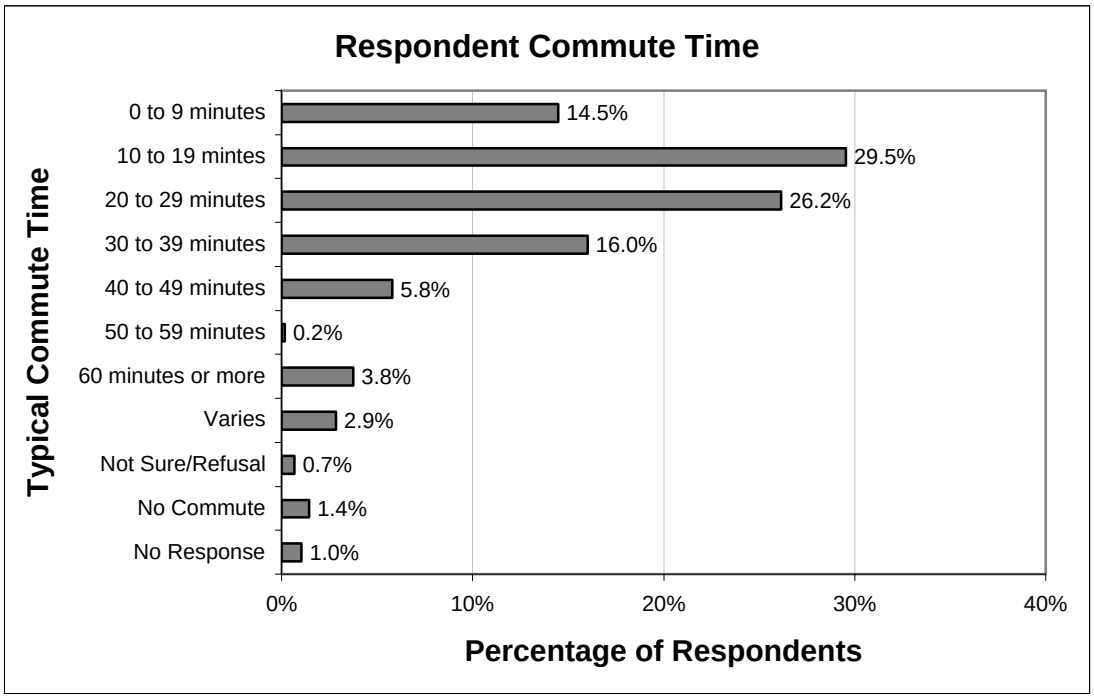
Origin	Destination					*Total*
	Richmond	Hanover	Henrico	Chesterfield	Other	
Richmond	16.7%	0.8%	3.5%	2.8%	2.1%	*25.9%*
Hanover	2.7%	3.7%	3.3%	0.8%	1.4%	*11.8%*
Henrico	12.5%	2.2%	17.3%	1.8%	2.6%	*36.4%*
Chesterfield	10.8%	2.0%	4.5%	14.2%	3.8%	*35.2%*
Total	*42.6%*	*8.7%*	*28.6%*	*19.6%*	*9.8%*	

The length of commute measured in time often plays a major role in an individual's decision of how to travel to work. Frequently, driving alone is the most time efficient means of transportation because it offers personalized point-to-point travel. Approximately 70 percent of commute trips in the region take under 30 minutes, with approximately 45 percent of commute trips taking under 20 minutes (see Figure 98). The relatively short commute times suggest that many of these trips could be served by GRTC efficiently. Generally, the short trips can be served by public transit without taking too much longer than personal automobile trips. In denser urban areas, like downtown Richmond, transit may even be the fastest transportation mode. Longer trips—such as those from the surrounding counties to downtown Richmond—are best served by express bus service. For commuters not already using transit, longer commute times on transit vehicles may act as a deterrent to transit use. Offering services that can compete with or speed up commuters' current commute times will help attract new riders. If transit service cannot provide competitive travel times, some other aspect of the service will need to be improved to attract and retain choice riders.

♦

[10] Some residents commute to more than one of the four jurisdictions during a typical work week, explaining how responses in the table total more than 100 percent.

Figure 98: Typical Commute Time



The start and end of the work or school day largely dictates the peak travel times during weekdays. It is during these times that GRTC generally focuses its transit service, offering the most frequent bus service. Increasing service during the morning and evening peak periods makes it easier to commute because buses come frequently and are not overcrowded. Work and school start times in the Richmond region conform to typical morning peak travel times; approximately 80 percent of trips are made to reach work or school starting between 6:00 a.m. and 10:00 a.m. (see Figure 99). The chart also reveals that people continue to commute throughout the remainder of the day, which suggests there are opportunities for GRTC to serve commute trips all day long.

Figure 99: Typical Work or School Start Time

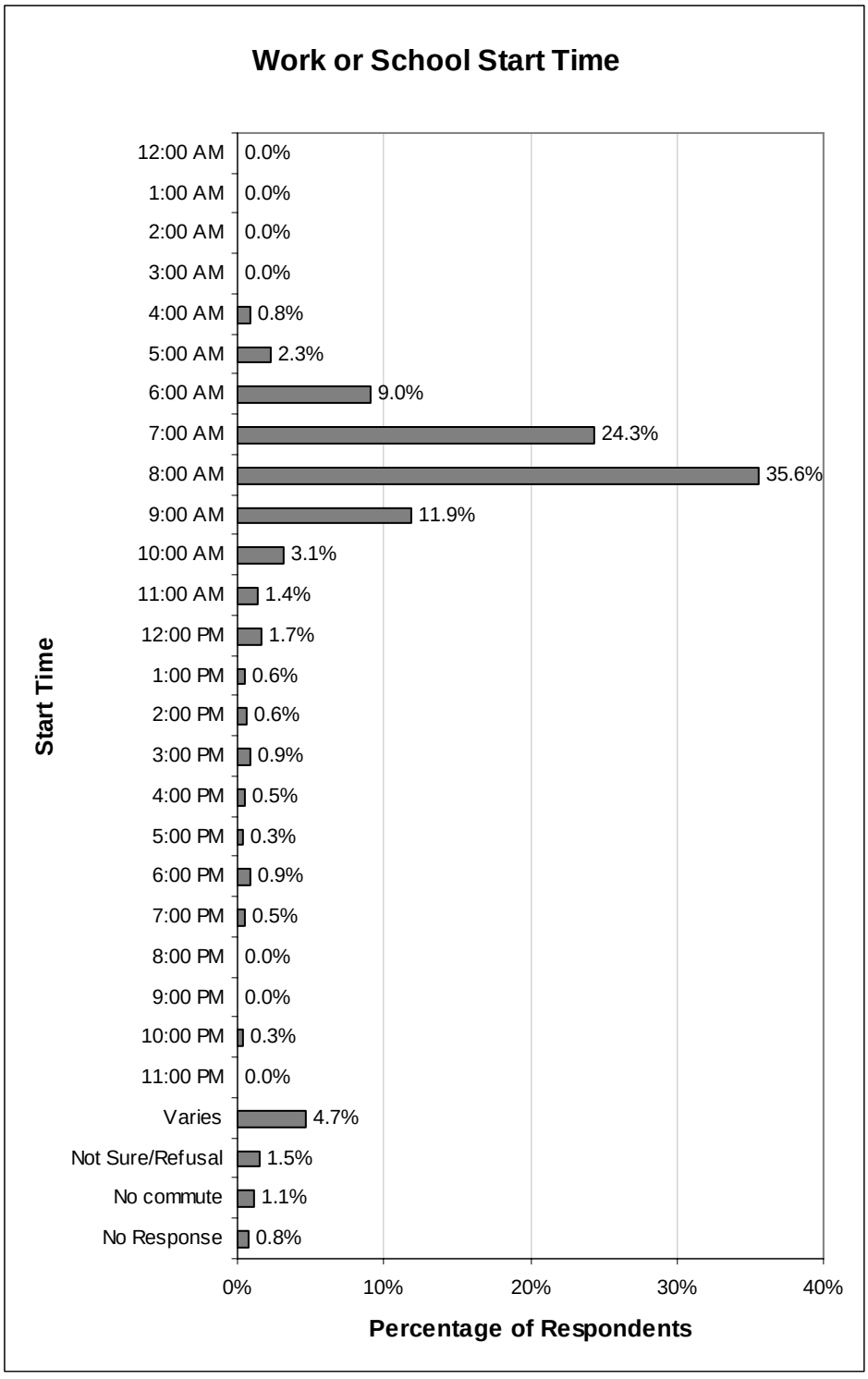
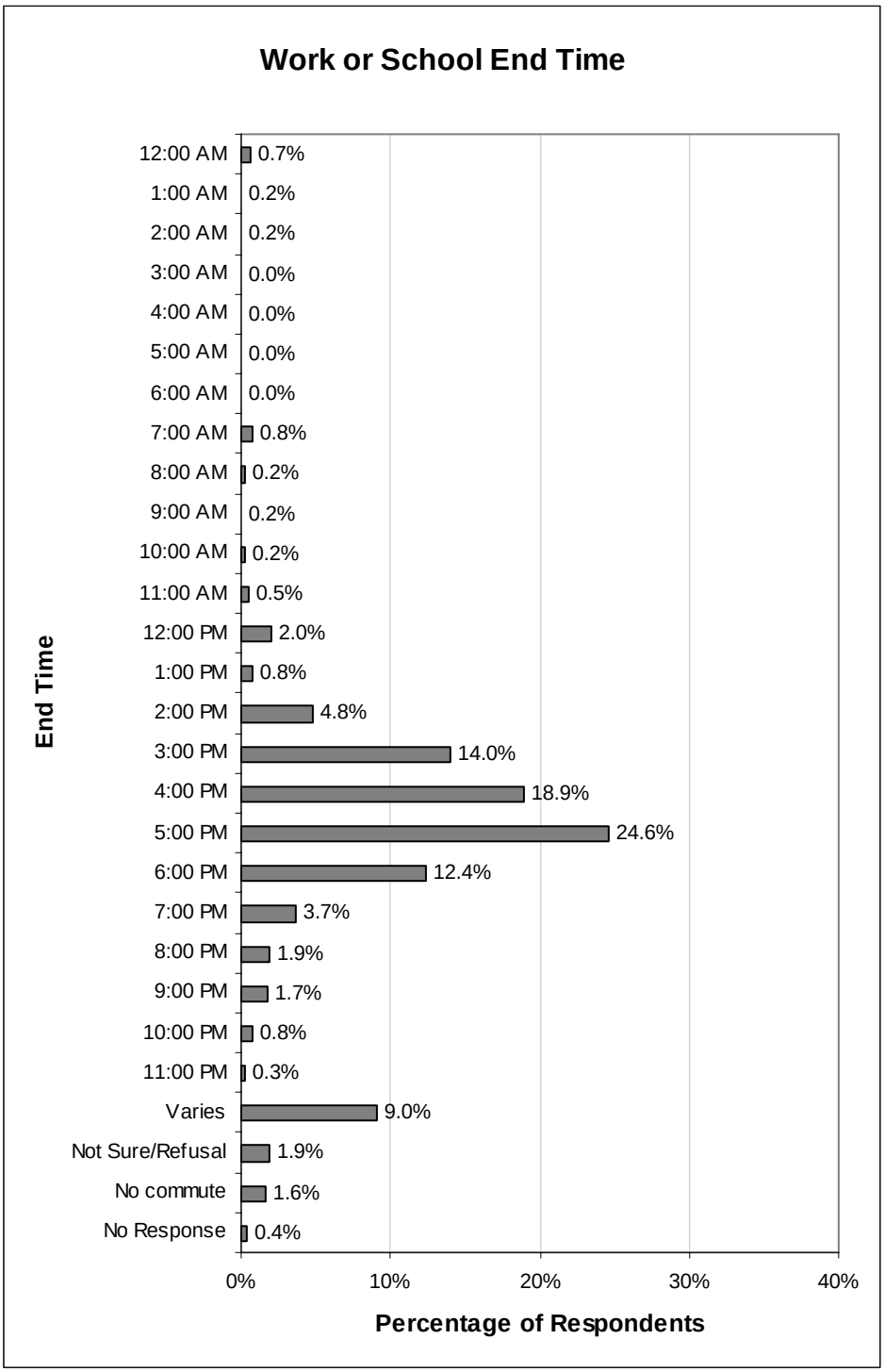


Figure 100 shows the typical end time for respondents' work or school preceding their commute home. Similar to the start times above, 74 percent of commute trips follow work or school days ending during typical evening peak travel times, between

3:00 p.m. and 7:00 p.m. Once again, although commute trips home are clustered over a four-hour span, residents make commute trips throughout the day.

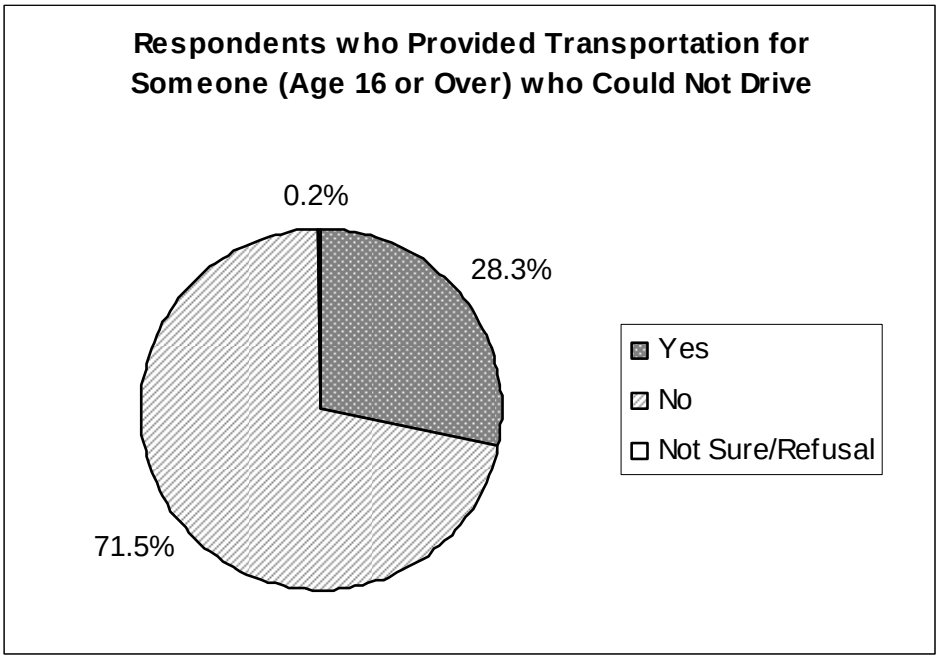
Figure 100: Typical Work or School End Time



Another indication of the potential need for transit service in the region is revealed by the rate of respondents providing transportation for someone over the age of 16

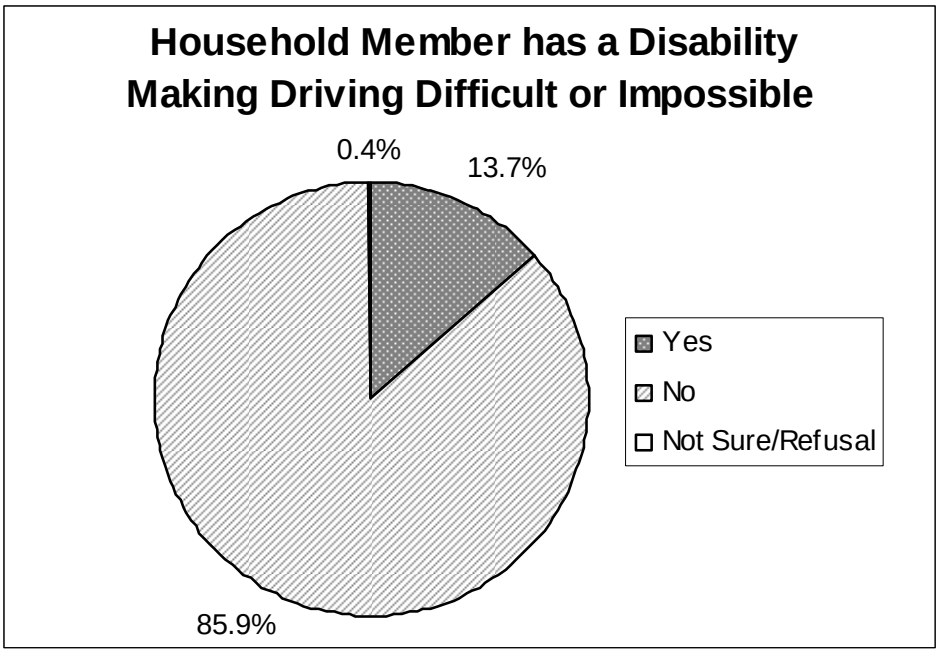
who could not drive. Figure 101 shows that approximately 28 percent of respondents had given someone else a ride who could potentially travel alone. This rate is much higher than the rate of households without licensed drivers or available vehicles. This chart shows the need in the region for greater transportation options other than driving alone. Transit service has the potential to grant at least some residents who have depended on others for transportation a greater level of travel independence.

Figure 101: Respondents Provided Transportation to Someone Else



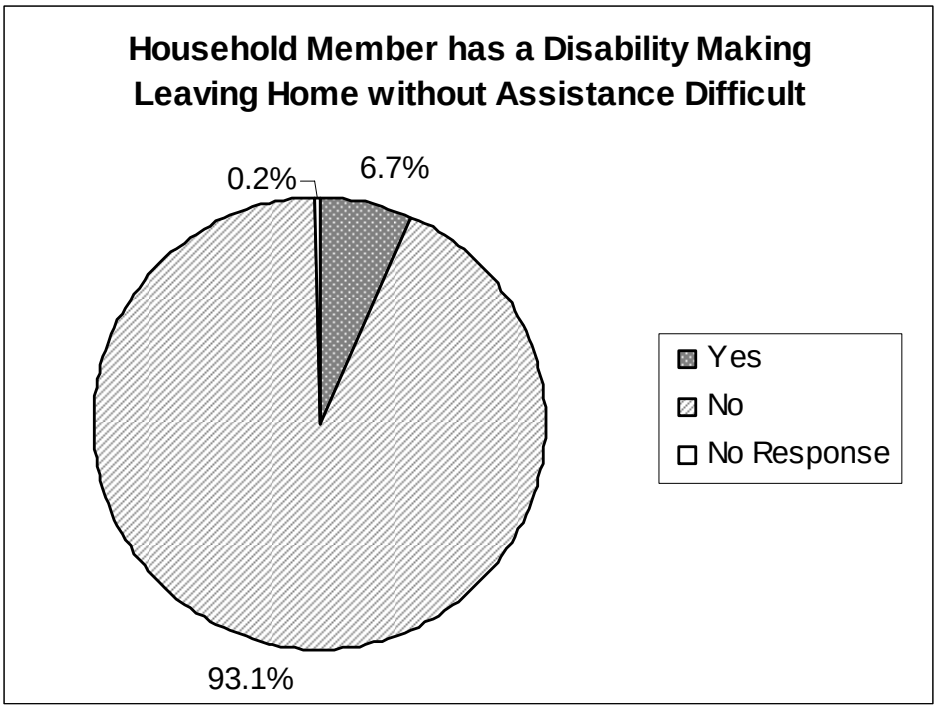
There also appears to be a relatively high percentage of regional residents who have difficulty driving because of a disability. Approximately 14 percent of respondents indicated that a member of their household fell into this category (see Figure 102). Since these residents have difficulty driving, transit may prove a viable transportation alternative for them. Transit service can grant individuals not suited to driving with a level of travel independence not available from other modes or transportation strategies. Continuing to cater to the transportation needs of residents with disabilities, improving service to meet the specialized needs of these residents, and reaching out to these members of the community can help ensure that GRTC service is used by people who need it most.

Figure 102: Household Member with a Disability making it Difficult to Drive



In addition to residents with disabilities that make it difficult to drive, nearly seven percent of households have at least one member with a disability that makes it difficult to leave the home unassisted (see Figure 103). While fixed-route transit service may not be the most appropriate mode for residents in this category, GRTC also offers paratransit service through its CARE program, which can better meet the needs of residents who cannot access fixed-route bus service. Once again, ensuring that CARE van service meets the needs of these residents will help afford them a level of travel independence difficult to find in another mode.

Figure 103: Household Member with a Disability making it Difficult to Leave the House without Assistance



GRTC Access

One potential reason why certain residents do not use GRTC service is because they do not have access to existing bus routes. The GRTC bus network is extensive and provides service throughout much of the region, but it is not exhaustive, especially the farther residents are located from downtown Richmond. Residents that do not have easy access to transit may be reluctant to go out of their way to use GRTC buses. In some ways, the solution seems clear: add more bus service. But some residents may not have access to bus service for a reason, such as development patterns do not support transit, there is no demand for it, or it would be too expensive to operate in that part of the region. In other words, there are some parts of the region where bus service may not make sense and would, therefore, not be used. It is also important to challenge this notion of where bus service makes sense. The Richmond region is growing, and that growth is not focused in the downtown urban core. As the outlying counties develop, new areas that have not previously had access to transit may be ripe for service expansion.

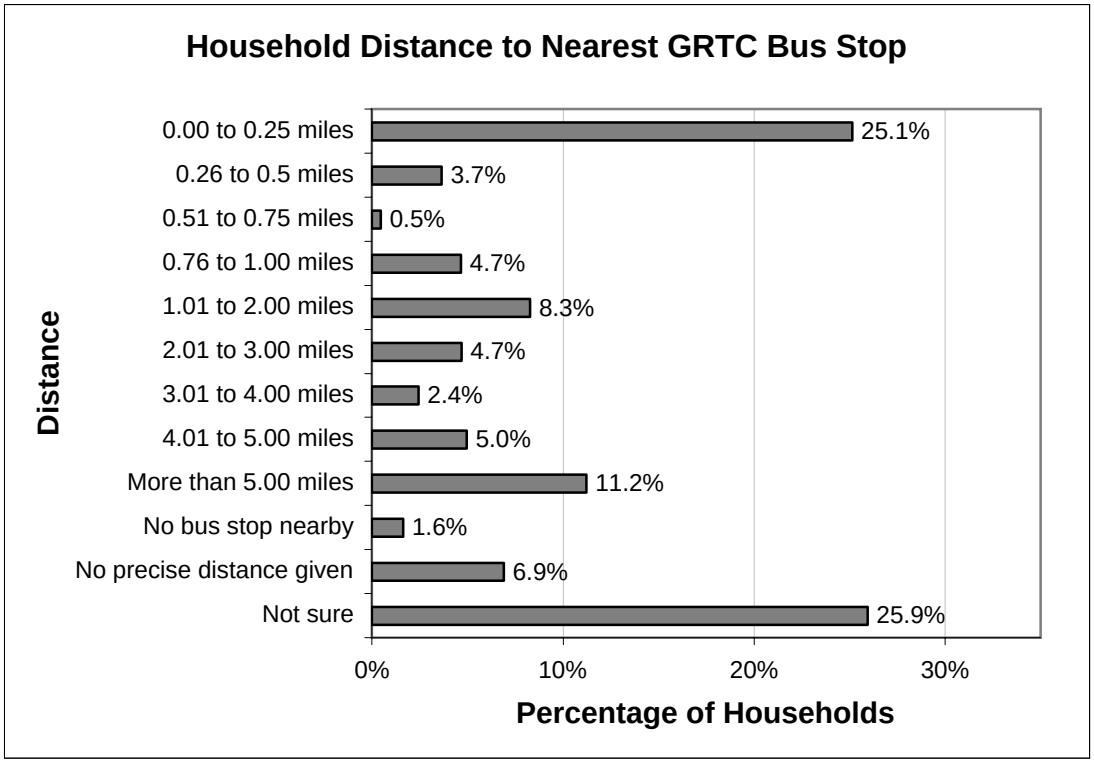
The household survey found that nearly 47 percent of respondents indicated they did not have transit service near their home. Of these 47 percent, 63 percent said they would like to have transit service available for use near their home. These respondents represent approximately 14 percent of the regional population who does not have access to transit service, but would like to have it as an option. This

finding suggests that by improving access to transit, GRTC can better meet the transportation needs of residents and increase its ridership.

Figure 104 shows respondents' estimates of the distance from their homes to the closest bus stops. Since respondents estimated the distances, they may not be accurate. Even if inaccurate, the distances collected through the survey reveal respondents' perceptions about how close bus service runs to their home. These perceptions may be even more valuable than the precise distances since the perception will inform respondents' decisions about walking to a bus stop. The table shows that roughly 30 percent of respondents reported a bus stop within a quarter of a mile of their home. It is standard transit planning guidance that people will walk up to a quarter of a mile to reach a bus stop. For distances farther than a quarter of a mile, chances decrease that residents will be willing to walk to catch a bus. Unless the bus stop is a park-and-ride, typical residents will not drive to a bus stop. These findings suggest that **the majority of people surveyed likely think the closest bus stop is located too far away for regular use**.

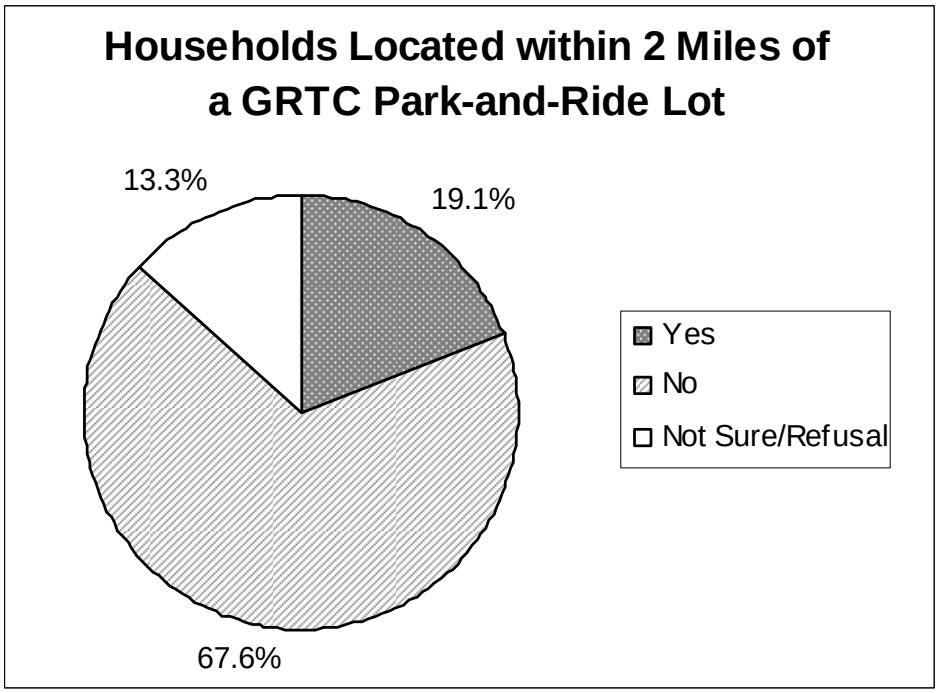
Approximately 26 percent of respondents did not know the location of the closest bus stop. This could be a reflection of a lack of bus service near respondents' homes or a lack of interest in transit service on the part of respondents. This finding might also indicate that there is an opportunity to better publicize GRTC service and make GRTC bus stops more visible. If residents are not aware of the service, they will not think to use it even if the occasion arises.

Figure 104: Distance from Home to Closest Bus Stop



Bus stops located at park-and-ride lots will attract riders from much farther distances than three quarters of a mile. But park-and-ride lots cannot be too far or else they will be seen as out of the way or of trivial benefit. Twenty percent of respondents reported a park-and-ride lot within two miles of their homes (see Figure 105). A significant percentage of respondents did not know if a park-and-ride lot was located near their homes. Once again, this suggests that there is an opportunity to improve marketing of park-and-ride services. Since most people in the region do not live near a park-and-ride lot, there may also be an opportunity to expand this type of service, especially in the growing suburbs in the outlying counties where development patterns are less accommodating to extensive transit service.

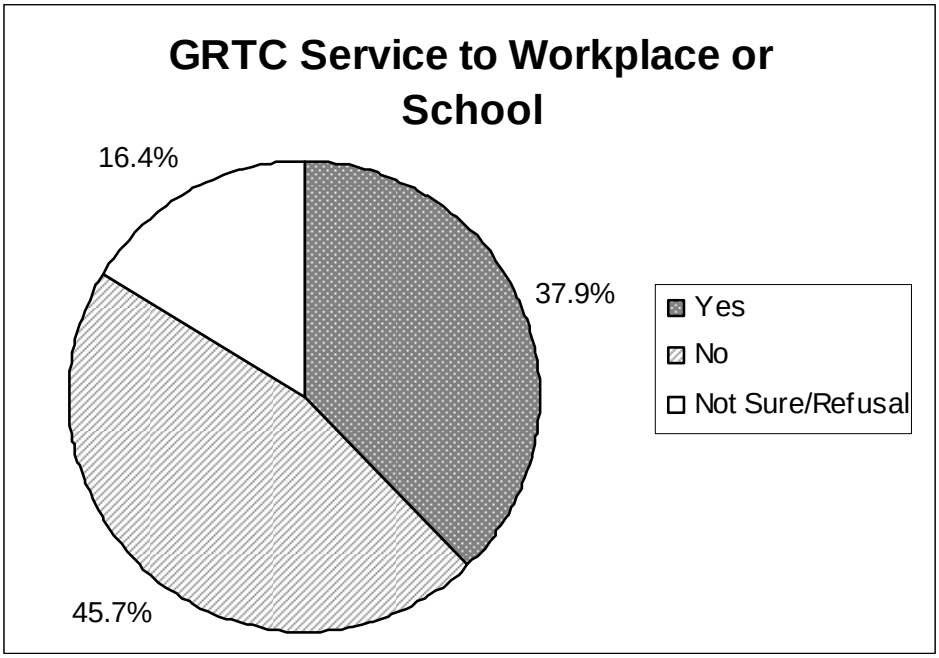
Figure 105: Household Located within 2 Miles of Park-and-Ride Lot



Since commute trips are some of the most frequent and regular trips residents make, it is essential that GRTC adequately serve the origins and destinations of commuters. **Figure 106 shows that approximately 38 percent of respondents' work or school destinations have GRTC service**. Forty-six percent of respondents said that bus service to their workplace or school was not available. This finding suggests that GRTC is not providing relatively direct service to employment and educational centers from residential locations. The lack of GRTC bus service to these destinations may in part be the result of employment growth in Henrico and Chesterfield counties. Although GRTC bus service does run in these counties, service appears to be primarily focused on transporting people from residential locations in these counties to downtown Richmond. Traveling within or between these counties to get to work or school by transit may be difficult under the current GRTC route structure.

This chart again shows that a relatively large percentage of residents do not know about the availability of GRTC service. Reaching out to the public and better communicating the availability of GRTC service will help residents make more informed transportation decisions.

Figure 106: GRTC Serves Work or School



Potential Service

One of the most important categories of information collected through the household survey deals with residents' opinions regarding GRTC bus service. The majority of residents in the Richmond region are choice riders, meaning they have other modes of transportation available. To use a GRTC bus, these choice riders would have to choose transit service over another transportation option, such as a personal vehicle. Choice riders can be difficult to attract to transit service, but doing so can benefit the riders, GRTC, and the regional transportation network. To expand service into new markets, it is first necessary that GRTC provides transit service that fits residents' travel behaviors and, therefore, could work as a substitute to personal automobile travel. Although necessary, providing service that better meets the transportation needs and behaviors of more regional residents is not sufficient to attract more GRTC use. GRTC will also have to understand what other issues and obstacles residents perceive with transit service. Only through improving access while simultaneously reducing barriers will GRTC enter more minds as a transportation option.

The household survey found that many residents perceived difficulties in using GRTC bus service (see Figure 107). Several of the difficulties indicated by respondents are focused on service operation and access. For example, 47 percent of respondents do not have service where they live and 34 percent of respondents

stated the bus did not go to their desired destinations. Forty percent of respondents also thought that the bus stop was too far from their home and 26 percent of respondents thought the bus stop was too far from their work or school. Additionally, approximately 20 percent of respondents indicated that the service span and frequency do not currently meet their needs. These difficulties can be addressed primarily through operational solutions, namely service expansions.

Residents also face difficulties accessing and waiting for the bus. Between 20 percent and 25 percent of respondents indicated that there is no safe place to walk to or wait for a bus near their home. Similar difficulties arise near workplaces and schools, with many respondents feeling that there is no safe place to walk to or wait at bus stops. GRTC may be able to improve feelings regarding bus stop safety by relocating some bus stops and improving bus stop amenities. Adequately addressing pedestrian access issues will likely require GRTC to work with individual municipalities to improve pedestrian infrastructure.

The household survey also revealed that 13 percent of respondents do not know how to use the bus. Although these residents may not know how to use the bus because they have no interest in using the bus, improving marketing and public outreach will help ensure residents can make informed transportation decisions. Advertising the service is also a fairly easy and cost-effective means to reducing one of the identified obstacles to transit use.

Figure 107: Difficulties Using GRTC Service

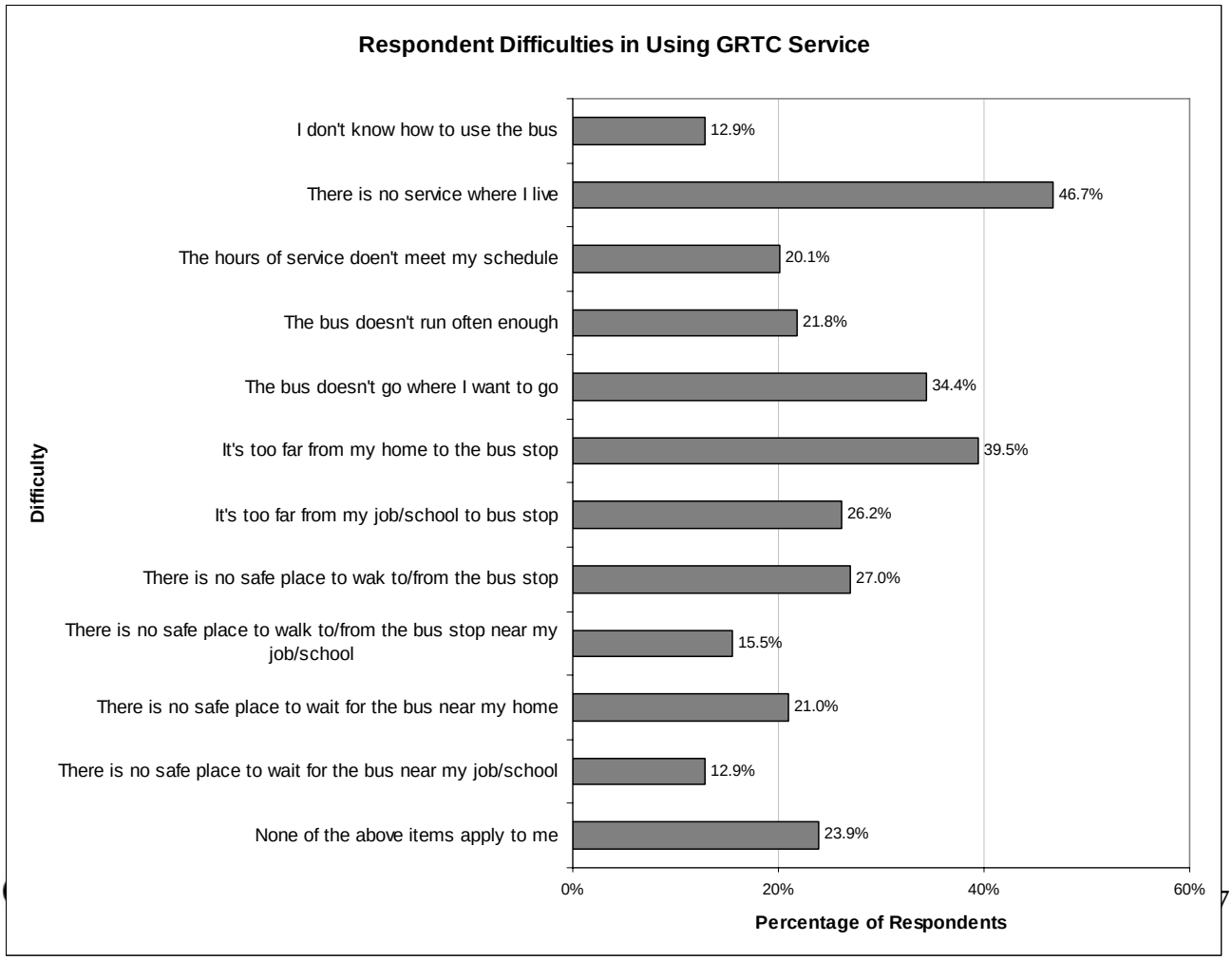


Figure 108 identifies the extent of GRTC's growth potential. **Approximately 38 percent of respondents would consider using GRTC to commute where as only seven percent of respondents currently commute by bus**. This response rate suggests that there are many residents who are open to the idea of switching to transit from another transportation mode. By improving GRTC service and tailoring service to the needs of a wider range of commuters—such as better service to employment centers—GRTC will attract more riders.

Figure 108: Consideration of Transit Use for Commuting

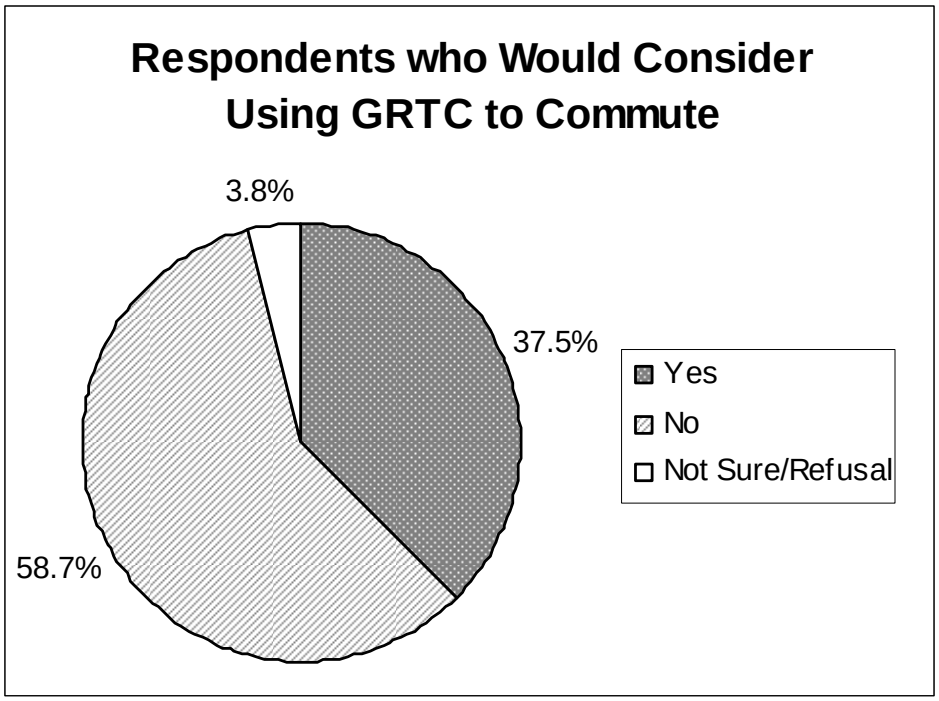
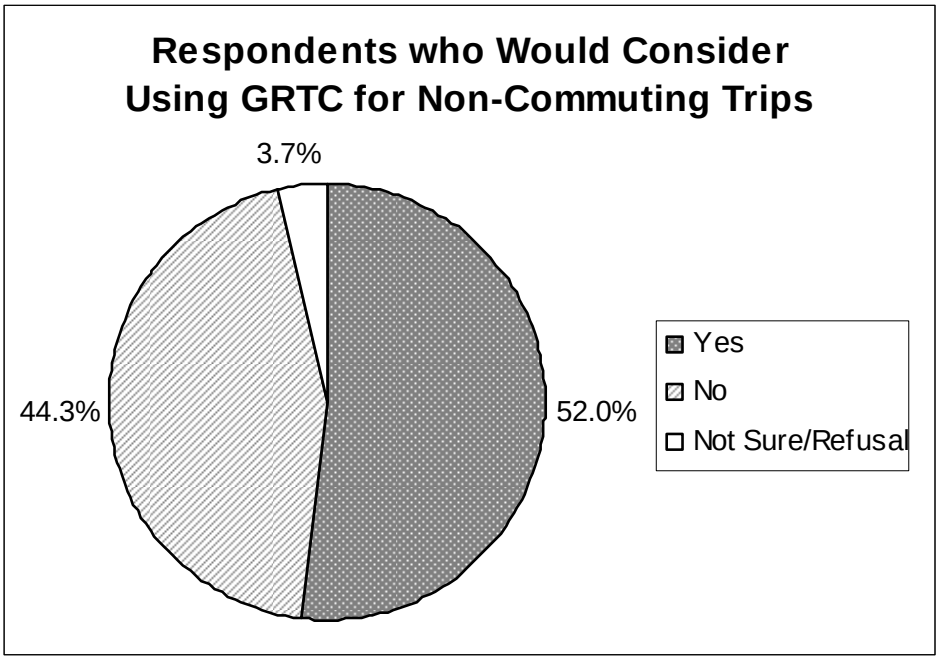


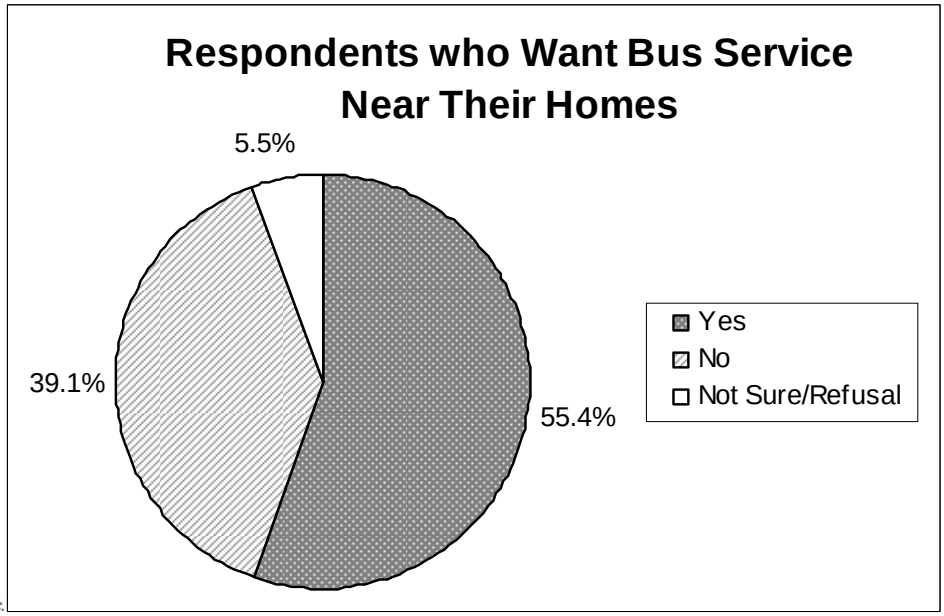
Figure 109 suggests that there is the potential to increase ridership for all types of trips, not just commuting. Over half of respondents said they could consider using GRTC for non-commuting trips, a significant increase over the 25 percent of respondents who indicated that a household member had used fixed-route bus service in the last three years. It appears that there are a significant number of residents who have not used transit but would use it under the right conditions. The high rate of residents responding that they would consider using GRTC service for non-commute trips suggests that the current route structure favoring commute trips to downtown may not be the most appropriate to attract new riders with other trip purposes.

Figure 109: Consideration of Transit Use for Other Purposes



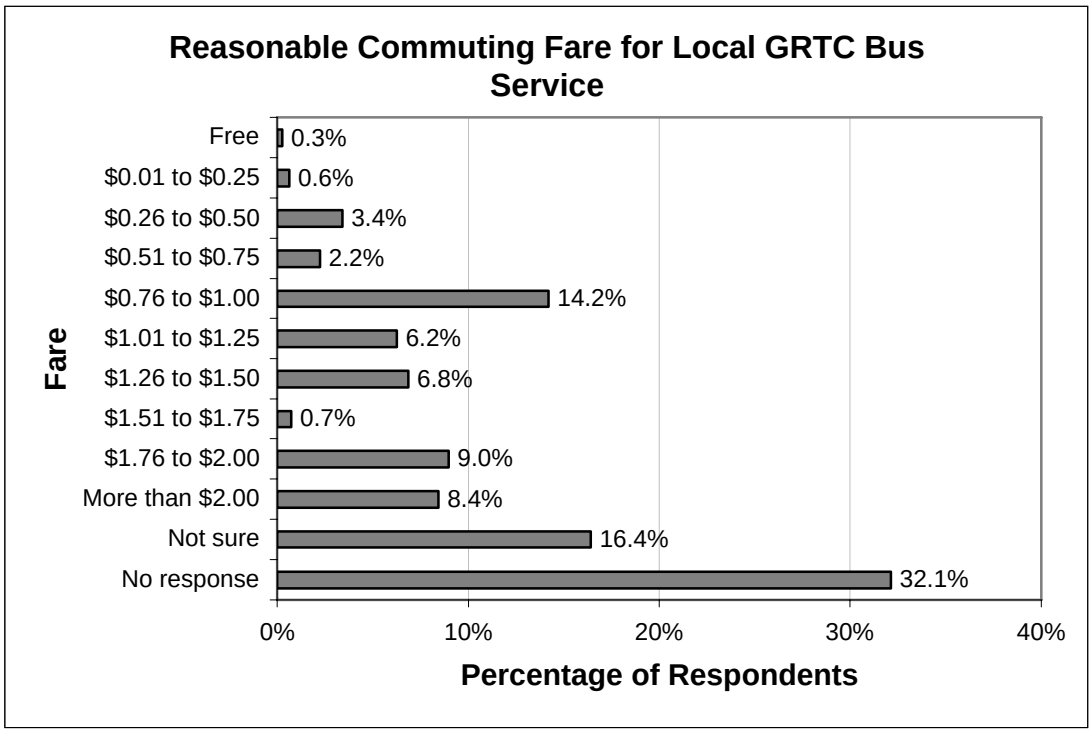
Corresponding to the high rate of residents who would consider using transit service, over 50 percent of respondents want bus service near their home (see Figure 110). This suggests that at least some of the residents would consider using bus service if it were available near their homes. Furthermore, there appears to be a desire for expanded transit service throughout the region. Over half of all residents want bus service near their home: 78 percent of Richmond respondents, 47 percent of Hanover respondents, 53 percent of Henrico respondents, and 55 percent of Chesterfield respondents. Expanding service, especially outside of Richmond, may offer some of these residents the opportunity to use bus service for the first time. For many of these choice riders, the bus may not become a primary means of transportation, but it could offer an alternative to driving under certain conditions.

Figure 110: Residents who Want Transit Service near Their Homes



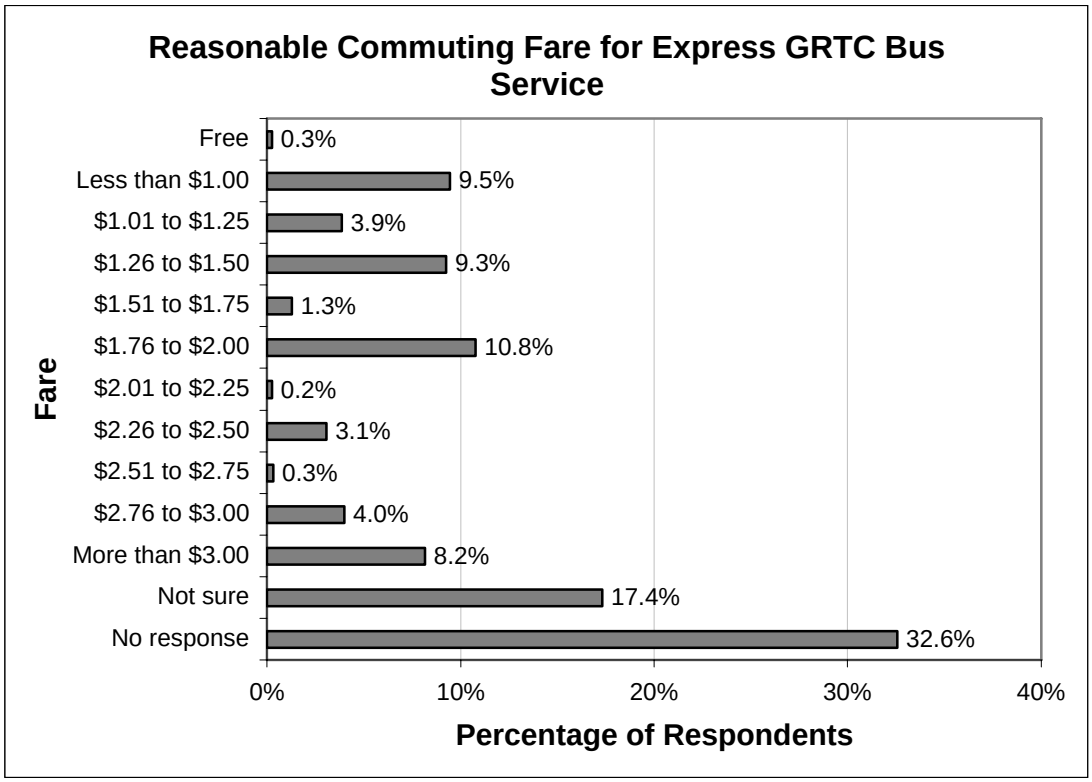
One advantage public transportation frequently has over private vehicle ownership is cost. Accounting for purchase price, maintenance, gas, parking, and insurance, it can be expensive to own and use a car. Some riders will use the bus all the time because of the associated expenses and other riders may use the bus only when it is the less expensive option, such as to avoid downtown parking costs. If the cost of the bus is perceived as too high, choice riders may avoid this transportation mode and current riders may look to switch to another mode. **For local bus service, GRTC charges a fare of $1.25. Just under a third of respondents seem willing to pay this approximate price or more**. Many of the respondents—nearly half—either did not know what they thought a reasonable price would be or did not respond to the question (see Figure 111). There did not appear to be any consensus that current local bus fares are too expensive.

Figure 111: Reasonable Fare for Local Bus Service



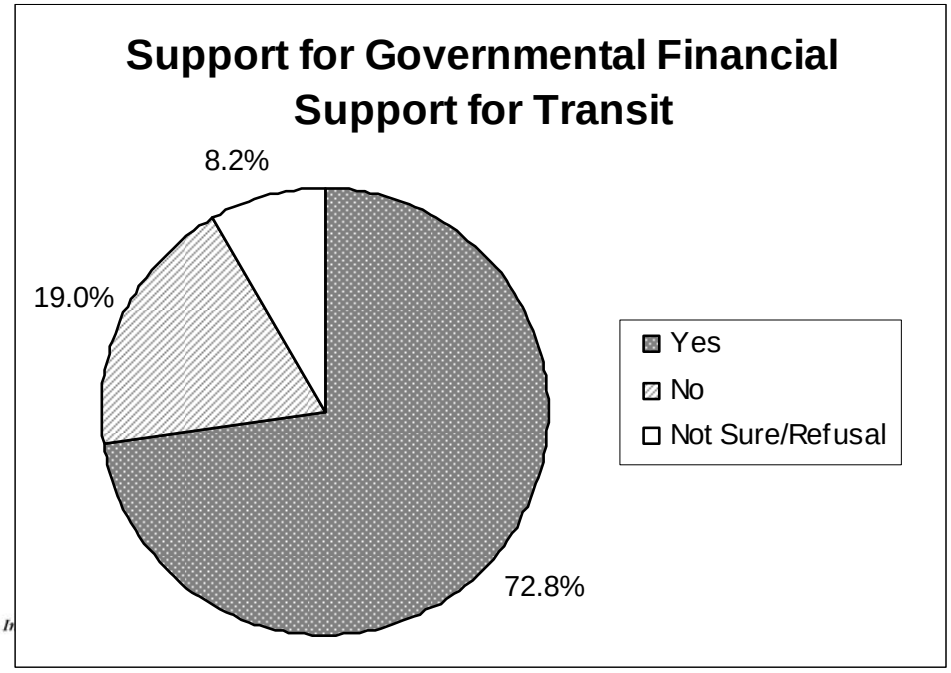
For express bus service, GRTC charges a fare of $1.75. Figure 112 shows that although many respondents did not put a value on express bus service, over a quarter of respondents appear willing to pay this approximate price or more. Compared to local bus service, respondents generally acknowledge the need to pay more for express bus service. Similar to the local bus cost, respondents do not appear united in a belief that current fares for express service are too high.

Figure 112: Reasonable Fare for Express Bus Service



Even though the majority of residents do not use transit service, the vast majority of the population supports GRTC's presence in the region (see Figure 113). **Nearly 75 percent of respondents indicated that they believe the government should provide financial support for transit**. Some of this support may be selfishly motivated—from current transit riders, potential transit riders, or drivers who want less congestion—but this may also indicate that regional residents believe high-quality transit service is an important part of their community whether they use it or not.

Figure 113: Support for Government Financial Support



Conclusion

All Richmond region residents are potential GRTC users. The household survey was intended to shed light on the travel behaviors and opinions of these potential users. These survey findings can be used to tailor GRTC service to fit the needs of a larger portion of residents within the region, specifically the needs of residents not currently using transit. One of the most important findings of the household survey is that although a relatively small percentage of residents use bus service regularly, a majority of residents are interested in transit service. To some extent, GRTC could expand ridership and meet the transportation needs of more residents if it expanded bus service and offered more routes. The household survey revealed that there is a demand for bus service, even among residents with other transportation choices, but there is not an adequate supply of bus service throughout the region.

Improving the supply of bus service in line with the transportation needs of choice riders can help attract more riders to GRTC service. This can benefit riders by expanding transportation choices and offering an inexpensive and easy travel mode, GRTC by making it more cost effective to operate, and the regional transportation network by reducing congestion. When planning for future service it is important to remember that beyond meeting the needs of current riders, the system should strive to meet as many of the regional transportation needs as possible. Improving service to attract choice riders appears to require expanding GRTC service, especially in the outlying counties. Unfortunately, simply expanding GRTC service may not be an easy solution to make GRTC a viable option for more residents. Expanding service increases the system's operation costs, which may not be in the best interest of GRTC. As service is planned for the future, trying to meet more of the transportation needs of residents will have to be balanced against the other goals of the transit system.

5

Performance Analysis

Load Factor Analysis

The work program calls for the examination of the bus fleet in terms of its condition and its suitability to current passenger volumes. An earlier memorandum addressed the fleet condition and its useful life in terms of age and accumulated mileage. This section focuses on seating capacity in light of observed passenger volumes. Seating capacity was taken from schedule information used by GRTC to assign buses to specific blocks. Actual ridership levels at the maximum load point were obtained from the ride checks conducted during weekdays as part of the current COA analysis.

The number of riders was then compared to the number of seats provided to determine the load factor. Typically, this measure is presented as a percentage. Values of 100 percent denote a fully seated load with values less than 100 percent indicating available capacity. When the load factor is over 100 percent, some riders are forced to stand. It should be noted that on local routes during the peak period some standees are permitted without the situation being identified as overcrowding. The proposed service standards call for load factor not to exceed 115 percent.

From the earlier analysis, an inventory of the current GRTC bus fleet was obtained. The majority of the bus fleet is comprised of heavy duty coaches either 35 or 40 feet in length, with most of the fleet manufactured by Gillig. Recent bus purchases have included low floor vehicles, which expedite passenger loading and unloading and have similar number of seats. GRTC also has smaller buses (i.e., Ford E-450) which account for about seven percent of the fleet. Fleet characteristics in terms of seating along with a description of the fleet in terms of year, make, model and length are shown in Tables 89 and 90 below.

Table 89: Fleet Seating Characteristics

Seats	Number of Vehicles	Percent
21	12	7.2
36	3	1.8
37	64	38.3
38	47	28.1
43	16	9.6
44	25	15.0
Total	167	

Table 90: Fleet Inventory

Vehicle Type	Number of Vehicles	Length (Feet)	Seats
1996 Gillig Phantom	19	35	37
1997 Gillig Phantom	13	35	37
1998 Gillig Phantom	32	35	37
2000 Gillig Phantom	25	40	44
2000 Gillig Low Floor	16	35	38
2001 Ford E-450	9	24	21
2001 Gillig Low Floor	14	35	38
2002 Ford E-450	3	24	21
2003 Gillig Phantom	16	40	43
2003 Gillig Low Floor	17	40	38
2003 Bluebird	3	35	36
Total	167		

The information above indicates the supply characteristics of the bus fleet. As part of the scheduling process, each block has a specific type of bus assigned to it on the basis of seating capacity. In some cases, the schedule indicates that more than a single bus type could be assigned to that block.

As part of the weekday ride check survey effort, field staff recorded the boardings and alightings by bus stop, which allowed the computation of riders on board the bus (i.e., load) at any given time along the route. The maximum load point is where ridership on board the bus is the greatest and was used in this analysis. This maximum load passenger volume was then compared to the number of seats on the bus assigned to that trip. The resulting statistic is the load factor, which is expressed as a percentage. Where more than one type of bus could be assigned, a separate

calculation was made. In addition, the average load on each trip was also computed, which can be compared to the bus seating capacity. (Most, but not all trips were surveyed for this calculation.) The information was compiled by route, direction and time period in Tables 91 through 95 below.

A summary of key findings has been prepared for each table that indicates many low load factor percentages throughout the day. It is recommended that GRTC investigate routes with an average load factor less than 50% to determine if a smaller vehicle could more efficiently serve that route. Due to operational constraints (interlining, operator scheduling, etc.) and the variability in service demand throughout the course of a day, instances of trips with low load factors are inevitable and may represent the most efficient option. However, wherever a clear trend of nearly empty vehicles can be observed, we are recommending greater reliance on smaller vehicles and/or increased headways on those routes.

Table 91: Early AM Period
Before 7:00 AM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
1-2	Eastbound	69	44 & 37	388	17.8	10	6.9
	Westbound	135	44 & 37	271	49.8	8	16.9
3-4	Eastbound	107	44	616	17.4	14	7.6
			37	518	20.7		
	Westbound	221	44	440	50.2	10	22.1
			37	370	59.7		
6	Eastbound	60	44	396	15.2	9	6.7
			43	387	15.5		
	Westbound	182	44	308	59.1	7	26.0
			43	301	60.5		
7	Eastbound	36	44	176	20.5	4	9.0
			43	172	20.9		
	Westbound	52	44	88	59.1	2	26.0
			43	86	60.5		
10	Eastbound	74	37	259	28.6	7	10.6
	Westbound	85	37	185	45.9	5	17.0
11	Eastbound	1	37	37	2.7	1	1.0
	Westbound	0	37	37	0.0	1	0.0
13	Eastbound	11	37	148	7.4	4	2.8
	Westbound	12	37	74	16.2	2	6.0
16	Eastbound	32	37	148	21.6	4	8.0
	Westbound	24	37	74	32.4	2	12.0
18	Eastbound	15	37	37	40.5	1	15.0
	Westbound	6	37	37	16.2	1	6.0
19	Eastbound	--	--	--	--	--	--
	Westbound	19	44	44	43.2	1	19.0
			43	43	44.2		

Before 7:00 AM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
20	Eastbound	16	37	37	43.2	1	16.0
	Westbound	14	37	37	37.8	1	14.0
22	Northbound	8	21	42	19.0	2	4.0
	Southbound	14	21	63	22.2	3	4.7
24	Northbound	23	37	74	31.1	2	11.5
	Southbound	12	37	74	16.2	2	6.0
26	Eastbound	21	37	37	56.8	1	21.0
	Westbound	11	37	37	29.7	1	11.0
27	Eastbound	24	37	37	64.9	1	24.0
	Westbound	--	--	--	--	--	--
29	Eastbound	43	44 & 37	81	53.1	2	21.5
	Westbound	21	44	44	47.7	1	21.0
32	Northbound	26	44 & 37	287	9.1	7	3.7
	Southbound	199	44,43 & 37	416	47.8	10	19.9
34	Northbound	21	44 & 37	338	6.2	8	2.6
	Southbound	201	44 & 37	338	59.5	8	25.1
37	Northbound	85	44 & 37	294	28.9	9	9.4
	Southbound	177	44,43 & 37	338	52.4	5	35.4
56	Eastbound	1	37	37	2.7	1	1.0
	Westbound	--	--	--	--	--	--
62-63	Northbound	101	44 & 37	331	30.5	8	12.6
	Southbound	101	44 & 37	324	31.2	8	12.6
64	Northbound	36	44 & 37	125	28.8	3	12.0
	Southbound	--	--	--	--	--	--
69	Northbound	31	37	37	83.8	1	31.0
	Southbound	--	--	--	--	--	--
70-71	Northbound	75	37	148	50.7	4	18.8
	Southbound	66	37	148	44.6	4	16.5
72-73	Northbound	146	44,43 & 37	162	90.1	4	36.5
	Southbound	102	44,43 & 37	169	60.4	4	25.5
74	Northbound	81	44 & 37	303	26.7	8	10.1
	Southbound	41	44 & 37	273	15.0	7	5.9
82	Northbound	33	44	44	75.0	1	33.0
			43	43	76.7	0	0.0
	Southbound	--	--	--	--	--	--
93	Northbound	3	21	21	14.3	1	3.0
	Southbound	3	21	21	14.3	1	3.0
95	Northbound	50	43	215	23.3	5	10.0
	Southbound	1	43	129	0.8	3	0.3

During the early morning time period (prior to 7:00 am) no buses are categorized as overcrowded, and the average load factor during this period is 33.1%. Many routes do have buses operating with a load factor of over 50% in the inbound direction, in addition to one outbound route (Route 72/73). The most crowded routes during this

time period have load factors greater than 75% and include Routes 72/73, 69 and 82 (all in the inbound direction). Most of the express routes operate with no passengers (or operate no trips) in the off-peak direction during this time period, however Route 29 operates with similar loads in both directions (around 50% full).

Several routes operate with low passenger loads in both directions during the early morning period. Routes 11 and 93, which each operate only one trip in each direction, and Route 56, which operates only one outbound trip have the lowest load factors during this time period. Route 95 (express to Petersburg) has extremely low ridership in the off-peak direction, with a load factor of 0.8%.

Table 92: Morning Peak Period
7 AM to 9 AM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
1-2	Eastbound	132	43 & 37	388	34.0	10	13.2
	Westbound	152	43 & 37	419	36.3	11	13.8
3-4	Eastbound	160	44	572	28.0	13	12.3
			37	494	32.4		
	Westbound	258	44	572	45.1	13	19.8
			37	493	52.3		
6	Eastbound	143	44	484	29.5	12	11.9
	Westbound	399	44	528	75.6	13	30.7
7	Eastbound	35	44	132	26.5	3	11.7
	Westbound	91	44	176	51.7	4	22.8
10	Eastbound	61	37	222	27.5	6	10.2
	Westbound	106	37	222	47.7	6	17.7
11	Eastbound	7	37	74	9.5	2	3.5
	Westbound	5	37	37	13.5	1	5.0
13	Eastbound	9	37	74	12.2	2	4.5
	Westbound	22	37	111	19.8	3	7.3
16	Eastbound	53	37	148	35.8	4	13.3
	Westbound	40	37	185	21.6	5	8.0
18	Eastbound	12	37	37	32.4	1	12.0
	Westbound	44	37	74	59.5	2	22.0
19	Eastbound	17	44 & 37	81	21.0	2	8.5
	Westbound	42	44 & 37	81	51.9	2	21.0
20	Eastbound	5	37	74	6.8	2	2.5
	Westbound	4	37	37	10.8	1	4.0
22	Northbound	32	21	105	30.5	5	6.4
	Southbound	28	21	84	33.3	4	7.0
24	Northbound	61	37	185	33.0	5	12.2
	Southbound	29	37	148	19.6	4	7.3
26	Eastbound	99	44 & 37	294	33.7	7	14.1
	Westbound	50	44 & 37	324	15.4	8	6.3
27	Eastbound	79	37	185	42.7	5	15.8
	Westbound	36	37	222	16.2	6	6.0

7 AM to 9 AM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
28	Eastbound	--	--	--	--	--	--
	Westbound	9	37	37	24.3	1	9.0
29	Eastbound	81	44 & 37	125	64.8	3	27.0
	Westbound	65	44 & 37	162	40.1	4	16.3
32	Northbound	78	44,43 & 37	447	17.4	11	7.1
	Southbound	236	44 & 37	449	52.6	12	19.7
34	Northbound	75	44 & 37	470	16.0	11	6.8
	Southbound	251	44 & 37	470	53.4	11	22.8
37	Northbound	108	44 & 37	294	36.7	7	15.4
	Southbound	233	44,43 & 37	338	68.9	8	29.1
56	Eastbound	7	37	74	9.5	2	3.5
	Westbound	--	--	--	--	--	--
62-63	Northbound	174	44,43 & 37	467	37.3	11	15.8
	Southbound	174	44,43 & 37	473	36.8	11	15.8
64	Northbound	63	44	220	28.6	5	12.6
	Southbound	55	44	176	31.3	4	13.8
65	Northbound	--	--	--	--	--	--
	Southbound	1	44	44	2.3	1	1.0
66	Northbound	40	37	111	36.0	3	13.3
	Southbound	16	37	111	14.4	3	5.3
67	Northbound	71	37	185	38.4	5	14.2
	Southbound	6	37	37	16.2	1	6.0
69	Northbound	25	37	74	33.8	2	12.5
	Southbound	26	37	111	23.4	3	8.7
70-71	Northbound	107	37	222	48.2	6	17.8
	Southbound	83	37	185	44.9	5	16.6
72-73	Northbound	96	44 & 37	206	46.6	5	19.2
	Southbound	73	44 & 37	250	29.2	6	12.2
74	Northbound	141	44 & 37	273	51.6	7	20.1
	Southbound	29	44 & 37	229	12.7	6	4.8
82	Northbound	66	44 & 43	87	75.9	2	33.0
	Southbound	--	--	--	--	--	--
93	Northbound	9	21	84	10.7	4	2.3
	Southbound	9	21	84	10.7	4	2.3
95	Northbound	79	43	172	45.9	4	19.8
	Southbound	12	43	86	14.0	2	6.0

During the morning peak period (between 6:00 am and 9:00 am) no routes can be categorized as overcrowded, as the average load factor during this time period is 30.2%. Many inbound routes operate with load factors greater than 50%, in addition to outbound Route 7 (which may be bringing employees to the airport) and Route 18 westbound (which transports employees of Henrico County). Route 82 and Route 6 operate with the highest load factors in the inbound direction, over 75%.

Several routes operate with very low loads in both directions during the morning peak period. Routes 11 and 20 have the lowest load factors in both directions of any of the local routes, while Route 65 (which operates only one inbound trip) has the lowest of the express routes.

Table 93: Midday Period
9 AM to 4 PM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
1-2	Eastbound	308	43 & 37	776	39.7	20	15.4
	Westbound	377	43 & 37	1,004	37.5	26	14.5
3-4	Eastbound	715	44	1,408	50.8	61	11.7
			37	1,183	60.4		
	Westbound	567	44	1,276	44.4	29	19.6
6	Eastbound	669	44	1,452	46.1	33	20.3
	Westbound	655	44	1,408	46.5	32	20.5
7	Eastbound	121	44	484	25.0	11	11.0
	Westbound	148	44	484	30.6	11	13.5
10	Eastbound	329	37	740	44.5	21	15.7
	Westbound	301	37	777	38.7	22	13.7
11	Eastbound	60	37	444	13.5	12	5.0
	Westbound	62	37	444	14.0	12	5.2
13	Eastbound	54	37	333	16.2	9	6.0
	Westbound	51	37	296	17.2	9	5.7
16	Eastbound	111	37	581	19.1	17	6.5
	Westbound	112	37	565	19.8	17	6.6
18	Eastbound	89	37	296	30.1	8	11.1
	Westbound	85	37	259	32.8	7	12.1
19	Eastbound	39	44 & 37	213	18.3	5	7.8
	Westbound	37	44 & 37	88	42.0	2	18.5
22	Northbound	80	21	252	31.7	12	6.7
	Southbound	37	21	252	14.7	12	3.1
24	Northbound	86	37	333	25.8	10	8.6
	Southbound	72	37	333	21.6	9	8.0
26	Eastbound	--	--	--	--	--	--
	Westbound	7	37	148	4.7	4	1.8
27	Eastbound	--	--	--	--	--	--
	Westbound	11	37	74	14.9	2	5.5
29	Eastbound	2	37	37	5.4	1	2.0
	Westbound	24	37	74	32.4	2	12.0
32	Northbound	429	44 & 43	1,109	38.7	26	16.5
	Southbound	418	44 & 43	1,102	37.9	26	16.1
34	Northbound	375	44	1,049	35.7	23	16.3
	Southbound	327	44	1,012	32.3	23	14.2
37	Northbound	355	44	572	62.1	13	27.3
	Southbound	382	44 & 37	609	62.7	14	27.3
56	Eastbound	--	--	--	--	--	--

9 AM to 4 PM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
	Westbound	21	37	37	56.8	1	21.0
62-63	Northbound	677	44 & 43	1,481	45.7	34	19.9
	Southbound	697	44 & 43	1,436	48.5	34	20.5
64	Northbound	--	--	--	--	--	--
	Southbound	26	37	37	70.3	1	26.0
65	Northbound	11	37	74	14.9	2	5.5
	Southbound	13	37	37	35.1	3	4.3
68	Eastbound	25	21	336	7.4	17	1.5
	Westbound	24	21	294	8.2	14	1.7
70-71	Northbound	253	37	518	48.8	16	15.8
	Southbound	250	37	666	37.5	18	13.9
72-73	Northbound	238	44 & 37	808	29.5	19	12.5
	Southbound	219	44 & 37	757	28.9	18	12.2
74	Northbound	201	44 & 37	604	33.3	15	13.4
	Southbound	204	44 & 37	523	39.0	14	14.6
93	Northbound	8	21	147	5.4	7	1.1
	Southbound	8	21	126	6.3	6	1.3
95	Northbound	32	43 & 37	117	27.4	3	10.7
	Southbound	12	43 & 37	80	15.0	2	6.0

Many buses operate with low passenger loads during the midday period, with an average load factor of 29.2%. In general, buses are operating with relatively low loads, between 20% and 50% of capacity. The highest load factors are on Route 64 (the single outbound run is 70% full) and Route 37 in both directions with load factors of 62%.

Many of the express routes do not run during the midday period, but those that do, operate with very low load factors. The Lunchtime Express (Route 68) which runs only during the midday period operates with relatively low loads, less than 10% in both directions. Also, Routes 11 and 93 operate with low loads in both directions during this time period.

Table 94: PM Peak Period
4 PM to 6 PM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
1-2	Eastbound	140	43 & 37	345	40.6	9	15.6
	Westbound	130	43 & 37	382	34.0	10	13.0
3-4	Eastbound	43	44	440	9.8	2	21.5
			37	376	11.4		
	Westbound	357	44	528	67.6	20	17.9
			37	456	78.3		
6	Eastbound	250	44	484	51.7	11	22.7
	Westbound	121	44	440	27.5	10	12.1

4 PM to 6 PM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
7	Eastbound	101	44	264	38.3	6	16.8
	Westbound	62	44	220	28.2	5	12.4
10	Eastbound	88	37	259	34.0	7	12.6
	Westbound	94	37	222	42.3	7	13.4
13	Eastbound	22	37	111	19.8	3	7.3
	Westbound	16	37	111	14.4	3	5.3
16	Eastbound	40	21 & 37	227	17.6	7	5.7
	Westbound	59	21 & 37	227	26.0	7	8.4
18	Eastbound	19	37	74	25.7	2	9.5
	Westbound	21	37	74	28.4	2	10.5
19	Eastbound	26	44 & 37	125	20.8	3	8.7
	Westbound	20	44	44	45.5	1	20.0
22	Northbound	33	21	84	39.3	4	8.3
	Southbound	16	21	84	19.0	4	4.0
24	Northbound	38	37	185	20.5	5	7.6
	Southbound	52	37	185	28.1	5	10.4
26	Eastbound	17	37	111	15.3	3	5.7
	Westbound	77	37	222	34.7	6	12.8
27	Eastbound	1	44	44	2.3	1	1.0
	Westbound	53	44 & 37	125	42.4	3	17.7
28	Eastbound	24	37	148	16.2	4	6.0
	Westbound	--	--	--	--	--	--
29	Eastbound	7	44 & 37	81	8.6	2	3.5
	Westbound	83	44 & 37	206	40.3	5	16.6
32	Northbound	215	44,43 & 37	498	43.2	12	17.9
	Southbound	78	44,43 & 37	454	17.2	11	7.1
34	Northbound	183	44 & 37	449	40.8	11	16.6
	Southbound	66	44 & 37	368	17.9	9	7.3
37	Northbound	191	44	220	86.8	5	38.2
			43 & 37	203			
	Southbound	62	44	220	28.2	5	12.4
			43 & 37	203	0.0		
56	Eastbound	--	--	--	--	--	--
	Westbound	7	37	74	9.5	2	3.5
62-63	Northbound	297	44	657	45.2	15	19.8
	Southbound	297	44	615	48.3	15	19.8
64	Northbound	11	44 & 37	162	6.8	4	2.8
	Southbound	77	44 & 37	250	30.8	6	12.8
65	Northbound	3	37	37	8.1	1	3.0
	Southbound	0	37	37	0.0	1	0.0
66	Northbound	28	21 & 37	95	29.5	3	9.3
	Southbound	30	21 & 37	58	51.7	2	15.0
67	Northbound	6	44	44	13.6	1	6.0
	Southbound	35	44 & 37	243	14.4	6	5.8

4 PM to 6 PM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
69	Northbound	17	44	88	19.3	2	8.5
	Southbound	34	44	88	38.6	2	17.0
70-71	Northbound	53	37	185	28.6	5	10.6
	Southbound	82	37	148	55.4	4	20.5
72-73	Northbound	89	44 & 37	280	31.8	7	12.7
	Southbound	167	44 & 37	324	51.5	8	20.9
74	Northbound	46	44 & 37	192	24.0	5	9.2
	Southbound	121	44 & 37	236	51.3	6	20.2
82	Northbound	--	--	--	--	--	--
	Southbound	101	43	129	78.3	3	33.7
93	Northbound	8	21	84	9.5	4	2.0
	Southbound	7	21	84	8.3	4	1.8
95	Northbound	78	43	258	30.2	6	13.0
	Southbound	37	43	129	28.7	3	12.3

None of the routes experience overcrowding during the afternoon peak period, with an average load factor of 28.9%. Despite this low average, several routes have high loads, especially Routes 37, 82 and 3/4 which all have load factors over 75% in the outbound direction. Several other routes also have load factors greater than 50% in the outbound direction, in addition to Route 6's inbound segment.

Several routes operate with very low load factors when traveling in the off-peak direction. Additionally, routes 65, 67 and 93 operate with low passenger levels in both directions.

Table 95: Evening Period
After 6PM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
1-2	Eastbound	96	43 &37	634	15.1	16	6.0
	Westbound	49	43 & 37	634	7.7	16	3.1
3-4	Eastbound	226	44	528	42.8	12	18.8
			43 & 37	468	48.3		
	Westbound	177	44	660	37.8	15	11.8
			37	573	26.8		
6	Eastbound	213	44	704	30.3	16	13.3
	Westbound	99	43	559	17.7	13	7.6
7	Eastbound	6	44	44	13.6	1	6.0
	Westbound	14	44	132	10.6	3	4.7
10	Eastbound	131	37	518	25.3	14	9.4
	Westbound	114	37	555	20.5	15	7.6
13	Eastbound	4	37	37	10.8	1	4.0
	Westbound	2	37	74	2.7	2	1.0

After 6PM

Route	Direction	Max Load Passengers	Bus Capacity	Seats	Load Factor (%)	Bus Trips	Average Load
16	Eastbound	17	21 & 37	195	8.7	7	2.4
	Westbound	30	21 & 37	137	21.9	5	6.0
18	Eastbound	4	37	37	10.8	1	4.0
	Westbound	7	37	37	18.9	1	7.0
19	Eastbound	5	44	88	5.7	2	2.5
	Westbound	0	44	0	0.0	0	0.0
22	Northbound	7	21	42	16.7	2	3.5
	Southbound	0	21	21	0.0	1	0.0
24	Northbound	13	37	148	8.8	4	3.3
	Southbound	30	37	222	13.5	6	5.0
32	Northbound	230	44,43 & 37	837	27.5	20	11.5
	Southbound	124	44,43 & 37	862	14.4	21	5.9
34	Northbound	145	44 & 37	574	25.3	14	10.4
	Southbound	67	44 & 37	611	11.0	15	4.5
37	Northbound	87	44	264	33.0	6	14.5
	Southbound	33	44	220	15.0	5	6.6
62-63	Northbound	200	44 & 43	699	28.6	16	12.5
	Southbound	200	44 & 43	699	28.6	16	12.5
64	Northbound	1	44	88	1.1	2	0.5
	Southbound	0	44	0	0.0	0	0.0
65	Northbound	2	37	185	1.1	5	0.4
	Southbound	2	44 & 37	155	1.3	4	0.5
66	Northbound	1	21	21	4.8	1	1.0
	Southbound	4	37	37	10.8	1	4.0
67	Northbound	0	44	0	0.0	0	0.0
	Southbound	3	44	44	6.8	1	3.0
70-71	Northbound	32	44 & 37	310	10.3	8	4.0
	Southbound	61	44 & 37	310	19.7	8	7.6
				37	0.0		
72-73	Northbound	61	44 & 37	581	10.5	14	4.4
	Southbound	111	44 & 37	493	22.5	12	9.3
74	Northbound	48	44 & 37	266	18.0	7	6.9
	Southbound	85	44 & 37	222	38.3	6	14.2
93	Northbound	1	21	21	4.8	1	1.0
	Southbound	1	42	21	4.8	2	0.5
95	Northbound	1	43	43	2.3	1	1.0
	Southbound	7	43	43	16.3	1	7.0

Buses during the evening time period are the least crowded, with an average load factor of only 15.1%, with no individual route load factor higher than 50%. Route 3/4 in the eastbound direction has the highest load factor during the evenings along with Routes 37, 6 and 74.

The express routes that are operating during these time periods have very low load factors in both directions (especially Route 65 which runs 9 trips in the evening). Routes 93, 13 and 19 also have low passengers loads in both directions, although not many trips occur on these routes during the evenings.

Key Findings

Regardless of the time period examined, there appears to be a consistent pattern when comparing the system demand and supply. The findings are summarized below:

- There is a substantial surplus capacity in the bus system for most routes and during all five time periods, including the morning and afternoon peak periods.
- These results are consistent with GRTC's own observations for assessing Title VI compliance. Moreover, field observations as part of the route planning efforts also indicate the relative imbalance between supply and demand.
- These results would suggest that GRTC's continued reliance on full-sized coaches 40 feet in length is not warranted and that a mix including smaller buses would be more appropriate.
- Purchase of low floor buses typically result in fewer seats for the same length vehicles than standard buses. In view of the maximum load volumes, this minor loss in seating capacity should not be a concern.
- Greater reliance on smaller vehicles such as heavy duty 30 and 35 foot buses and cutaway type vehicles seems an appropriate strategy.
- The results of the survey efforts should be incorporated into the GRTC fleet replacement and expansion program.

GRTC Service Standards

In order to evaluate the adequacy of the existing GRTC fixed route bus service and to guide any route restructuring and new service proposals, it is necessary to establish a set of transit performance criteria. Initially, these criteria are used as appropriate standards in assessing the present service. In a subsequent phase of the current study, certain standards will guide the formulation of route improvement proposals to bridge the gap between actual and desired performance. The service standards discussed herein also provide the framework for subsequent service monitoring which will be an on-going effort for GRTC.

The development of service standards for GRTC is based on several key factors including:

- Suitability to the characteristics of the service territory and requirements.
- Consideration of the cost implications of each standard.

- Ease of use in that the parameters defined in each standard permit a straightforward evaluation of actual system performance and set forth clear guidelines for evaluating service alternatives.
- Prevailing practice in the transit industry.
- Standards developed for GRTC as part of earlier planning efforts.

Several points should be made with respect to the development and subsequent application of the service standards. Reasonable judgment must be used in applying the service standards to assess current GRTC service. While the standards are quantitative for the most part, other factors may be considered in making a service change decision. Further, issues related to public policy in terms of funding cannot always be addressed fully by numerical standards. Also, the service standards may conflict with one another since some yardsticks relate to the benefits derived from transit service while others relate to the costs. Nonetheless, the standards permit the tradeoffs to be delineated and an informed decision made to resolve differences.

Establishing standards for transit services often involves a trade-off between the quality of service as perceived by GRTC's customers – current and potential riders – and the cost of providing services. Passengers seek bus services that operate very frequently (short headways), on which they can always find a seat (load factor less than 1), that is available at any time of day (long service span), and which is always on-time. Transit agencies strive to meet these expectations within the constraints of available resources, but often find that compromises are required. To assist transit agencies in evaluating services, the Transportation Research Board has developed the Transit Capacity and Quality of Service Manual (TCQSM).[11] The Manual does not address all aspects of transit operations or the many topics for which standards are useful in assessing system performance. Rather, the Manual addresses the key factors that relate to quality of service as perceived by customers. For these factors, the Manual suggests ratings of "A" to "F" akin to the level-of-service ratings used in highway planning. It is not suggested that all transit systems must achieve level-of-service "A," or any specific service level. Rather, the Manual recognizes that needs and resources will vary by community and that different levels-of-service will be appropriate not only in different communities but also in different portions of a single urban area.

Relating GRTC's recommended standards to the levels-of-service defined by the Transit Capacity and Quality of Service Manual permits staff and management to assess the quality of service provide to customers to accepted national measures, and to consider how best to allocate resources.

Another point related to service assessment is that the comparison of actual performance with the standards should not be made on a "pass/fail" basis. Instead, results should be viewed in terms of the proportion of the standard that is met or the

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[11] *Transit Capacity and Quality of Service Manual, 2nd Edition,* TCRP Report 100, Transit Cooperative Research Program, Transportation Research Board, Washington DC, 2003

level of attainment. Further, the standards have been set at reasonable values to reflect current and prospective operating conditions. Another point regarding the standards is that they represent minimums that should be achieved. This would not preclude GRTC exceeding thresholds that have been established for each criterion.

The standards presented in this chapter are based primarily on the work performed in the previous COA performed several years ago. The criteria presented in that earlier analysis represented a relatively complete set of measures to assess GRTC service from the standpoint of the transit agency, the riders and the broader community. Changes have been made in the definition of some standards while the values established for acceptable performance have been modified in others. For other portions of the service standards no changes are suggested since they remain valid in the current transportation setting. Delineating a service standards policy is a dynamic process. Based on the evaluation of the GRTC bus system, further modifications may be made to define acceptable performance.

The proposed set of service standards appropriate for GRTC includes four major aspects of service: service coverage, patron convenience, fiscal condition and passenger comfort. A listing of more than a dozen separate service standards within the four broad categories and the recommended level of performance for each is summarized and presented in Table 107.

Service Coverage

This category deals with transit routes and schedules and includes standards related to availability, frequency, span and directness.

Availability

A transit operator inevitably receives many requests for service from citizens who are not within walking distance of any bus route, or who desire that buses operating in their neighborhoods serve different destinations. Since transit resources are limited, it is unlikely that everyone will be accommodated to a satisfactory degree. Therefore, it is necessary to determine how to allocate the available resources to provide the best possible service.

In developing availability measures to gauge GRTC fixed route bus service, this standard has been divided into two separate components that reflect travel concentrations, trip purpose and the need for bus service. Availability standards are developed for the residential trip end that produces travel and the non-home end that attracts travel. A description of each of these two is presented below:

Production End

Determination of which residential neighborhoods should be candidates for service is a function of the distance that people are willing to walk. Repeated surveys have shown that the maximum distance an average person in Virginia can reside from a bus route and still consider oneself to "have service" is approximately one quarter of a mile, or roughly 1500 feet. However, this rule of thumb must be applied in conjunction with data regarding auto ownership and population density in an area to determine optimum spacing of bus routes. Table 96 indicates the route coverage standards suggested for GRTC based on auto ownership and population density. The former criterion reflects the need for public transportation service while the latter measures the concentration of development necessary to support reasonable utilization levels.

The suggested standard would mandate an 800 foot (one-sixth of a mile) walking distance between home and the closest route in high density and low auto ownership areas. In contrast, for those areas where residential density is relatively low and auto ownership relatively high, routes can be spaced farther apart while still meeting the standard. These standards apply where the percentage of households without autos and the population density are sufficient to justify such "specified" transit coverage. In areas that do not exhibit characteristics associated with the need or propensity to use transit, the standard permits limited or no service.

The route coverage guide is just that - a guide. It is not an exact measurement. In some areas, the street pattern is not uniform or major generators may be further apart than the guide indicates. GRTC bus service may not and probably should not conform to the guide in all areas. Service should, however, meet the intent of the guide -- areas with more people and/or fewer cars need more transit service than sparsely populated or relatively affluent areas.

Table 96: Transit Route Spacing Guide (Distance to Nearest Bus Route)

Percent of Households w/out Autos	Population Density (Households Per Acre)			
	Over 10	7 to 10	4 to 6.9	Under 4
Over 15.0	800 Feet (1/6 Mile)	800 Feet (1/6 Mile)	1,300 Feet (1/4 Mile)	2,600 Feet (1/2 Mile)
10.0 to 15.0	800 Feet (1/6 Mile)	1,300 Feet (1/4 Mile)	2,600 Feet (1/2 Mile)	5,280 Feet (1 Mile)
5.0 to 9.9	1,300 Feet (1/4 Mile)	2,600 Feet (1/2 Mile)	5,280 Feet (1 Mile)	*
Below 5.0	2,600 Feet (1/2 Mile)	5,280 Feet (1 Mile)	*	*

* Fixed route service or other service types should be provided to residential communities on a special situation basis.

Attraction End

Activity centers deserve transit service if they are large enough to attract an adequate number of transit trips. To assist in this determination, "threshold levels" have been

established for different categories of activity centers. These threshold levels, which are based on past experience and judgment, should serve as guidelines in determining which centers in each category should be given consideration for service. Other factors, such as the proximity of the center to existing bus routes, should be considered before providing new service to a major activity center.

Employers - Employers with 350 or more employees are large enough to warrant consideration for service. This standard applies to both individual employers and groups of employers in a concentrated area (e.g., industrial or office park).

Shopping Centers - Shopping trips constitute a major reason for transit travel. Shopping centers (including malls and major plazas) with more than 100,000 square feet of leased retail space are large enough to warrant consideration for GRTC service.

Hospitals/Nursing Homes - These usually do not attract a large number of trips. However, they often serve those who depend on transit. Therefore, institutions of 100 beds or more may be considered candidates for GRTC service.

Colleges/Universities - Students often comprise a major segment of the transportation dependent population in a community. For this reason, colleges and other post-secondary schools have been included in the availability standard. Institutions with an enrollment of at least 1,000 full-time students warrant consideration for service.

Social Service/Government Centers - Public agencies, government centers and community facilities attract some volume of traffic. Since the nature and size of these facilities varies greatly, no numerical threshold will be set. Judgment, as well as trip purposes and characteristics of the users (e.g., elderly and low income citizens) should be considered in deciding whether to serve a facility.

The categories of generators listed above represent the destination end of the transit trip. Combined with the availability standard for the production end of the trip, they provide a comprehensive view of service requirements within the GRTC service area. It should be noted that application of the availability standard will provide a major input to subsequent service planning activities.

Frequency

This standard is one of the commonly applied measures of transit adequacy, particularly from the patron's point of view. Consequently, it is one service characteristic which is typically the source of patron dissatisfaction. In general, frequencies or "headways" (i.e., the time between buses at the same location) are established to provide enough vehicles past the maximum load point(s) on a route to accommodate the passenger volume and stay within the recommended loading standards, discussed later in this report. If passenger loads are so light that an excessive time is needed between vehicles to meet loading standards, then headways should be set on the basis of policy considerations.

The TCQSM defines the levels-of-service for frequency as:

LOS	Avg. Headway (min)	veh/h	Comments
A	<10	>6	Passengers do not need schedules
B	10-14	5-6	Frequent service, passengers consult schedules
C	15-20	3-4	Maximum desirable time to wait if bus/train missed
D	21-30	2	Service unattractive to choice riders
E	31-60	1	Service available during the hour
F	>60	<1	Service unattractive to all riders

For GRTC, we suggest service standards both for types of service and time period. For periods when service is operated, the minimum policy headways are suggested in Table 97. These correspond to level-of-service "C" during peak periods and level-of-service "D" or "E" during off-peak periods and on weekends.

Table 97: Minimum Headway Policy Guide (minutes)

Period	Local	Express
Weekday: Peak	15-20	2 Trips
Weekday: Off-Peak	30-60	--
Saturday	30-60	--
Sunday	60	--

It should be recognized that the policy headways represent minimum acceptable values in terms of frequencies. For example, a bus route that operates every 30 minutes on Sunday exceeds the standard and would not warrant changes. On the other hand, a route with less frequent service (e.g., a bus every 90 minutes) would not conform to the standard and should be examined for more frequent service.

In some cases, the headway of a route may be established as the round trip cycle time. As with all standards, the headway matrix presented above should be considered a guide, not an absolute measure. In some cases, limited service may be afforded to outlying areas or residential concentrations at greater headways in order to maintain a satisfactory farebox recovery or productivity. Further, to the extent possible, headways should be designed to conform to regularly recurring clock face intervals (e.g., on the hour, half past, etc.).

Span

This measure is the duration of time each bus route is "made available" or operated during the day. The TCQSM defines the following measures:

LOS	Hours of Service	Comments
A	19-24	Night or "owl" service provided
B	17-18	Late evening service provided
C	14-16	Early evening service provided
D	12-13	Daytime service provided
E	4-11	Peak hour service only or limited midday service
F	0-3	Very limited or no service

Desires of the transit constituency and financial capability of the operator are key considerations in setting not only weekday service spans, but also which routes are operated on Saturdays and Sundays. For weekday routes oriented to work and school trips, service should begin early enough to permit workers and students to make their morning start times and should end late enough to provide for return trips home, including those for whom the work day ends at 9:00pm or10:00pm.

Service oriented to non-work travel can start later and end sooner, although with several retail areas in the GRTC service area, service should be provided until at least 10:00pm to accommodate both shoppers and mall employees.

Table 98: Service Span Guide

Service	Begin	End	Hours
Weekday	5:00am	11:00pm	18
Saturday	6:00am	11:00pm	17
Sunday	6:00am	10:00pm	16

Work trip services should be provided on an as needed basis. Slightly reduced spans are suggested for Saturdays and Sundays. Service span, like other standards, is a guide. Specific routes may start earlier or later than the suggested span depending on the need for service in a specific area, the generators served and the types of trip purposes. Similar to the frequency standard, the suggested spans are minimums. For example, if a route started at 5:00AM on Saturday the standard would be exceeded and there would be no need to start later in the day.

Given that there is a significant population served by GRTC that is dependent on transit for travel to and from work as well as other needs, the suggested standards, as shown in Table 98, are:

Weekday - Level of service "B"
Saturday and Sunday – Level of service "C"

Directness

This standard addresses the need for system coordination, coherence and accessibility. Complicated, circuitous routes and inordinate trip travel times

discourage transit use. It must be recognized, however, that GRTC cannot provide door-to-door bus service or even a one seat ride for every passenger. Two components are involved in measuring the directness of GRTC's bus routes. *First, the ratio of the actual route path distance to the straight air line mileage between route terminals should be no more than 1.70.* That is, the distance from one terminal to the other should be no more than 70 percent greater than the straight air line distance between the route's termini. This allows for deviation caused by both road alignment and route circulation, and would apply to all bus lines. Routes with ratios that exceed 1.70 should be examined and modified if feasible.

Service standards permit tradeoffs regarding service to be identified. For example, the lack of through roadways or need to cross physical barriers may result in a route directness ratio greater than that proposed by the standard. Routes exhibiting a directness ratio of 2.00 may be attempting to serve too many locations. In order to straighten out the alignment, deletion of service to certain generators may be necessary. If GRTC wishes to continue serving these locations, development of a new route may be in order. The tradeoff involves weighing the costs of the new route versus the expected ridership gain from offering a more direct and swift service.

The second component of the directness standard states no more than 30 percent of the system's patrons should need to transfer between vehicles in order to complete their trips. Also, transfer connections should be scheduled as closely as possible to minimize waiting times. In general, passengers should be required to wait no longer than 15 minutes. Waits of five minutes or less are preferable.

Patron Convenience

The next five service standards- speed, loading, bus stop spacing, dependability and accident ratio- are concerned primarily with patron convenience and safety in using the system, but also influence system operating costs.

Speed

Buses face certain unavoidable constraints that all vehicles on public streets experience. For this reason the speed of transit vehicles, in the absence of any preferential treatments, will not exceed the speed of traffic in general. Passenger boarding and alighting volumes, route alignments, stop spacing and fare collection methods are factors under the operator's control which influence operating speed.

While there are several measures of speed which may be employed in the evaluation of this criterion, the most meaningful to the patron is running speed -- route miles/running time (excluding layover). As the GRTC system operates in a variety of settings, different running speeds are appropriate as shown in Table 99.

Table 99: Running Speed Guide

Location	Speed (MPH)
Core	8 to 12
Fringe	10 to 14
Outlying	12 to 18

The core area is defined by the Richmond central business district with the fringe being the adjacent environs. The outlying area includes the remainder of the service area. As might be expected, traffic and safety conditions in each of these areas will have varying influence on running speed. Further, when buses operate on limited access roadways, they should travel at the same speed as automobile traffic.

Loading

To insure that most passengers will be able to obtain a seat on a GRTC vehicle for at least a major portion of their trip, loading standards must be established and schedules devised that reflect passenger volumes. This standard is measured as the ratio of passengers on board to the seated bus capacity expressed as a percentage. Values of 100 percent or less indicate all riders are provided a seated ride while values of more than 100 percent denote standees. Loading standards indicate the degree of crowding (number of standees) which is acceptable, with consideration given to both the type of service and the operating period. Currently, overcrowding is not a problem on GRTC bus routes; however, the service standards will aid in the selection of the proper fleet mix.

The recommended loading standard (shown in Table 100) for GRTC requires that a seat is available for every rider's entire trip (LOS "C") except during the peak periods on local bus routes during weekdays. (LOS"D"). Because of the higher rate of speed, all express bus passengers should be seated during their trip (LOS "C"). In situations with standees, no rider should be expected to stand for more than 10 minutes.

Table 100: Loading TCQSM Level-of-Service Criteria

LOS	Load Factor (p/seat)	Standing Passenger Area (ft^2/p) (m^2/p)		Comments
A	0.00-0.50	>10.8†	>1.00†	No passenger need sit next to another
B	0.51-0.75	8.2-10.8†	0.76-1.00†	Passengers can choose where to sit
C	0.76-1.00	5.5-8.1†	0.51-0.75†	All passengers can sit
D	1.01-1.25*	3.9-5.4	0.36-0.50	Comfortable standee load for design
E	1.26-1.50*	2.2-3.8	0.20-0.35	Maximum schedule load
F	>1.50*	<2.2	<0.20	Crush load

Bus Stop Spacing

While route alignments are the primary determinants of transit availability, a second influence on the proximity of transit is the bus stop spacing along those routes. Placing stops at every intersection provides the shortest walking distance to the bus,

however operating speed and efficiency decrease when stops are too close together. Therefore, a bus stop spacing standard must consider the density of the service area, characteristics of the land uses served, and appropriate operating speeds.

In some instances, the bus stop spacing standard should be discarded in favor of simply considering the location of patron concentration. This is especially true for stops that serve major activity centers such as regional shopping malls or university campuses.

The exact placement of a bus stop in the area of a signalized intersection is also a matter of concern. Site-specific traffic and street conditions should ultimately determine stop locations, and the exact placement of a stop should always be a matter for individual traffic engineering analysis. Overall, a consistent policy should be pursued with respect to location. In many cases, it may be necessary to discuss bus stop placement with local municipalities.

There is an inverse relationship between bus stop spacing and overall development patterns. *Within the core area, bus stops should be placed every other block; however, consideration should be given to permitting convenient transfers between bus lines. As the density of development decreases, bus stop spacing can be increased as shown in Table 101*[12].

Table 101: Bus Stop Spacing Guide

Location	Spacing
Core	5 to 6 per mile
Fringe	4 to 5 per mile
Outlying	3 or 4 per mile

Dependability

Published timetables must provide the transit patron with a reasonable guarantee that the scheduled service will operate, and will operate on time. The dependability of GRTC is important to people who typically plan trips around the availability of bus service. Moreover, riders associate a time penalty with unreliable bus service which reduces the attractiveness of public transportation.

The first measure of GRTC's dependability is schedule adherence, which measures the difference between scheduled time and the time the bus actually passes a particular location. The schedule adherence standard consists of two parts: the definition of on-time and the proportion of buses that operate within the on-time range. For purposes of assessing GRTC's dependability, on-time is established at up

[12] *Guidelines for the Location and Design of Bus Stops*, TCRP Report 19, Transit Cooperative Research Program, Transportation Research Board, Washington DC, 1996.

to five minutes later than the scheduled arrival time. This standard allows the bus reasonable latitude for encountering general delays, without unduly inconveniencing waiting patrons. For most passengers, a wait of up to five additional minutes is not regarded as excessive. Buses should never be early, as this would cause patrons to miss the bus entirely, subjecting them to an even longer wait for the next scheduled bus.

The standard proposed for GRTC schedule adherence is LOS "B" - 90 and 95 percent for local services during the peak and off-peak periods, respectively, as shown in Table 102. The guide suggests that LOS "A," 95 percent on time, or better, be established for peak hour commuter/express services. Therefore, 18 out of 20 peak local buses and 19 out of 20 local off-peak and express trips should be considered on-time according to the standard. The higher value for local bus service during off-peak hours is established because buses are less likely to be delayed because of traffic congestion at these times of the day.

Table 102: On-Time Performance TCQSM Level-of-Service Criteria

LOS	On-Time Percentage	Comments*
A	*95.0-100.0%*	*1 late transit vehicle every 2 weeks (no transfer)*
B	*90.0-94.9%*	*1 late transit vehicle every week (no transfer)*
C	*85.0-89.9%*	*3 late transit vehicles every 2 weeks (no transfer)*
D	*80.0-84.9%*	*2 late transit vehicles every week (no transfer)*
E	*75.0-79.9%*	*1 late transit vehicle every day (with a transfer)*
F	*<75.0%*	*1 late transit vehicle at least daily (with a transfer)*

NOTE: Applies to routes with a published timetable, particularly to those with headways longer than 10 minutes.
"On-time" is 0 to 5 minutes late, and can be applied to either arrivals or departures, as appropriate for the situation being measured.
Early departures are considered on-time only in locations where no passengers would typically board (e.g., toward the end of a route).
*Individual's perspective, based on 5 round trips per week

The next group of measures indicates the level of dependability of GRTC vehicles and whether the service is actually operated. Measures of actual versus scheduled service are expressed as the percentage of scheduled trips and the percentage of scheduled pull-outs which are actually made and the miles between road calls. *For GRTC, the missed trip standard is established at 99.8 percent.* Therefore, only one in five hundred bus trips can be missed and still meet the standard. Buses are subject to significant delays because of a variety of factors such as traffic delays due to accidents, bus breakdowns and passenger illnesses.

Since it is easier to recover from service disruptions at a garage than out in the field, an even more stringent standard of 99.9 percent is appropriate for missed pull-outs. This permits one pull-out in a thousand to be missed and still meet the standard. GRTC should have sufficient spare vehicles and extraboard operators to permit the missed trips and pull-out standards to be met. The final measure of dependability is the number of miles operated between service disruption road calls. *A general guide for GRTC should be 6,000 miles between road calls for mechanical reasons.*

Fiscal Condition

GRTC's financial situation can be defined, both for the system and individual routes, in terms of three service standards: fare structure, farebox recovery, and productivity.

Fare Structure

A transit fare structure should be easy to understand, easy to remember and easy to administer. There is a tradeoff, however, between simplicity and equity. For example, a zone structure charges people more equitably by having those who ride farther pay more, but the zones add another dimension to the fare structure. On the other hand, a flat fare is simple to understand and administer, but those who ride short distances pay just as much as long distance travelers. Another facet of fares to consider is special fares for certain ridership groups, such as senior citizens or the disabled.

Fare structure is a subjective element for which no quantitative standard is established for GRTC. Rather, judgment and/or local policy must be used to establish or change the fare structure. Five qualitative criteria should guide that process:

- Equity - How equitable is the fare structure?
- Administrative Ease - How easily is the fare structure administered?
- Patron Comprehension - How easy is the fare structure for people to understand?
- Revenue Generation - Can the fare structure encourage new ridership?
- Fiscal Integrity - Will the fare structure provide a reasonable level of revenue?

Farebox Recovery

One of GRTC's primary objectives is to provide area residents with the best possible service within a reasonable budget constraint. To achieve this, the farebox recovery (i.e., the ratio of patron fares to operating costs expressed as a percent) guideline should apply at both the system and individual route level. The system value applies to the regular fixed route services operated on both local and express routes and does not include the VCU shuttles which are operated under contract and should require no subsidy. In addition, each route should be examined individually to determine if any bus line is placing an inordinate financial burden on the entire system. Routes should be periodically compared to system-wide averages as was performed as part of the route diagnostics analysis.

To assure that operating deficits are consistent with available funding levels, three farebox recovery levels have been suggested. *The first relates to system-wide performance with a farebox recovery value of 27 percent*. GRTC's system-wide farebox

recovery rate for 2006 was 28.4 percent with both higher and lower values in previous years based on National Transit Data Base reporting. It should be noted that these values also include VCU contract services. For 2006, the combined farebox recovery for both local and express bus routes was 27.2 percent. The suggested value requires the system to maintain this level in spite of escalating costs. The second farebox recovery guideline is applied to each service type (i.e., local and express) as shown in Table 103.

Table 103: Farebox Recovery Guide (System and Service Type)

Service Type	Percent
System	27
Local	30
Express	15

The third farebox recovery measure looks at the performance of each individual GRTC bus route. Each bus route's farebox recovery ratio should be calculated. System costs must be computed for each route, and the route's revenue compared to its calculated cost. Individual route performance should then be compared to the suggested farebox recovery standard which differs by service type. Table 104 provides guidelines for evaluating route performance against the suggested standard and indicates a rating category.

Table 104: Farebox Recovery Guide (Route)

Category	Percent Applied To Service Type	Service Type Guideline	Criteria
Local Bus Routes			
Successful	Over 80	30	Over 24
Marginal	60-80	30	18.1 - 24.0
Problem	Under 60	30	Under 18
Express Bus Routes			
Successful	Over 80	15	Over 12
Marginal	60-80	15	9.1 - 12.0
Problem	Under 60	15	Under 9

Productivity

Productivity is measured in terms of how many passengers a transit system carries for each unit of service. For this evaluation, the statistic of passengers per vehicle hour is used as the primary measure of productivity. During the past five years, productivity has ranged from about 24 to 28 passengers per vehicle hour, including both regular and VCU services. When the VCU shuttles are excluded, the

productivity for the local and express routes combined was about 23 passengers per hour in 2006 with a wide disparity between local and express service. Because of the line haul portion of the express routes, there is little turnover of seats, while the local routes have far more instances where people are getting on and off the bus along the entire length of the route.

In a similar manner to farebox recovery, productivity guidelines are specified for the system (excluding VCU service) and the two regular service types in Table 105.

Table 105: Passengers per Vehicle Hour (Service and System Type)

Service Type	Value
System	23
Local	25
Express	15

The guideline by route permits individual bus lines to be categorized by performance levels as shown in Table 106.

Table 106: Passengers per Vehicle Hour Guide (Route)

Category	Percent Applied To Service Type	Service Type Guideline	Criteria
Local Bus Routes			
Successful	Over 80	25	Over 20
Marginal	60-80	25	15.1 - 20.0
Problem	Under 60	25	Under 15
Express Bus Routes			
Successful	Over 80	15	Over 12
Marginal	60-80	15	9.1 - 12.0
Problem	Under 60	15	Under 9

Passenger Comfort

The final group of standards contains four separate elements which deal with increasing system utilization by providing a comfortable and functional environment. Standards in this category address GRTC's equipment and facilities.

Waiting Shelters/Benches

A major concern of transit riders, particularly in inclement weather, is the amount of time spent on the street exposed to the elements. While this is particularly true for transit systems in northern latitudes where winters can be relatively harsh, protection from rain, wind and too much sun in the summertime is also a concern. Accordingly, any set of transit guidelines should include specific reference to waiting shelters.

The placement of shelters and the development of a priority location program should be based on the number of boarding and/or transferring passengers at a specific stop. *Placing shelters at all stops which serve 400 or more boarding and/or transferring riders per week, or which serve concentrations of elderly or handicapped residents, should be the first priority.* Stops where passenger boarding/transferring activity is between 200 and 399 weekly occurrences would be assigned a second priority.

Shelters should comply with ADA standards and include a minimum of 50 square feet of area and should provide adequate enclosure to protect waiting passengers from the elements. Benches should be provided for the comfort of waiting passengers. Service information including route numbers, schedules of bus lines which serve the stop and GRTC's telephone information number and web page should be displayed.

For bus stops where ridership activity would not warrant a stop, benches are suggested where weekly boardings exceed 100 passengers.

Bus Stop Signs

All bus stops in the system should be identified by a uniform style bus stop sign bearing a symbol denoting GRTC, route numbers of bus lines that stop there, telephone information number and web page address.

Revenue Equipment

In order to maximize the pleasure and comfort of the bus rider, and thereby spur demand, GRTC should provide attractive and comfortable vehicles. This standard is primarily a matter of maintenance: seats should not be loose or ripped, floor covering should be in good repair, lighting should be operational, and each vehicle's interior should be clean. Of particular importance is the riding environment for the patron, including functional air conditioning, ventilation and heating systems.

Buses should also be attractive for the community in general -- noise, smoke and odor should be kept to as low a level as possible through use of the latest equipment and strict maintenance procedures. Exteriors of buses used for the full service routes

should be washed daily while buses used in the peak hour special service should be washed at least once a week. For all buses, body damage should be scheduled for immediate repair.

Buses should indicate clearly their route number and final destination. Traditionally, buses have a route destination sign overhead in front and also one on the side. These signs should display route number and destination information in a manner easily understood by patrons.

Public Information

A transit system should develop and maintain a public information program which not only provides information to those who ask for it, but also aggressively educates the public about the system and how to use it.

Route timetables should include all the information necessary for a non-user to make a trip on the bus, including route maps, schedules which show intermediate time points, fare information and transfer information. Individual route timetables should be available in addition to the guide which contains all routes. Specific service information should be available and prominently displayed on all buses. Appropriate sets of public information should be available at major activity centers as well. A route map of the area showing all of GRTC's routes should be available at no cost. System route maps should also be displayed at each bus shelter along with specific departure times for each bus on each route.

Finally, information should be available by phone during service hours. A complaint handling and processing procedure should also be in place. It should include the mechanism to take action to assure that the complaint is satisfactorily resolved.

Summary of Standards

The following table summarizes all of the service standards recommended for GRTC.

Table 107: Service Guidelines Summary

Goals/Objectives	Categories	Standards		
Service Coverage				
Availability	Production End	Walking distance or whether service is available is based on density (persons per square mile) and auto ownership rates (percent of autoless household).		
	Attraction End	Thresholds for activity centers (employers, shopping, medical, school and human service centers) size to be large enough to attract adequate number of transit trips.		
Frequency	Period	Headway		
		Local		Express
	Weekday: Peak Weekday Off-Peak	15 to 20 Minutes 30 to 60 Minutes		2 Trips --
	Saturday	30 to 60 Minutes		--
	Sunday	30 to 60 Minutes		--
Span	Day	Begin	End	Hours
	Weekday	5:00am	11:00pm	18
	Saturday	6:00am	11:00pm	17
	Sunday	6:00am	10:00pm	16
Directness	Terminal Distances	Distance between route terminals should not exceed the straight air line mileage by more than 70 percent.		
	Transfers	Less than 30% of patrons need to transfer. Connecting times of less than 15 minutes.		
Patron Convenience				
Speed	Area	Operating Speed (MPH)		
	Core (CBD)	8 to 12		
	Fringe	10 to 14		
	Outlying	10 to 18mph		

Goals/Objectives	Categories	Standards	
Patron Convenience (Continued)			
Loading	Period	Load Factor (Percent)	
		Local	Express
	Peak	115	100
	Off-Peak	100	--
Bus Stop Spacing	Area	Spacing (Per Mile)	
	Core	5 to 6	
	Fringe	4 to 5	
	Outlying	3 or 4	
Dependability	Period	Percent On-Time On-time is 0 minutes early to 5 minutes late	
		Local	Express
	Peak	90	95
	Off-Peak	95	--
	Trips Operated	99.8 %	
	Pull-Outs Dispatched	99.9 %	
	Miles Per Road Call	6,000	
Fiscal Condition			
Fare Structure	Five Criteria (Qualitative)	Equity, Administrative Ease, Patron Comprehension, Revenue Generation Fiscal Integrity	
Farebox Recovery	Service Type	Percent	
	System (Regular Routes)	27	
	Local	30	
	Express	15	
	Route	Local	Express
	Successful (Over 80%)	Over 24.0	Over 12.0
	Marginal (60% to 80%)	18.1 to24.0	9.1 to 12.0
	Problem (Under 60%)	Under 18.0	Under 9.0

Fiscal Condition (Continued)			
Productivity	Service Type	Passengers Per Vehicle Hour	
	System (Regular Routes)	23	
	Local	25	
	Express	15	
	Route	Local	Express
	Successful (Over 80%)	Over 20.0	Over 12.0
	Marginal (60% to 80%)	15.1 to20.0	9.1 to 12.0
	Problem (Under 60%)	Under 15.0	Under 9.0
Passenger Comfort			
Waiting Shelters/Benches	Passenger Criteria	Shelter First Priority: More than 400 boarding or transferring passengers per week. Shelter Second Priority: More than 200 boarding or transferring passengers per week. Benches: More than 100 boarding or transferring passengers per week	
	Dimensions	Shelters should be a minimum of 50 square feet and should provide adequate protection from the elements. Compliance with ADA regulations. Benches and passenger information should be available at shelters.	
Bus Stop Signs	Features	Uniform bus stop signs with route information. Signs should display GRTC logo, route numbers, telephone information number and web page address.	
Revenue Equipment	Features	Clean, comfortable, well maintained fleet.	
Public Information	Features	Timetables should be easy to read and understand. Individual route timetables. Telephone information number available during service hours. System route maps, displaying all routes as well as major attractions, should be made readily available to passengers. A complaint handling procedure should be in place.	

Service Adequacy

The previous section described a comprehensive set of service standards for the GRTC system. The standards deal with a variety of issues related to the quality and quantity of bus service. In this section of the Technical Memorandum, GRTC's performance relative to each element of the recommended standards is assessed. In this way, guidance can be obtained for the development of transit service improvements. One point that should be noted at the outset is that GRTC's performance should be reviewed in relation to tradeoffs associated with the different elements comprising the service standards policy. Moreover, the analysis presented in this section of the report delineates the competing requirements of providing extensive coverage and frequent service within the practical constraints of limited funding. The results of this review of GRTC routes will become an important input in the development of service proposals.

The standards are organized into four categories: service coverage; patron convenience; fiscal condition; and passenger comfort.

Service Coverage

This broad category includes four specific items as follows: availability, frequency, span, and directness. Each element of the coverage standard is evaluated below.

Availability

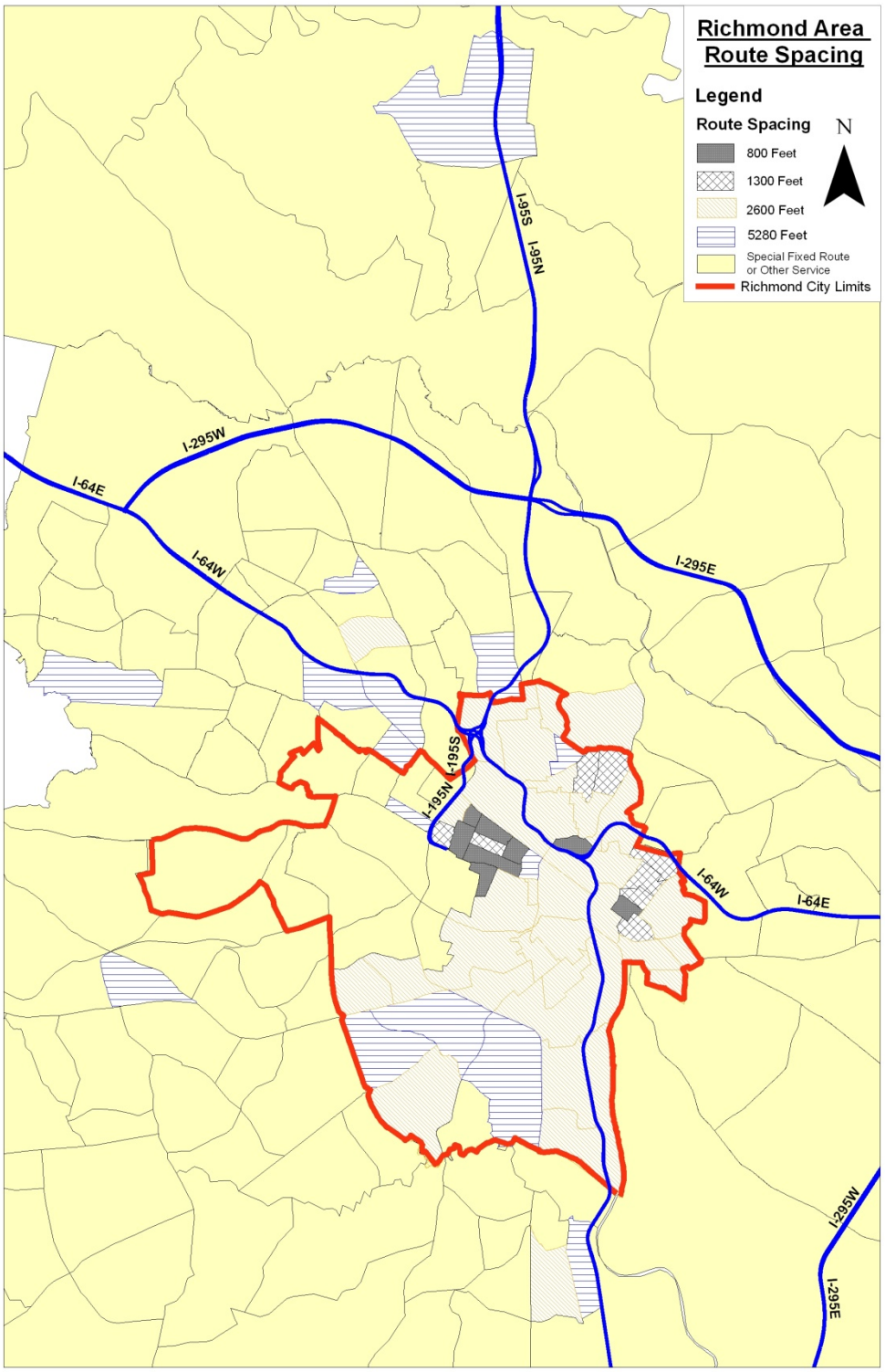
There are two components of the service availability standard for GRTC. The first concerns the location of routes relative to the population which produces transit trips. The other relates transit service to the activity centers which attract transit patrons. Each of these components of GRTC's service is assessed in this section.

Production End

One of the more difficult decisions facing transit management is where service should be provided and how the routes should be spaced. The suggested standard for GRTC relates route spacing and coverage to population density and the concentration of households with no automobiles. Generally, more densely developed areas with low auto ownership warrant the greatest transit availability. Conversely, low-density areas with high auto ownership rates suggest relatively wide route spacing. In some communities, the development patterns and need as measured by auto ownership may indicate that no bus service needs to be provided.

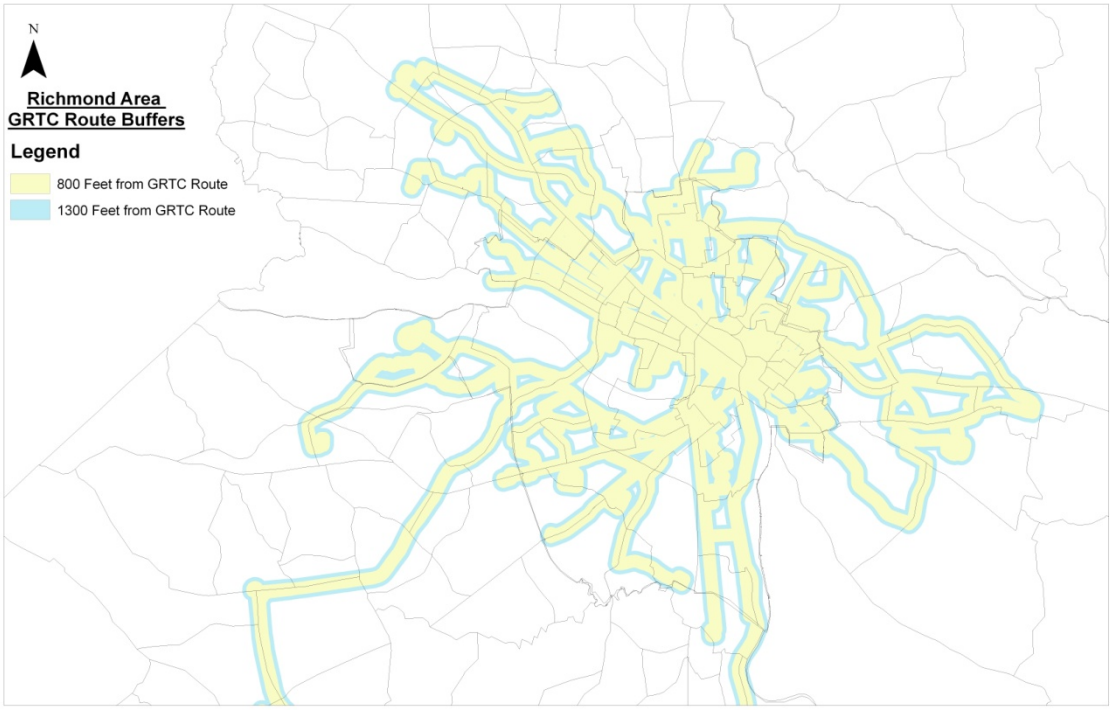
Figure 114 demonstrates how the standard applies to the GRTC service area.

Figure 114: Recommended Route Spacing



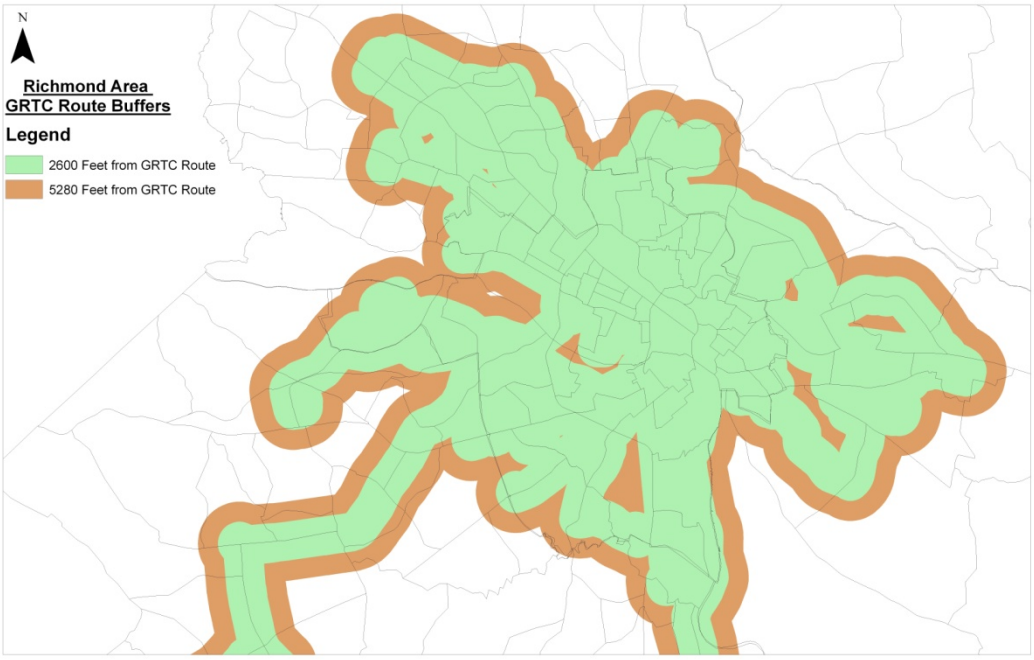
The figure shows the route spacing standard calls for ¼ mile spacing or less in the central area of Richmond – mainly in the area west of Belvidere Street, south of Broad to the James River and east of I-95. There are also pockets in eastern and northern Richmond where ¼ mile spacing or less is warranted. Throughout much of the remainder of the City of Richmond, ½ mile spacing is appropriate with some areas requiring only one-mile spacing. Areas that only require one-mile spacing are mainly in the southern and western edges of the city. According to the standard, there are also areas in the southern and western parts of the city where fixed route service is only required to meet another element of the standards (e.g., major generator). Figure 115 and Figure 116 show how GRTC's current route spacing conforms to the standard.

Figure 115: 800 and 1,300 Foot Coverage by GRTC Routes



Comparing Figure 116 to Figure 115 shows that GRTC's routes spacing is 1/6 or ¼ mile as recommended under the standards. A similar comparison of Figure 1 with Figure 3 shows that GRTC also provides 1/2 to 1 mile route spacing in the portions of the service area where warranted by the service standards. This analysis indicates that GRTC is in compliance with this element of the coverage standard.

Figure 116: ½ ***and 1 Mile Coverage by GRTC Routes***



Attraction End

The service standards developed for GRTC established minimum threshold sizes for activity centers to warrant transit service. These were as follows:

Major Employers - Employers with at least 350 employees at a single location.

Shopping Centers – Retail centers with more than 100,000 square feet of retail space.

Hospitals/Nursing Home Facilities – Locations with 100 beds or more.

Colleges/Schools – Institutions with at least 1,000 enrolled students.

Social Service/Government Centers – Consider trip purpose and characteristics of users.

A review of the current GRTC services shows that GRTC is in compliance with this element of the standards and provides good coverage to the various locations in the service area that meet these designated thresholds. Three sites that are in close proximity to the City of Richmond that meet the thresholds above but are not currently served by GRTC include the Short Pump Mall, Virginia Center Commons Mall and Chesterfield Town Center Mall. These sites were also commonly identified

by respondents to the household survey as locations to which they would like to travel using transit.

Frequency

It is recommended that all GRTC local routes should be operated with at least a 15- to 20-minute headway during peak travel periods, while the off peak headway should not exceed 30- to 60-minutes. Saturday service, when provided, should be operated with headways of at least 30- to 60-minutes, while Sunday headways should be at least 60-minutes. Express routes should provide at least two round trips in each peak period.

A review of the current schedules shows that GRTC typically meets the suggested frequency standard on most routes. Table 108 lists each instance in which the current schedules for GRTC routes do not comply with this suggested standard. While the table lists numerous instances, it should be noted that the headways operated on these routes are not at substantial variance from the standards. Also, the frequency of service must be balanced with the farebox recovery and productivity guidelines. This underscores the tradeoffs between the various elements of the service standards policy.

Overall, GRTC provides service at a relatively high frequency when compared to similarly sized transit systems in other areas. It should also be noted that certain routes, such as Route 1 and Route 2 or Route 70 and Route 71, share a common trunk segment. While the frequency of these routes, in some instances, does not meet the standard on the far ends of the branches, sufficient headways are provided on the trunk segments. Instances such as these may respond appropriately to conditions in the area served by the specific route. Therefore, each instance should be examined for cause and appropriateness.

Table 108: Instances of Non-Compliance with Frequency Standard

	Frequency (minutes)						
	Weekday				Saturday		
	AM Peak	Midday	PM Peak	Evening	Day	Evening	Sunday
Standard	**15-20**	**30-60**	**15-20**	**30-60**	**30-60**	**30-60**	**60**
Local Routes							
1 - Monument/Church Hill	26	-	24	-	-	-	64
2 - Patterson/Church Hill	22	-	24	-	-	-	64
7 - Seven Pines	33	-	24	-	-	-	-
11 - Laurel/17th St.	64	-	62	-	-	-	-
13 - Main St./Church Hill	45	-	34	-	45	-	-
16 - Westhampton	18	-	18	-	65	-	65
18 – Henrico Shuttle	55	-	58	-	-	-	-
19 – Pemberton Road	60	-	37	-	-	-	-
20 – Northside	75	-	1 EB, 1 WB	-	Weekday	-	-

	Frequency (minutes)						
	Weekday				Saturday		
	AM Peak	Midday	PM Peak	Evening	Day	Evening	Sunday
Standard	**15-20**	**30-60**	**15-20**	**30-60**	**30-60**	**30-60**	**60**
22 – Hermitage	33	-	33	1 IB, 1 OB	62	1 IB, 1 OB	62
24 - Crestwood	36	-	25	-	-	-	-
56 – South Laburnum	33	-	36	-	-	-	-
61 – Broad Rock Shuttle	56	-	60	-	-	-	84
70 – Forest Hill	47	-	40	62	67	67	65
71 – Forest Hill	38	-	40	68	-	65	-
72 – Ruffin Road	40	-	40	1 IB, 1 OB	-	1 IB, 1 OB	-
73 – Ampthill - Dupont	40	-	22	-	-	-	-
93 – Azalea Connector	30	-	30	-	-	-	-

A dash (-) indicates that the route schedule either complies with the standard for that period, or the standard is not applicable.

Span

The duration of time that routes are available to the riding public must reflect the need for service, the availability of resources to provide the service, as well as the specific needs of certain activity centers located along the bus route. The standard suggests that service on local bus routes operate from 5:00AM to 11:00PM on weekdays, on Saturdays from 6:00AM to 11:00PM, and on Sundays from 6:00AM to 10:00PM.

As with frequency of service, a review of the current schedules shows that the schedules of most routes comply with the suggested standard. Table 109 shows the instances in which the current schedules are not in compliance. For the purposes of this analysis, if the start or end time of a route schedule is within 20 minutes of the standard, it was considered to be in compliance.

Many of the instances listed in Table 109 address the lack of weekend service on various routes. While the standards call for weekend service on local routes, the standards also state that service availability decisions must be based on the specific area served by the route due to limited available resources. This is also true for the start and end times suggested for weekday service. Since the span of service of individual routes may respond to conditions in the area served, each of the instances noted below should be examined for cause during the development of service improvement recommendations.

Table 109: Instances of Non-Compliance with Span Standard

	Service Span		
	Weekday	**Saturday**	**Sunday**
Standard	**5:00AM-11:PM**	**6:00AM-11:00PM**	**6:00AM-10:00PM**
Local Routes			
2 - Patterson/Church Hill	5:45AM-12:32AM	-	-
7 - Seven Pines	6:15AM-7:30PM	No Service	No Service
11 - Laurel/17th St.	6:24AM-5:53PM	9:10AM-4:20PM	No Service
13 - Main St./Church Hill	-	-	No Service
16 - Westhampton	5:28AM-10:19PM	5:29AM-10:13PM	6:24AM-10:13PM
18 – Henrico Shuttle*	6:40AM-7:00PM	No Service	No Service
19 – Pemberton Road*	6:07AM-7:16PM	No Service	No Service
20 – Northside	6:30AM-8:46AM 3:54PM-4:38PM	6:30AM-8:46AM 3:54PM-4:38PM	No Service
22 – Hermitage	5:32AM-11:21PM	-	-
24 - Crestwood	5:50AM-10:40PM	-	5:59AM-9:11PM
37 - Chamberlayne	5:42AM-12:30AM	-	6:30AM-12:55AM
56 – South Laburnum	6:09AM-5:43PM	No Service	No Service
60 – Hickory Hill Connector	4:00PM-10:00PM	No Service	No Service
61 – Broad Rock Shuttle	No Service	5:40AM-6:45PM	5:53AM-6:00PM
67 – Chippenham	7:00AM-8:54AM 4:40PM-6:37PM	No Service	No Service
70 – Forest Hill	6:08AM-11:31PM	-	-
71 – Forest Hill	5:36AM-11:34PM	6:40AM-11:28PM	6:40AM-10:32PM
72 – Ruffin Road	5:55AM-11:35PM	No Service	No Service
73 – Ampthill - Dupont	5:35AM-12:57AM	-	-
93 – Azalea Connector*	6:40AM-6:55PM	No Service	No Service

A dash (-) indicates that the route schedule either complies with the standard for that period, or the standard is not applicable.
An asterisk (*) indicates a Henrico County route. GRTC service in Henrico County was restricted to 7 am to 7 pm as of mid-2007.

Directness

There are two methods that are typically utilized for assessing the "directness" of a transit system. The first method of assessing directness concerns route length. This service standard suggests that each route should be no more than 1.70 times the straight "air line" distance between the route's terminal points. To determine GRTC's performance in this regard, the directness ratio was calculated for each of GRTC's fixed routes. There are 11 GRTC local routes that exceed the standard of

1.70. The ratios for the routes which exceed this guideline are shown in Table 110. The highest ratio is Route 93, with a directness ratio of 3.40. Each of the routes listed may be attempting to serve too many destinations and each instance should be examined for cause. Potential changes to the alignments of these routes should be pursued as service improvement recommendations are developed.

Table 110: Non-Compliance with Directness Ratio Standard

	Route Distance (mi)	Air Line Distance (mi)	Ratio
Standard	**-**	**-**	**1.70**
Local Routes			
3 – Robinson (West End)	4.9	2.2	2.23
4 – Fairmount (East End)	2.9	1.2	2.42
6 - Main Street (East End)	5.5	3.1	1.77
11 – Laurel (West End)	1.8	1.0	1.80
11 - 17th Street (East End)	2.5	1.2	2.08
18 – Henrico Shuttle	12.8	7.4	1.73
56 – South Laburnum	12.8	7.1	1.80
24 - Crestwood	7.7	4.1	1.88
61 – Broad Rock Shuttle	11.6	5.3	2.19
63 - Midlothian	11.6	5.9	1.97
93 – Azalea Connector	6.8	2.0	3.40

The second component of the directness standard suggests that no more than 30 percent of the system's patrons should require more than one bus to complete their trip. Results of the rider survey conducted as part of this study effort provides some indication of GRTC's compliance with this element of the directness standard. An analysis of the trip patterns (i.e., origin and destination) described by the passengers surveyed was performed. Based on this analysis, it was estimated that approximately 14.4 percent of GRTC passengers must transfer to complete their trips. Other information compiled by GRTC indicates transfer rates of approximately 25 percent. This would indicate that GRTC is in compliance with this standard.

Based on this review, it can be concluded that, overall, GRTC complies with the service coverage guidelines, with only minor instances of non-compliance. These instances will be examined further as service improvement recommendations are developed.

This section presents GRTC's performance in areas related to patron convenience. Operational characteristics are reviewed in terms of speed, loading, bus stop spacing, and dependability.

Speed

The running speed of a bus, which excludes layover, is the most meaningful measure of speed for passengers. The standard suggests different speeds for core, fringe, and outlying areas. The standard calls for speeds of 8 to 12 miles per hour in the core area, 10 to 14 miles per hour in the fringe, and 12 to 18 miles per hour in the outlying areas.

Based on route level data tracked by GRTC, the system is in general compliance with this standard on nearly all routes. Speeds of local routes range from a low of 9.0 miles per hour on Route 3-4 Robinson-Fairmount to a high of 19.1 on Route 56 South Laburnum. This would be expected given the more urban nature of the area served by Route 3-4 and the more suburban nature of the area served by Route 56. None of the local routes fall below the 8 miles per hour threshold. Among the Express Routes, the route with the lowest speed is Route 64 Stony Point with a speed of 12.7 miles per hour. The highest speed is on Route 95 which has an average running speed of 32.7 miles per hour. Both the Route 64 Stony Point and Route 66 K-Mart Express (16.6 miles per hour) have low running speeds for express routes. This is due to the fact that a significant portion of these routes are operated on local streets rather than on limited access highways. Changes to the alignments of these express routes may be warranted.

Loading

The standard suggests that each passenger should be provided with a seated ride during the off-peak periods and that the maximum load during peak periods on local routes should not exceed 125 percent of the seated capacity of the bus. Loads on express routes should never exceed 100 percent of the seated capacity. As part of this study effort, on-board ride checks were performed on all GRTC weekday trips. The results of these checks were reviewed to identify any instances of overcrowding. The results showed that, typically, GRTC meets the loading standard. However, there were a few instances of loads that exceeded the suggested thresholds. These are listed below.

Table 111: Instances of Overcrowding

Route	Direction/Trip Type	Occurrence
4	Eastbound from Douglasdale	Midday load exceeded 100%
4	Eastbound from Douglasdale	Peak trip exceeded 125%
6	Eastbound	Midday load exceeded 100%
32	Southbound via West Loop	Midday load exceeded 100%
32	Southbound via West Loop	Early AM load exceeded 100%
37	Northbound	Peak load exceeded 125% (2 trips)
73	Northbound	Early AM load exceeded 100%

It is interesting to note that five of the eight occurrences of loads exceeding the suggested standard occurred in off-peak periods.

Bus Stop Spacing

The spacing of bus stops should strike a balance between passenger convenience and the speed of operation. The spacing standard calls for five to six bus stops per mile, or about one every other block in the core urban area. In the fringe area, the standard calls for four to five stops per mile and three to four stops per mile in the outlying areas. To measure GRTC's compliance with this element of the standard, four major corridors in the area were selected including a corridor from each quadrant of the city. The number of bus stops along these selected corridors was then recorded using the bus stop list provided by GRTC. The portion of the corridor examined was measured for distance and the number of stops per mile was calculated. The results are shown below.

Table 112: Bus Stop Spacing

Street	Segment	Distance (miles)	Stops	Stops per Mile
Broad St.	11th St. – Willow Lawn	4.7	38	8
Nine Mile Rd.	Fairmount Ave. – Lake Ave.	4.3	21	5
Chamberlayne Ave.	Price St. – Laburnum Ave.	2.5	20	8
Hull St.	Broad Rock Rd. – 1st St.	2.0	19	10

For the most part, these selected corridors should be considered under the core area standard, with segments in the fringe. The results of the analysis show that GRTC exceeds the suggested standard in three of the selected corridors and meets the standard in the fourth. While exceeding the suggested spacing may make accessing the system more convenient for the passenger, having too many bus stops can slow down the service thereby increase running times or cause on-time performance issues. GRTC could possibly reduce the number of stops along some of these major corridors.

Dependability

The dependability standard for GRTC contains four components. First, the service operated must be reliable in that the service complies with published schedules. This component of the dependability standard suggests that 90 to 95 percent of both peak period and off-peak period trips on local routes should run on-time (defined as zero minutes early to five minutes late). Throughout the service day, 95 percent of trips on express routes should operate on-time. In 2008, Automatic Vehicle Locators (AVL) will be installed on the GRTC fleet, allowing for a full analysis of on-time performance.

Fiscal Condition

Three sets of standards have been developed to define GRTC's financial situation. The first, fare structure, is analyzed on a system-wide basis. The other standards, farebox recovery and passenger productivity, are defined for both the system and individual routes.

Fare Structure

In terms of the appropriateness of the fare structure, no quantitative standard has been established for the GRTC system. Rather, qualitative criteria which pertain to matters such as equity, ease of administration, patron comprehension, revenue generation, and fiscal integrity must be examined by transit policy makers. These criteria are discussed below.

Equity - The GRTC fare structure contains a single zone base fare for all local routes of $1.25. Premium fares are charged for certain routes such as express services or routes that serve neighboring counties from downtown Richmond. These premium fares range from $1.75 to $6.00 depending on the distance traveled. With such a system, there is a direct relationship between the distance traveled and the fare paid. In addition, passengers pay more for a premium service such as an express bus. Transfers are sold for $0.15 and the fare structure provides discounts to disabled riders and senior citizens, who ride for $0.50. Several prepayment media (i.e., "Go Cards") are also available. The present fare structure satisfies the equity criterion.

Administrative Ease - In terms of administrative ease, the present fare structure is rated as favorable. Although there are several fare programs, the necessary resources associated with collecting and processing revenue do not appear burdensome. The level of effort associated with passes is offset by the reduced effort for handling and counting cash.

Patron Comprehension - The present fare structure is rated favorably with respect to this criterion. Seasoned patrons as well as first-time users can readily understand the fare structure and what they will need to pay for their ride.

Revenue Generation – The fare structure is also rated favorably for revenue generation in that it presents various fare options to the riders. Also, the base fare is in line with peer systems. One issue concerning this criterion is that the use of Go Cards does not provide any discount on a price per trip basis. This should be considered by GRTC both to promote wider use of the pass and increased overall ridership.

Fiscal Integrity - This criterion deals with the amount of revenue obtained from riders in relation to the cost of providing service. The current fare structure appears reasonable in terms of providing a level of farebox recovery (i.e., approximately 27 percent for the fixed route system) acceptable to the local governmental bodies. This implies a subsidy of $0.73 for each dollar spent to operate the system.

Based on the review of the GRTC fare structure in terms of the criteria discussed above, the present fare structure attains mostly favorable results.

Farebox Recovery

The proportion of operating costs which are covered by farebox revenue is another measure of fiscal integrity. Farebox recovery goals have been set in this study for both the system as a whole and the individual routes which comprise the system. The GRTC system should recover at least 27 percent of its costs from passenger revenue. The 2006 system-wide farebox recovery ratio, excluding VCU shuttles, was approximately 27 percent, which meets the suggested standard.

The farebox recovery ratios of individual bus routes are measured with the standard that a successful ratio is over 80 percent of the guideline for the route category, a marginal ratio is over 60 percent, and an unacceptable, or problem, ratio is 60 percent or below. For the local routes, the standards suggest a farebox recovery rate of 30 percent; therefore, a "successful" level would be over 24 percent, a "marginal" farebox recovery rate is 18.1 to 24.0 percent, and "problem" routes are those with rates of 18.0 percent or lower. For express routes, the service type guideline is 15 percent. Therefore, routes with a farebox recovery rate of over 12.0 percent are considered "successful", those with rates between 9.1 and 12.0 percent are considered "marginal", and those with rates of 9.0 percent or below are considered "problem" routes. Based on these thresholds, Table 113 lists the routes that fall into the marginal and problem categories.

There are three local routes that fall into the marginal category and ten in the problem category. Among express routes, one route falls into the marginal category

and one into the problem category. According to the standards, the marginal routes should be reviewed for potential changes to increase productivity. Problem routes should also be reviewed for potential productivity enhancing changes with the elimination of the route being a potential option.

Table 113: Marginal and Problem Routes
Farebox Recovery

Route	Farebox Recovery (%)
Local Routes	
Marginal	
Standard	**18.1 - 24.0**
18 – Henrico Shuttle	23.6
19 – Pemberton Road	19.0
24 - Crestwood	19.1
Problem	
Standard	**18.0 and below**
11 – Laurel/17th Street	14.1
13 - Main Street/Church Hill	11.3
16 - Westhampton	16.3
20 – Northside	9.9
22 – Hermitage	10.0
56 – South Laburnum	7.3
60 – Hickory Hill Connector	1.0
61 – Broad Rock Shuttle	7.9
67 – Chippenham	10.2
93 – Azalea Connector	6.6
Express Routes	
Marginal	
Standard	**9.1 - 12.0**
66 – Kmart	11.6
Problem	
Standard	**9.0 and below**
65 – Fashion Park/ VCU	5.0

Productivity

Similar to farebox recovery, this standard is measured at both the system and individual route level. The 2006 productivity figure for the GRTC system, excluding VCU shuttles, was approximately 23 passengers per hour. This meets the suggested system-wide productivity standard.

The productivity of individual bus routes is measured with the standard that a successful productivity rate is over 80 percent of the guideline for the route category, a marginal rate is 60 percent or greater, and an unacceptable, or problem rate is 60 percent or below. For the local routes, the standards suggest a productivity level of 25 passengers per hour; therefore, a "successful" level would be over 20 passengers per hour, a "marginal" productivity level is 15.1 to 20.0 passengers per hour, and "problem" routes are those with levels of 15.0 or lower. For express routes, the service type guideline is 15 passengers per hour. Therefore, routes with a productivity level of over 12.0 passengers per hour are considered "successful", those with rates between 9.1 and 12.0 are considered "marginal", and those with rates of 9.0 or below are considered "problem" routes. Based on these thresholds, Table 114 lists the routes that fall into the marginal and problem categories.

Table 114: Marginal and Problem Routes Productivity

Route	Passengers Per Hour
Local Routes	
Marginal	
Standard	**15.1 – 20.0**
1-2 – Church Hill/Patterson	18.3
19 - Pemberton	16.8
24 - Crestwood	16.5
Problem	
Standard	**15.0 or below**
11 – Laurel/17th Street	11.2
13 - Main Street/Church Hill	9.5
16 - Westhampton	12.0
20 – Northside	11.1
22 – Hermitage	9.4
56 – South Laburnum	10.8
60 – Hickory Hill Connector	1.0
61 – Broad Rock Shuttle	4.8

Route	Passengers Per Hour
67 – Chippenham	14.1
68 – Lunch Time Express	7.1
93 – Azalea Connector	6.0
Express Routes	
Marginal	
Standard	**9.1 – 12.0**
64 – Stony Point	10.0
66 – Kmart	11.6
Problem	
Standard	**9.0 and below**
65 – Fashion Park/ VCU	5.2

There are three local routes that fall into the marginal category and 11 in the problem category. These ratings have the same implications as the farebox recovery standards in terms of the development of service improvement recommendations. It should be noted that among the local routes, the problem routes are the same for both productivity and farebox recovery. The same is true for the marginal category, with one exception. This is a telling indicator of the weaker routes in the system.

Among express routes, two fall into the marginal category and one into the problem category. Again, with the exception of Route 64 – Stony Point, these are the same routes that fall into these categories for farebox recovery. Service recommendations should address these performance issues.

Passenger Comfort

The final set of standards deal with system performance in terms of fulfilling the functional aspects of the rider's needs. These standards relate primarily to the hardware aspects of the system and include bus shelters, bus stop signs, revenue equipment and public information.

Waiting Shelters/Benches

The standard calls for bus stops with at least 400 weekly boardings to be furnished with a waiting shelter. Ride check data collected for this study effort was examined to identify the stops that have at least 75 weekday boardings, which would translate to approximately 400 weekly boardings. Ride checks show that there are 78 bus stops throughout the GRTC system which meet this threshold. While GRTC has

furnished 108 bus stops with bus waiting shelters, 43 of the 78 stops which meet the boarding standard do not have shelters. These are listed in Table 115. It should be mentioned that some stops that meet the boardings threshold but are not furnished with shelters are within one block of stops that do have shelters.

The shelters that are provided comply with dimensional standards. System maps and applicable bus route and schedule information are not displayed in any shelters.

Table 115: Stops Meeting Threshold with no Current Shelter

Stop Number	Location	Daily Boardings
368*	Broad & 3rd	915
364*	Broad & 1st	474
117*	2nd & Marshall	427
365*	Broad & 2nd	319
164*	7th & Broad	299
158*	5th Street at Grace Street	208
447	Broad & Lombardy (eastbound)	185
1675*	Marshall & 7th	182
1057*	Grace Street at 8th Street	180
363*	Broad & 1st	168
440*	Broad & Jefferson (westbound)	167
446	Broad & Laurel (eastbound)	162
543	Brookland Park Boulevard & 4th	160
457*	Broad & Old 14th	158
435*	Broad & Henry	155
2523	9th Street at Marshall Street (northbound)	153
1606*	Main & 10th	149
878	Fairfield & Kane	146
1609	Main & 13th (eastbound)	144
167*	7th & Franklin	131
352	Broad & 11th	129
181*	9th & Main	127
1607*	Main & 11th	114
499*	Broad at Willow Lawn S.C.	108
1943	North & Hooper	108
474*	Broad & Staples Mill	101
1714*	Meadowbridge & Brookland Park Blvd.	101
172*	8th & Cary	96
1171*	Harrison & Broad	96
611*	Cary & 9th	87
2333	Whitcomb & Redwood	86
439	Broad & Jefferson (eastbound)	82
1460*	Laburnum & Alma	82
452	Broad & Meadow (eastbound)	81
4*	11th & Broad	80
418	Broad & Davis (eastbound)	79
454	Broad & Monroe (eastbound)	78

Stop Number	Location	Daily Boardings
389*	Broad & Allen	77
464*	Broad & Ryland	76
2446	R & Oakwood	76
794	Cowardin & Hull (eastbound)	75

An asterisk (*) indicates that the stop was previously considered for a shelter but was deemed infeasible by GRTC.

Bus Stop Signs

According to the standards, GRTC bus stops should be marked with a uniform bus stop sign. GRTC's performance in this regard satisfies this standard in that stops are consistently marked with a standard sign. The signs include the GRTC logo as well as a picture of a bus to signify a bus stop. In addition, GRTC's phone number is listed on the sign; however, the sign does not list the GRTC website address. Figure 4 shows the sign that is used by GRTC to mark its bus stops. Despite what the sign indicates, schedule information is not provided on the back of the sign.

Figure 117: GRTC Bus Stop Sign

Revenue Equipment

The standards outline several aspects of how the revenue fleet used by GRTC should be maintained. These primarily deal with the appearance of the vehicles to the riders and the general public. Some also address the experience of the rider through such aspects as functioning heat and air conditioning systems. As part of this study effort, a detailed examination of the condition of the fleet was conducted, and detailed in the first Technical Memoranda. A total of 56 buses were inspected for cleanliness and other attributes.

The results of this inspection showed that GRTC's revenue fleet, overall, is in good to excellent condition. The passenger seats, paint jobs, and windows were all deemed to be in excellent condition. The only issue raised through this inspection was that, while in good condition, there were some issues regarding the interior and exterior cleanliness of the vehicles. Overall, however, it can be concluded that GRTC is in compliance with this element of the standards.

Public Information

The standards also outline the components of a public information program which can effectively educate and inform current users and the general public as a whole about the transit system. GRTC currently makes two route guides available, one for local routes and a second for express routes. These guides do provide fare information, how to ride instructions, and contact information for GRTC. The guides also provide route maps and schedules for individual routes or groups of routes. While the route guide includes "how to read" instructions, a review of the guide found it to be confusing in many instances due to the grouping of various routes into a single schedule. Also, the communication of route variations is often not presented in a manner which would be easy for a new or occasional rider to understand.

The areas in which GRTC does not meet the outlined standards include the fact that GRTC does not make individual route timetables easily available. While the route guide is useful, individual route timetables are easier for passengers to carry and understand. Individual route timetables are available through GRTC's internet website, ridegrtc.com and on-board the route itself. These individual timetables are the individual pages from the route guide.

GRTC also does not have a system map. While the route guide includes area maps, an overall system map at a readable scale is not available. Also, service information is not available on buses or at major activity centers.

GRTC does have a telephone information number which is available during GRTC's hours of operation. A member of the consultant team called the customer service number, which is published in the route guide and appears on GRTC bus stop signs, to determine the convenience and effectiveness of the customer service function. Upon dialing 804-358-GRTC (4782), an automated voice answers the call immediately and asks the caller to hold for the next available agent. In this instance, the waiting time for an agent was less than one minute. The agent who answered was polite and provided accurate information on how the caller could make the hypothetical trip used as part of the call. As noted above, GRTC also has an internet website, ridegrtc.com. This also appears prominently throughout the ride guide. The website is well designed and easy to use. In addition, the site provides all relevant information needed to use the system.

Summary of Findings

The following table summarizes all of the findings of this adequacy of service analysis of current GRTC services.

Table 116: Adequacy of Service Summary

Goals/Objectives	Categories	Standards
Service Coverage		
Availability	Production End	Current coverage complies with route spacing guidelines.
	Attraction End	Good coverage of locations that meet the designated thresholds. Short Pump Mall, Virginia Center Commons Mall, Chesterfield Town Center commonly requested as part of household survey.
Frequency	Limited number of instances in which current route schedules do not meet suggested frequency standard. Instances may respond to conditions in area served. Each instance will be examined for cause as part of the development of service improvement recommendations and a determination will be made whether remediation is necessary.	
Span	Limited number of instances in which current route schedules do not meet suggested span of service standard. Instances may respond to conditions in area served. Each instance will be examined for cause as part of the development of service improvement recommendations and a determination will be made whether remediation is necessary.	
Directness	Directness Ratio	12 routes exceed standard: 3 (Westside); 4 (Eastside); 6 (Eastside); 11 (Westside); 11 (Eastside); 56, 92, 18, 24, 93, 61, 63
	Transfers	System meets standard of less than 30% of patrons needing to transfer.
Patron Convenience		
Speed	Current routes meet standard; 64 – Stony Point and 66 – K-Mart have slow operating speeds for express routes.	
Loading	Eight instances of overcrowding identified from ride checks of all weekday trips. Five off-peak occurrences, three peak.	
Bus Stop Spacing	System exceeds standard. Provides convenience to passengers, but too many bus stops could affect speed of operation.	
Dependability	On-Time Performance	Systemwide on-time performance concerns; all periods of the day
	Trips Operated	System meets standard
	Pull-Outs Dispatched	System meets standard
	Miles Per Road Call	System does not meet standard; does not cause dependability issues based on other measures.

Goals/Objectives	Categories	Standards	
Fiscal Condition			
Fare Structure	Five Criteria (Qualitative)	Current fare structure meets standard. In terms of revenue generation, could consider providing a cost per trip savings through the Go Cards.	
Farebox Recovery	System (Regular Routes)	System meets standard	
	Route	Local	Express
	Marginal (60% to 80%)	18, 19, 24	66
	Problem (Under 60%)	11, 13, 16, 20, 22, 56, 60, 61, 67, 93	65
Productivity	System (Regular Routes)	System meets standard	
	Route	Local	Express
	Marginal (60% to 80%)	1-2, 19, 24	64, 66
	Problem (Under 60%)	11, 13, 16, 20, 22, 56, 60, 61, 67, 68, 93	65
Passenger Comfort			
Waiting Shelters	Passenger Criteria	43 stops meet boardings threshold that are not currently furnished with a shelter.	
	Dimensions/Attributes	System meets dimension standards. No information available at shelters.	
Bus Stop Signs	Features	System has uniform bus stop signs but no route information. Signs display GRTC logo and telephone information number but no route numbers or web page address.	
Revenue Equipment	Features	System meets standard; some issues with interior and exterior cleanliness.	
Public Information	Features	System has route guide but no individual timetables. Route guide can be confusing. System does not have a system map. Information is not made available on buses or at major stops/activity centers. System does have telephone information number available during service hours. System has website with all relevant information.	

6
Service Improvements

Phase I: Route Recommendations

So far, the analysis in the COA has focused on data assembly and analysis at the system, route and sub-route level. All of this data and analysis was used to discern areas where some type of service improvement is necessary. Input to the proposed changes to the GRTC system relied on a variety of information including:

- The findings of the peer group comparison and trend analysis for key system performance indicators such as passengers per hour and farebox recovery;
- On-board surveys that included both ride checks and passenger surveys
- Household surveys of general transportation and specific transit issues
- Demographic and land use patterns within the service area and anticipated changes during the next few years.
- Route diagnostics analysis which presented individual route performance by a variety of techniques
- Service standards that establish desirable thresholds for service and its effectiveness
- Field views of the current route structure and existing service area characteristics
- Consultation and advice from GRTC staff, management and the Technical Advisory Committee

General Recommendations

This report was developed in close coordination with GRTC management and staff and presents general proposals which apply to many routes and are oriented to make the system more user-friendly. This will simplify the system for current riders, but more importantly for those people who do not currently use the GRTC system and may find the existing system too complex. This latter group comprises the majority of travelers in Richmond and significant latent demand.

The types of recommended improvements include:

- Routing changes
- Scheduling improvements
- Service span extensions
- Improvements to public information

Routing Changes

As the existing route structure functions well for GRTC and its customers, the structure and naming conventions have been left intact and routing changes have been only made where necessary. Some routes have been simplified in order to make them more understandable for potential new riders. Based on origin-destination data, many of the existing routes have been broken in half along the Broad Street, allowing the neighborhood services to operate at more appropriate headways using fewer vehicles. Some service was removed from Broad Street and transferred to other corridors where service was missing or light. Segments of some routes that had extremely low ridership have been removed all together while service was extended to serve destinations without service.

Broad Street Service

Broad Street currently serves as the major east-west transit corridor through the city of Richmond, with more than 20 local routes running along some portion of it. The overlapping of all of these services results in extremely high frequency service at some locations on Broad Street, even if the frequencies of individual routes remain low. It can also result in congestion and the perception that too many buses are operating in this corridor. Table 117 shows the average headway experienced on the street at various locations on the Broad Street corridor for several periods during the day. Service frequencies at the center of downtown can approach 48 buses in one hour the equivalent of one bus every 75 seconds.

Table 117: Average 2007 Bus Frequency on Broad Street, buses per hour

Eastbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	16.8	44.4	24.8	19.6	26.4
Midday	12.9	33.4	21.8	15.5	20.9
PM Peak	19.0	48.0	26.0	21.0	28.5
Saturday	9.3	24.5	15.7	11.7	15.3
Sunday	7.3	17.3	10.8	7.8	10.8
Average	13.1	33.5	19.8	15.1	

Westbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	17.6	36.0	29.2	21.2	26.0
Midday	12.5	26.8	22.9	14.9	19.3
PM Peak	19.5	38.0	31.0	19.5	27.0
Saturday	9.3	20.5	16.8	11.5	14.5
Sunday	7.5	14.5	12.3	8.0	10.6
Average	13.3	27.2	22.4	15.0	

In order to provide more service to other parallel corridors and to ease the congestion along Broad Street, route changes have been made where appropriate to relocate some service from Broad Street. The routing recommendations detailed in the following sections combined with the proposed frequency improvements retain the high-quality transit service while providing more service to other areas. The result is shown in Table 118, where the peak frequency is reduced slightly at the peak location to 45 buses per hour, the equivalent of one bus every 80 seconds.

Table 118: Average Proposed Phase I Frequency on Broad Street, buses per hour

Eastbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	9.20	39.93	19.93	10.40	19.87
Midday	7.82	34.53	19.70	10.17	18.05
PM Peak	11.00	45.03	21.53	12.00	22.39
Saturday	6.50	29.89	16.32	6.79	14.87
Sunday	4.25	22.73	14.53	5.00	11.63
Average	7.75	34.42	18.40	8.87	

Westbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	13.60	28.53	22.73	10.40	18.82
Midday	12.31	26.21	21.54	10.01	17.52
PM Peak	16.30	32.03	25.03	12.50	21.47
Saturday	11.47	23.03	18.03	6.79	14.83
Sunday	9.05	18.78	15.78	5.25	12.22
Average	12.55	25.72	20.62	8.99	

New Markets

As part of the COA, an extensive household survey was conducted that included both current passengers and non-riders. As part of this survey, respondents were asked for locations that they would like to be able to travel to using public transit. Over one thousand households were surveyed and over one hundred different destinations were identified, including office locations, out-of-town destinations, medical facilities and shopping locations. Many of the major regional destinations were mentioned frequently during the survey, and a "wish list" of service areas was compiled.

Further analysis revealed that many of these locations were already served by GRTC, indicating that additional marketing may be necessary to make potential passengers aware of the services that are offered. While they do provide important regional connections, intercity buses are not generally provided by GRTC, and therefore were not considered in detail. However, there were several major destinations in the region that were not served adequately by transit that were revealed to have significant unmet demand. Three shopping destinations without current transit service were among the most requested destinations including:

- Short Pump Mall in Henrico County (31 requests)
- Virginia Center Commons Mall in Henrico County (24 requests)
- Chesterfield Town Center Mall in Chesterfield County (15 requests)

Based on this information recommendations have been made to expand the service area to include these popular destinations. Extensions of existing routes have been developed to provide service to the shopping centers in Henrico County: an extension of Route 19 to Short Pump along Broad Street and an extension of Route 37 along Brook Road to the Virginia Center Commons. Chesterfield County has not indicated a desire to have local GRTC operate within its borders, so no specific route proposal was developed to extend service to the Chesterfield Town Center.

Park-and Ride Lots

GRTC currently has park-and-ride lots spread throughout the service area. The park-and-rides are fairly well used as many of the express buses reach capacity during the morning and evening peak periods. Unfortunately, GRTC can no longer provide service to the Fair Oaks park-and-ride, which is the only one east of the city.

This is an essential service that should be replaced as soon as another suitable park-and-ride location can be secured.

Another addition to the system of park-and-ride lots and express bus routes should be in the Town of Ashland in Hanover County. Demand for trips to and from Ashland was identified in the household survey and a significant number of Ashland residents commute daily into Richmond. Service to a park-and-ride lot in Ashland could be added without requiring an additional route by adding a stop to the existing Route 96 express that operates between Richmond and Fredericksburg. Adding this stop would add only a small deviation into the route and would not significantly increase the travel time. A suitable park-and-ride location in Ashland needs to be located before service can commence.

The on-board survey also revealed that some passengers are using their cars to access local routes that are not served by official park-and-ride lots. This indicates that some passengers are parking in other lots, probably at shopping centers, and using the bus for the rest of their trip. Some kiss-and-ride access was also noted on a few routes. This was particularly notable on Route 19, 22 and 72/73 which all terminate at shopping centers (or former shopping centers) with significant parking facilities. A study investigating the potential demand for dedicated park-and-ride lots at these locations within the city is advisable in the future.

Effects on Transfers

GRTC has collected a one-day sample of transferring passengers throughout the system, indicating that just over 8,400 transfers occur each day. The routing changes recommended in this section will change how some of the bus routes connect, limiting the number of these transfers that will still be possible. Over 97% of the existing transfers would still be possible under the recommendations in this section, although they may be moved to different locations. That results in 252 transfers that would be unavailable with a single transfer. Many of these would still be possible with a short walk of only a few blocks. However, it must be noted that in all likelihood the transfer patterns will change, especially in areas where the routes have been substantially modified and some transfers may no longer be necessary at all.

Schedule Improvements

Buses should arrive frequently, regularly and reliably. Standards for service frequency have already been detailed in this report, and it has been shown that most of the routes meet or exceed these standards. However, there are some instances, especially in the neighborhoods, where service is very infrequent. Where necessary, recommendations have been made to improve the headways in order to increase ridership and efficiency on those routes.

Headways on most routes (especially local routes) throughout the system were very irregular, changing frequently throughout the day and even within an hour, making it very difficult for passengers to know when their bus will arrive without the Ride Guide. From a passenger's perspective, it is best to schedule buses to arrive at regular intervals.

Schedule adherence is an issue that will need to be addressed by GRTC in the future as additional data becomes available through the implementation of AVL technology.

General recommendations to improve the schedules of the GRTC system include:

- All routes should adhere to the recommended frequency standards presented in this report
- Run-time assumptions need to be re-examined to help create more accurate schedules and improve on-time performance
- Headways on individual routes should be more consistent, using repeating clock-face numbers where possible (on the hour, half past…etc)

Service Span Extensions

Most of the routes met the span standard set out previously in this report. Weekend service was the major span issue, although some weekday routes required additional service hours to meet the demand along the route. Weekend service was recommended for routes that serve important shopping destinations, with the goal of allowing people to use GRTC services for all of their travel needs.

Improvements to Public Information

The last major area of discussion was the availability and quality of information about transit services that is available to the public. The current ride guide is bulky and many of the schedules are difficult to read. Improvements to the routes maps and schedules have been recommended wherever the consultant team had significant difficulty understanding the service patterns and frequency.

- Present each route separately in the timetable on both the schedules and the maps (combined routes like 1/2 and 62/63 are too complicated to be understood easily by new riders)
- The schedule should be on the page opposite the appropriate map so that a passenger can see both at the same time
- Separate timetables for key service markets (eg. All Broad St service, routes serving particular destinations, hubs, etc…)
- A legible system map should be available online, in hard copy and at all stops with shelters

In addition, the route groupings presented in the Ride Guide should be clarified and/or redesigned. The current color groupings are not used frequently enough to be meaningful to passengers, and a new type of geographic grouping (East End, Southside, etc.) may be more appropriate. In this document, the existing color groupings are used for convenience of referencing with the existing schedules.

The remainder of this report presents the specific route proposals in both a narrative and graphical format showing the proposed and the existing routes.

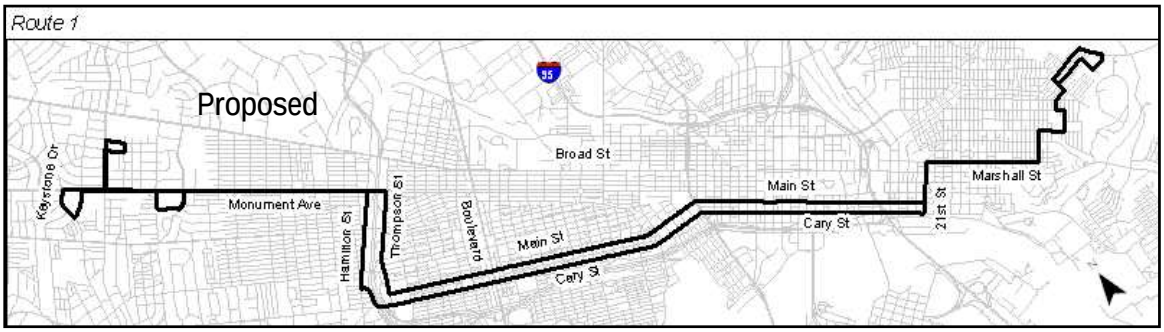
Blue Routes

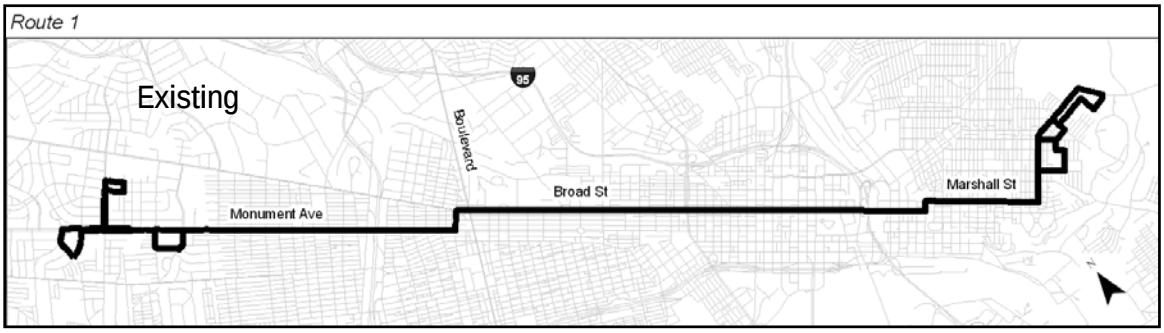
This section addresses the recommended service changes to the group of routes currently grouped in the Ride Guide as 'Blue Routes.' Generally, these routes serve the western and northwestern portions of the City of Richmond, although many of them also travel through the downtown core and provide service to neighborhoods directly north or east of downtown.

Route 1

The two endpoints on this route will remain the same; however service will be taken off Broad St and re-routed through Carytown along Main St & Cary St. As a result, Routes 1 & 2 will need to be separated in the GRTC timetable. The headways on this route will stay the same. While traffic congestion and parking are concerns in the heart of Carytown, transit service is important in this area and should be implemented in conjunction with the Master Plan (which may include the removal of one-way streets and parking in some locations). Maintaining the safety of pedestrians, drivers and transit users on Cary St should be made a priority when implementing this route, including the enforcement of parking regulations to help the buses meet their schedules. Routing changes are as follows:

- Eastbound: Follows existing route east on Monument to Hamilton – south on Hamilton –east on Floyd – south on Cameron - east on Cary – north on 21st – east on Marshall – north on 35th – east on M – north on 37th – west on O – north on 36th – west on R – east on 35th – south on Briel – east on 37th – north on East Richmond – west on Oakwood – south on R
- Westbound: Continues west along 36th reversing the eastbound routing - west on Marshall - south on 21st – west on Main – north on Thompson – west on Monument following existing routing



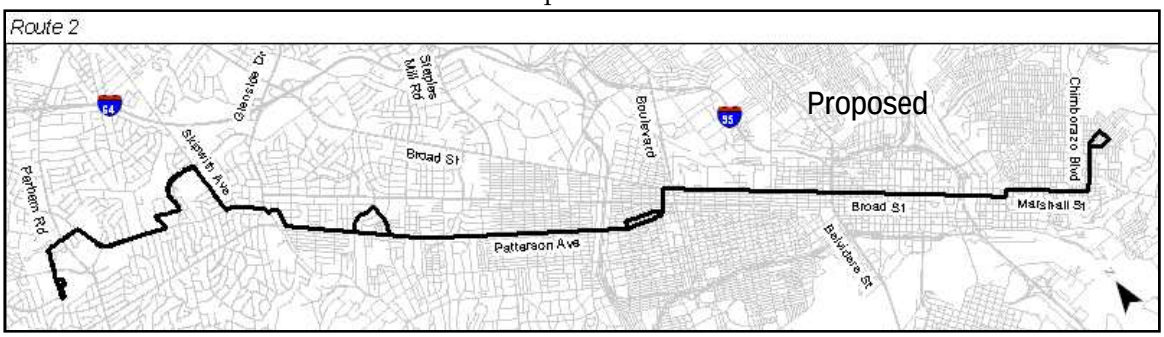


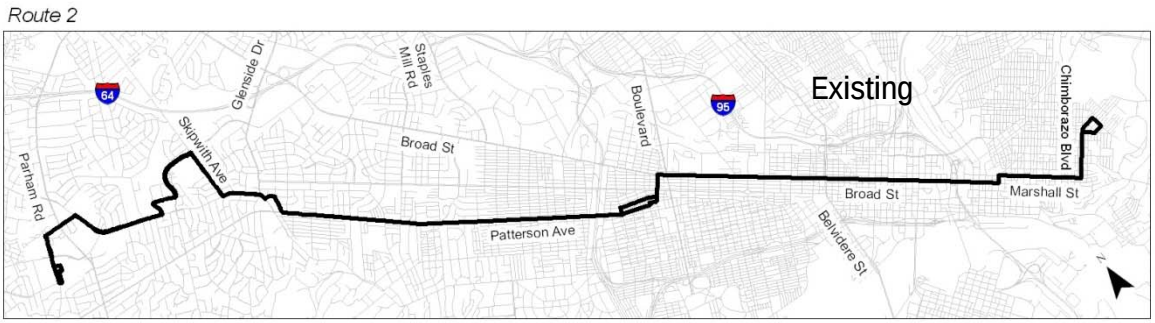
Route 2

A small deviation should be implemented to add a stop at St. Mary's Hospital to provide direct service to the VCU campus on some trips. This requires a small addition to the existing route:

- East on Patterson – north on Pepper – east on Dustin – south on Maple – continue east on Patterson along the existing route

Route 2 should be separated from Route 1 in the GRTC timetable.



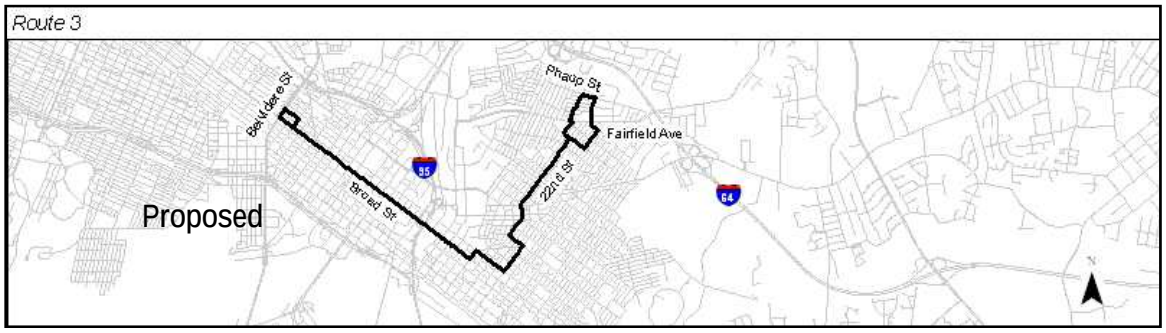


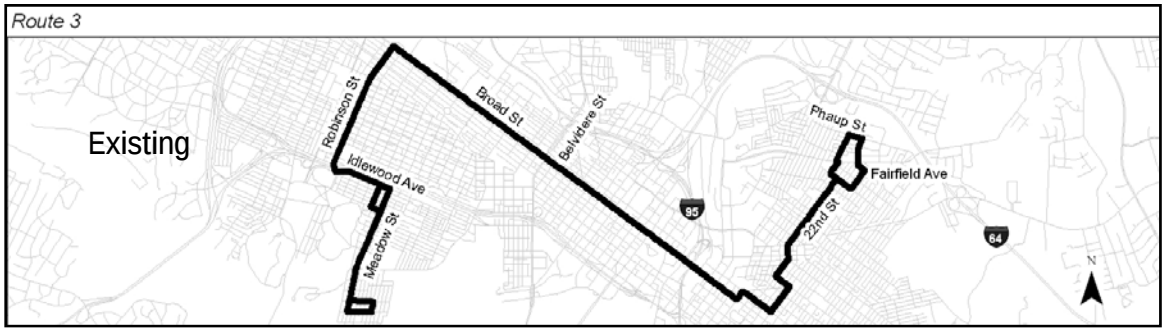
Route 3

The east and west ends (routes 3 and 3PP) will be unhooked and will no longer operate together to allow each end to operate at more appropriate headways. According to the on-board survey conducted as part of this project, very few (if any) passengers ride the whole route, as most alight or transfer downtown along Broad St. The western end of the route (Route 3) should be removed entirely, and this service will be covered by a new expanded Route 10. The proposed Route 3 would follow the existing Route 3PP to Broad Street. The route would turn back towards the east at Belvidere St along this route:

- Follows existing routing west on Broad – north on Belvidere – east on Marshall – south on Monroe – east on Broad along existing routing

The route should be operated with an all-day headway of 25-30 minutes so that only 2 buses would be required. Additionally, Route 3 should be separated from Route 4 in the GRTC timetable.



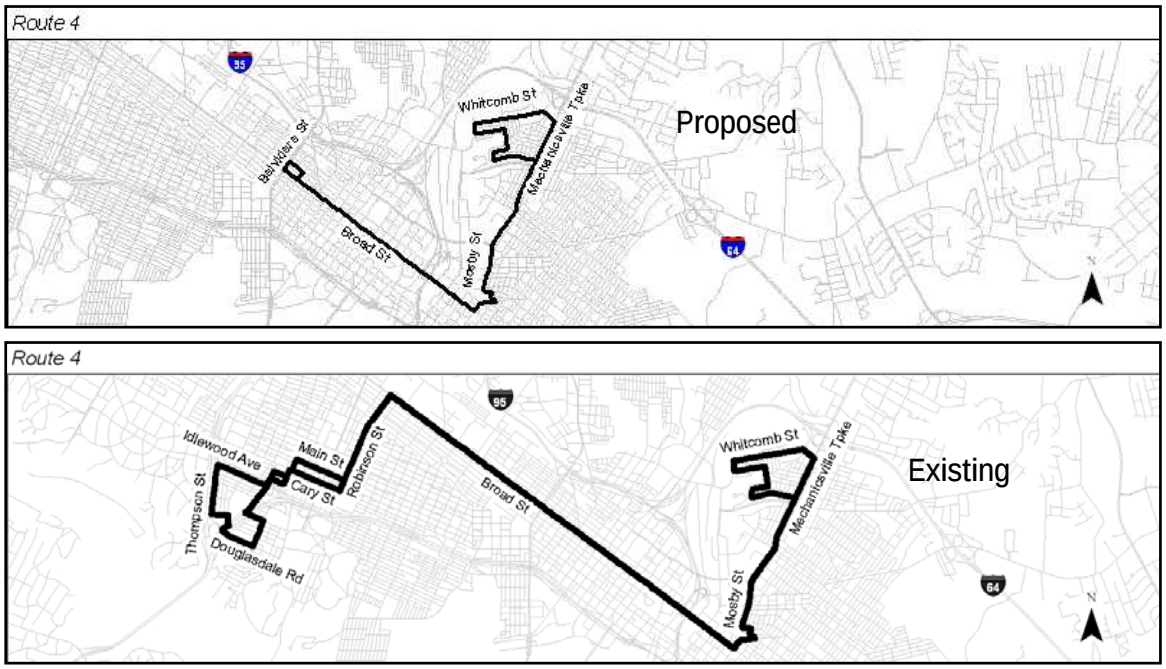


Route 4

The east and west ends (Routes 4 and 4P) will be unhooked and will no longer operate together to allow each end to operate at more appropriate headways. According to the on-board survey conducted as part of this project, very few (if any) passengers ride the whole route, as most alight or transfer downtown along Broad St. The western end of the route (current route 4) will be merged with the west end of Route 11 to create a new Route (see Route 8). The proposed Route 4 would follow the existing 4P routing to Broad Street and turn back towards the east at Belvidere along this route:

- Follows existing routing west on Broad – north on Belvidere – west on Marshall – south on Monroe – east on Broad along existing routing

The route should be operated with an all-day headway of 25-30 minutes so that only 2 buses would be required. Additionally, Route 4 should be separated from Route 3 in the GRTC timetable.

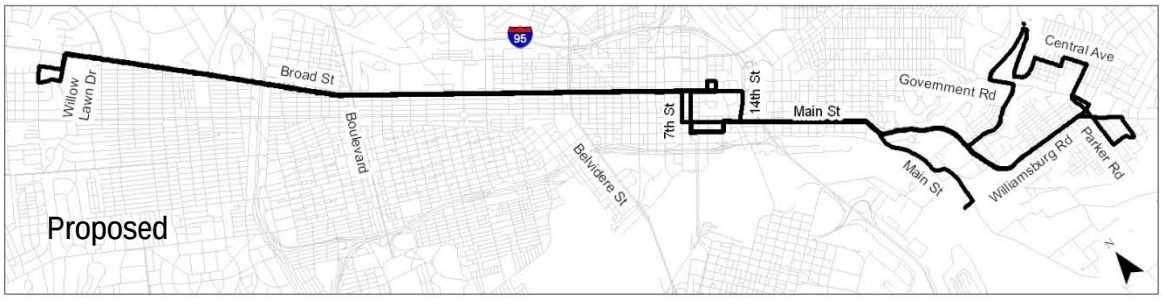


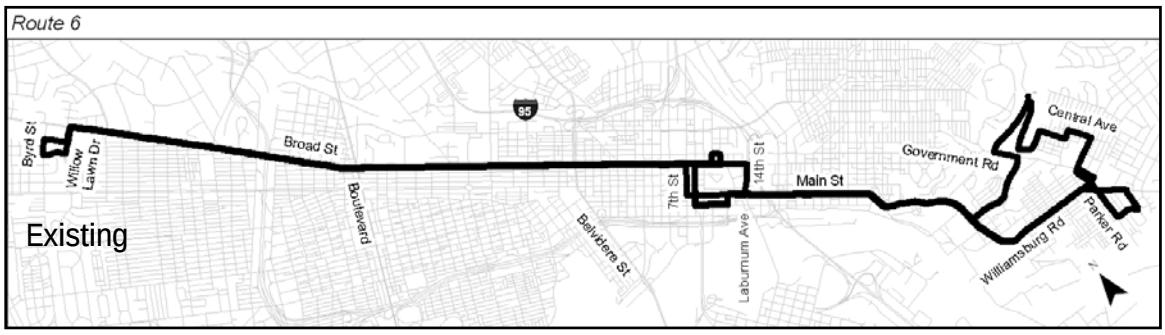
Route 6

The general routing of this route should remain the same, with one addition. Those trips that currently terminate downtown should instead be extended to serve Rocketts Landing via Main Street. A turn around location within the Rocketts Landing development needs to be determined.

The presentation of the routing and scheduling - especially for the loop on the eastern end - needs to be improved and clarified.

Route 6



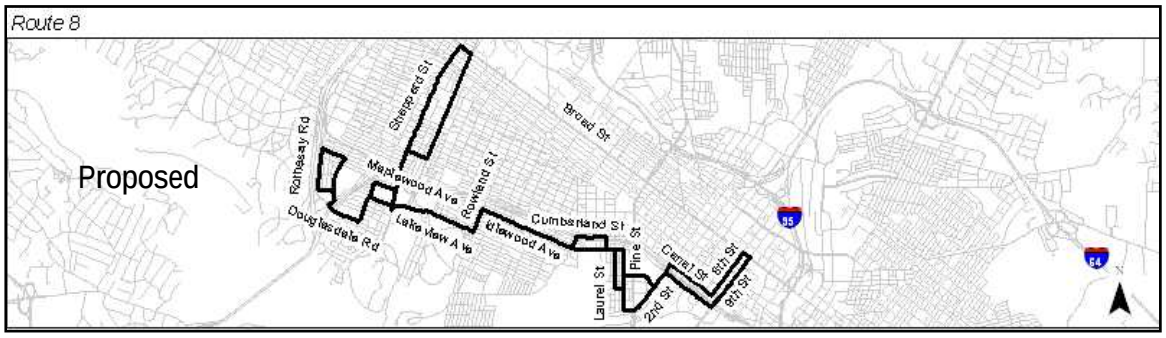


Route 8

This new Route would combine the western ends of Routes 3, 4 and 11 while also providing service to downtown offices on Byrd Street. This new Route 8 will operate on a headway that will require only two buses along the following routing from Rosewood and Rothesay:

- Eastbound: south on Rothesay – east on French – south on Freeman – south on McCloy – east on Douglasdale – north on Belmont – east on Maplewood – north on Sheppard – east on Cary – north on Boulevard – west on Broad – south on Sheppard – east on Grant – east on Boat Lake - east on Lakeview – north on Rowland - east on Idlewood – south on Laurel – east on China – north on Pine – east on Spring – north on 2nd – east on Byrd – north on 9th – west on Broad to 8th
- Westbound: south on 8th – west on Canal – south on 2nd – north on Pine – west on Idlewood – north on Cherry - west on Cumberland – south on Harrison – west on Idlewood – south on Rowland – west on Lakeview – west on Grant – south on Belmont – west on Douglasdale – north on McCloy – north on Freeman – west on Rosewood to Rothesay

Transfer opportunities would be available at both ends of Broad Street with a frequent and direct connection to downtown destinations.

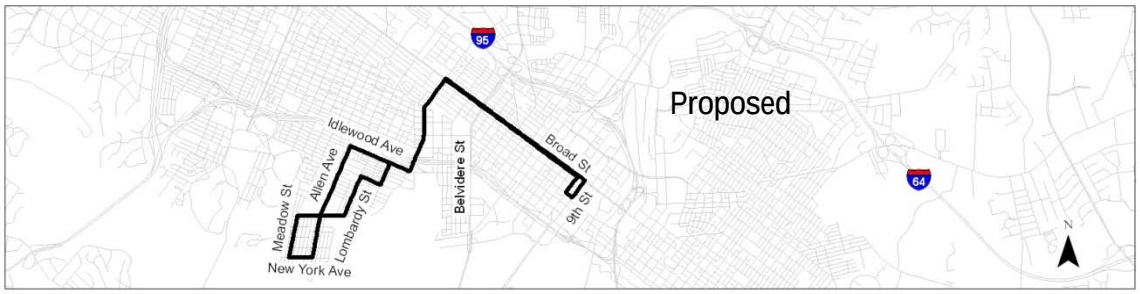


Route 10

The east and west portions of this route should be unlinked to create two routes: 10E and 10W (or other appropriate numbers). Route 10W should be expanded to cover the western portion of Route 3 (that is recommended for deletion) on 30-minute headways along the following route:

- West on Idlewood – south on Randolph – west on Lakeview – south on Lombardy - west on Colorado – south on Meadow – east on New York – north on Carter/Allen – east on Idlewood – north on Harrison – east on Broad – south on 8th – east on Franklin – north on 9th – west on Broad – south on Harrison to Idlewood

Route 10W

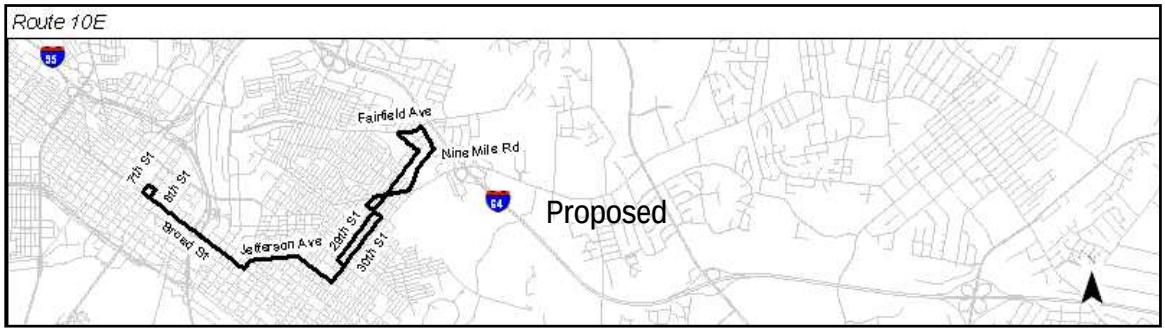


Route 10E will follow the current routing as the eastern portion of the existing Route 10, turning around downtown at Broad & 8th along the following route:

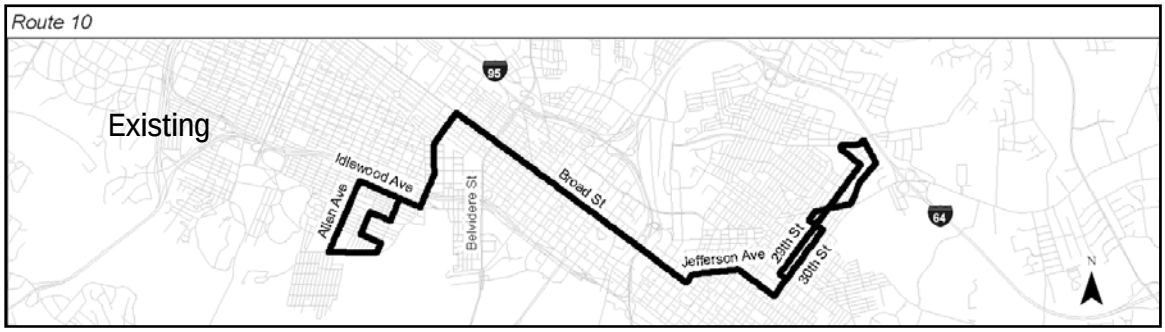
- West on Broad – north on 7th – east on Marshall – south on 8th – continue east on Broad

Route 10E should operate on 30-minute headways all day 7 days per week.

Route 10E

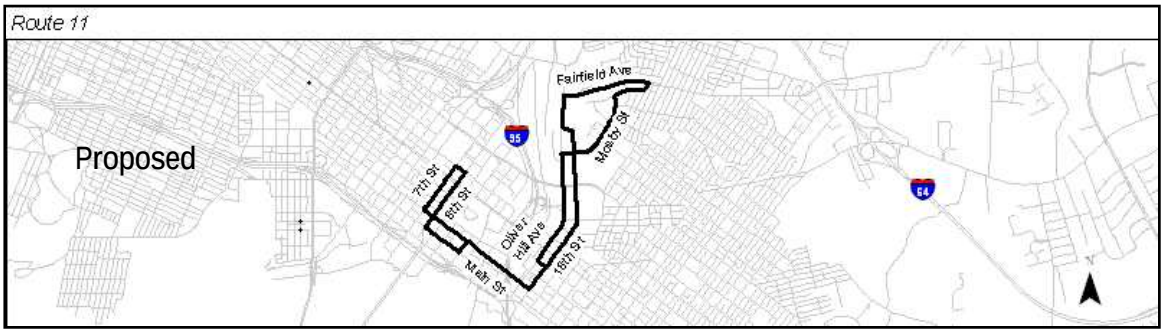


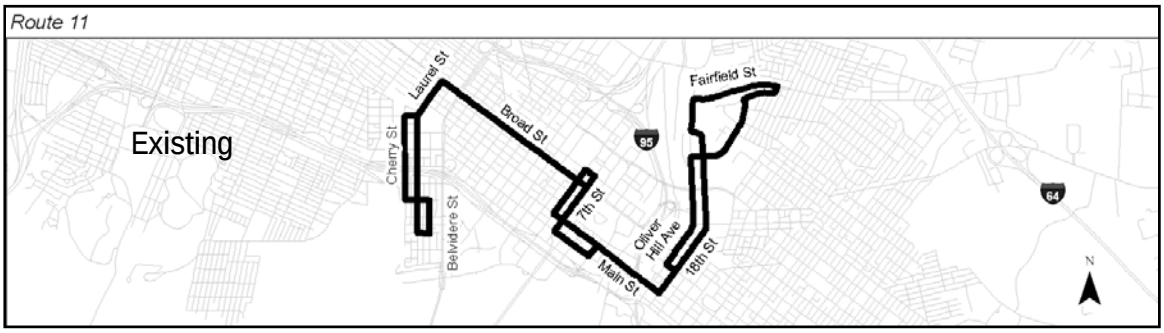
Route 10



Route 11

The western section of this route can be eliminated as it will now be served by the new Route 8. The eastern portion of the route will remain the same, and should terminate at Marshall & 7th. To improve ridership and service, headways should be improved to 30-minutes all day on weekdays and Saturdays. Weekday service should be extended by two hours in the evening (until 8 pm) and regular Saturday service should be provided from 9am – 5pm.



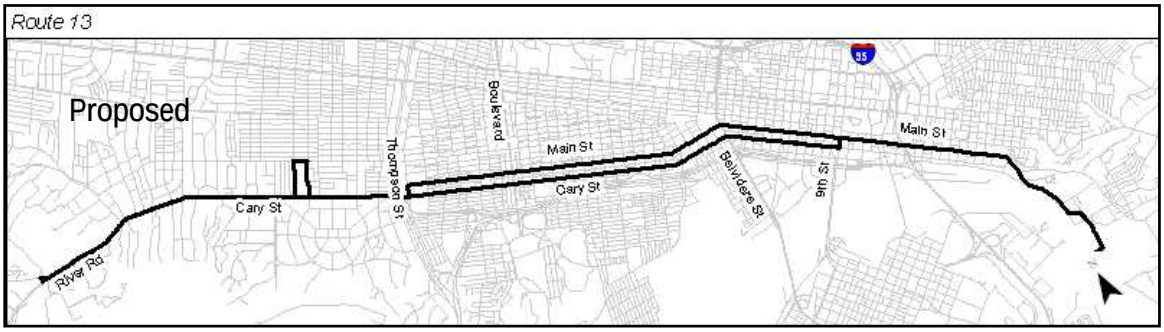


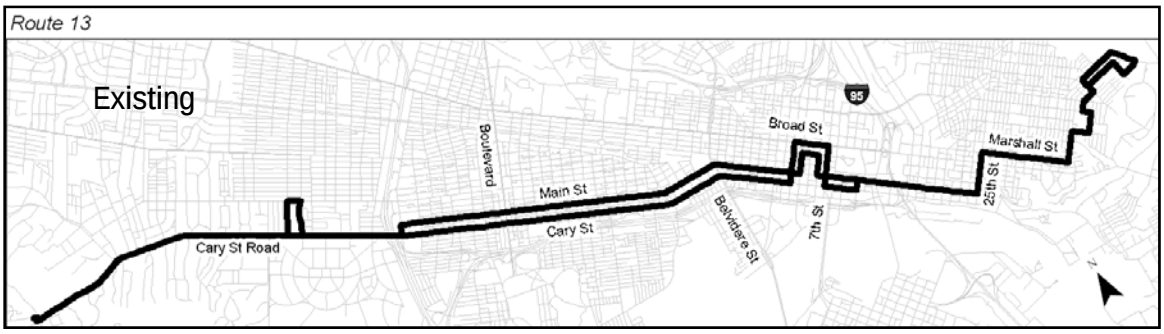
Route 13

The main service provided by Route 13 will be concentrated between Carytown and Rocketts Landing. However, the same number of trips to the River Rd Shopping Center will still be provided along the same routing. The western portion of the route in Church Hill will be removed, but the area will still be served by Routes 1 and 2. The new routing for Route 13 from Rocketts Landing would be:

- West on Main – south on Thompson - east on Cary – north on 9th – east on Main to turn around in Rocketts Landing

Due to the concentration of housing, entertainment and restaurants in the Carytown and Rocketts Landing neighborhoods, service should be extended to 11 pm on weekdays and Saturdays. On the weekends, service should be provided on 30-minute headways.

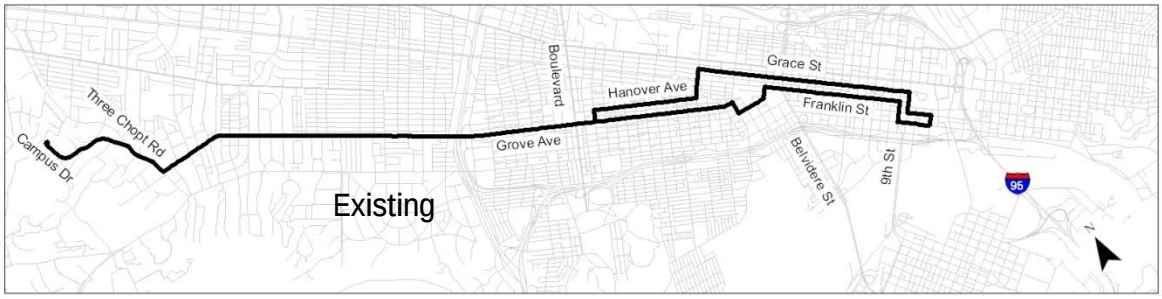




Route 16

Route 16 should remain running along the existing routing between downtown and the University of Richmond. Very poor on-time performance indicates that the published schedules and running times may need to be adjusted to account for actual conditions on the street. Additionally, a specific drop-off location on the University of Richmond campus should be specified in the schedule and on the map.

Route 16



Purple Routes

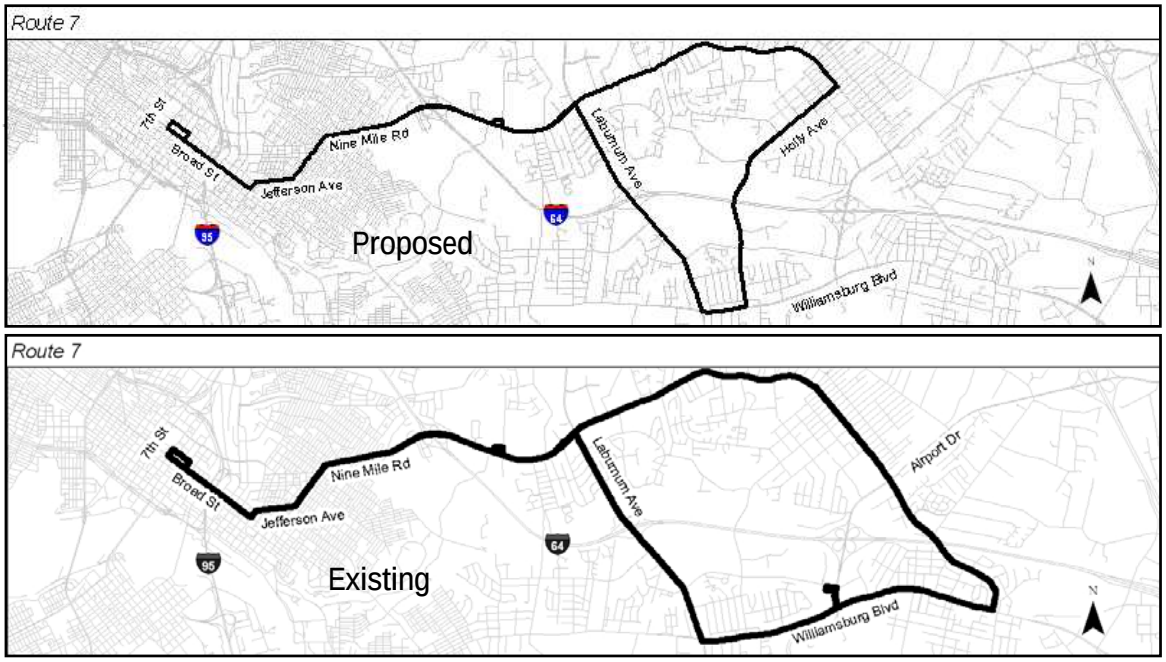
This section presents the recommended changes to the routes that are grouped together in the Ride Guide as 'Purple.' These two routes serve the East End of the City of Richmond and into eastern Henrico County. This group is very small, and some type of reorganization may be appropriate to create more regularly sized groups with easily understandable names. (Routes 91 and 92 have been added to this group in the middle of 2007, but will not be addressed in this COA.)

Route 7

GRTC is no longer able to serve the Airport Park-and-Ride and this route suffers from low ridership along the eastern portions of Nine Mile Rd and Williamsburg Rd. In addition, a new shopping center (The Shops at White Oaks Village) is planned for Laburnum Ave just south of I-64, creating another major destination in this area. Therefore a shortened loop that serves the shopping centers in the area should be implemented along the following route:

- East on Nine Mile – south on Holly - west on Williamsburg – north on Laburnum

Saturday service should be added to the route and headways improved as much as possible due to the shortening of the route.

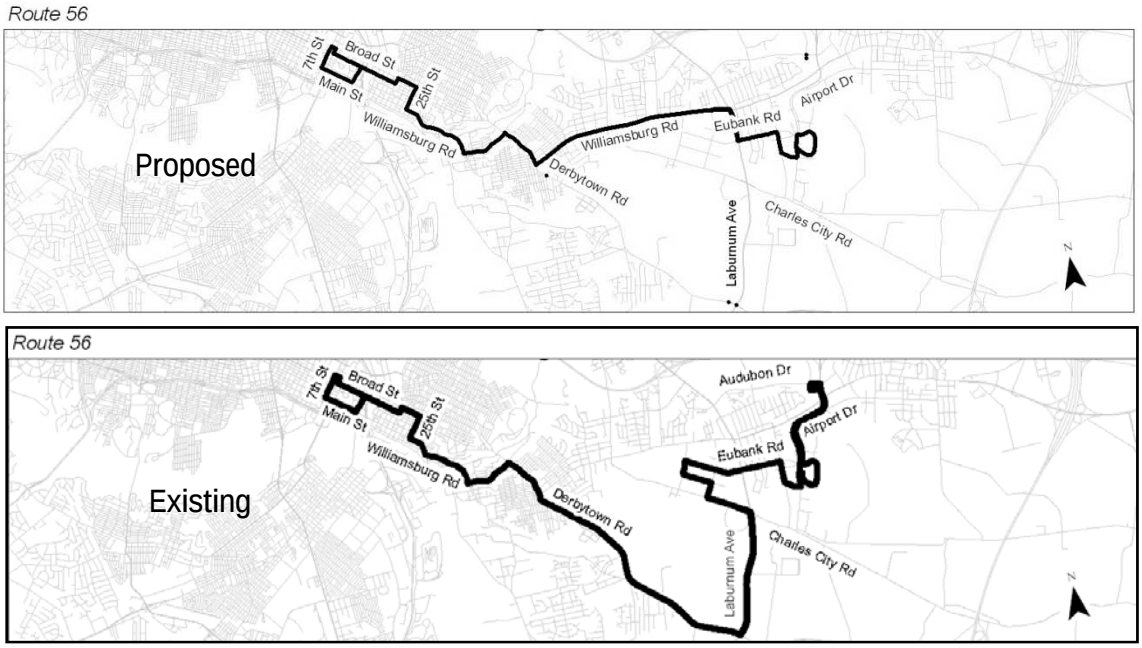


Route 56

Several routing changes are recommended for Route 56, although the route will continue to provide service between downtown and Richmond International Airport. As GRTC is no longer able to provide service from the Fair Oaks Park-and-Ride, the eastern end of the route will terminate at the airport. Low ridership and boardings in the industrial areas along Darbytown Rd allow for a shortened route with a lower trip time along the following route:

- Follows existing route through downtown to Government Rd - east on Williamsburg Rd – south on Laburnum – east on Eubank – south on Lewis – east on Norman – north on Airport Dr and turnaround at the Airport terminal

The new route can be traversed more quickly and should be able to be operated on a slightly lower headway.



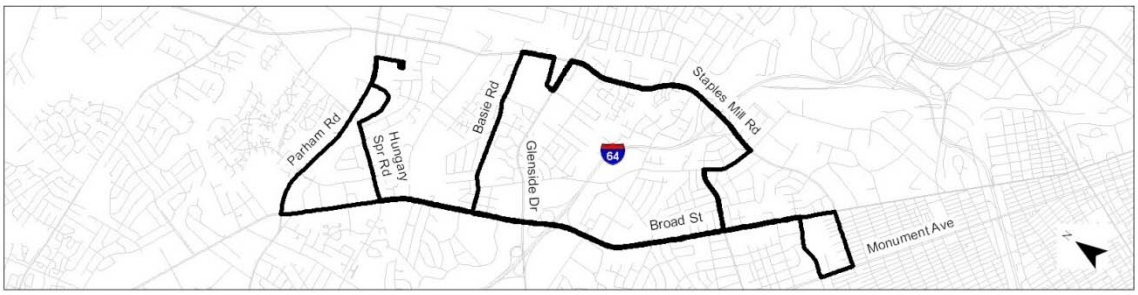
Orange Routes

This section presents the few recommendations for the routes grouped together in the Ride Guide as 'Orange.' The two routes in the Orange Group serve northwestern Henrico County, with some connecting service into the City of Richmond. Like the Purple Group, this group is very small.

Route 18

No changes proposed.

Route 18



Route 19

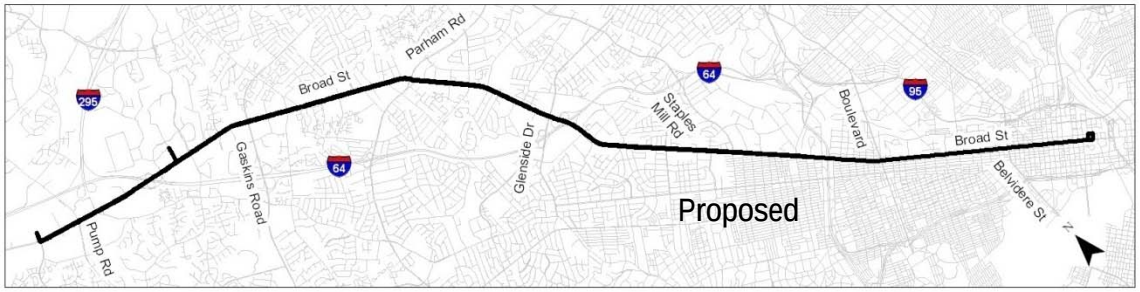
Route 19 should be extended to provide service to Short Pump Mall, one of the biggest shopping destinations in the region. Service to the mall should start at 9 am with hourly service until 10:15 pm. This service expansion should include the addition of midday, evening and weekend service. During the peak periods, three of the trips should also serve the Innsbrook Corporate Center. The recommended routing is:

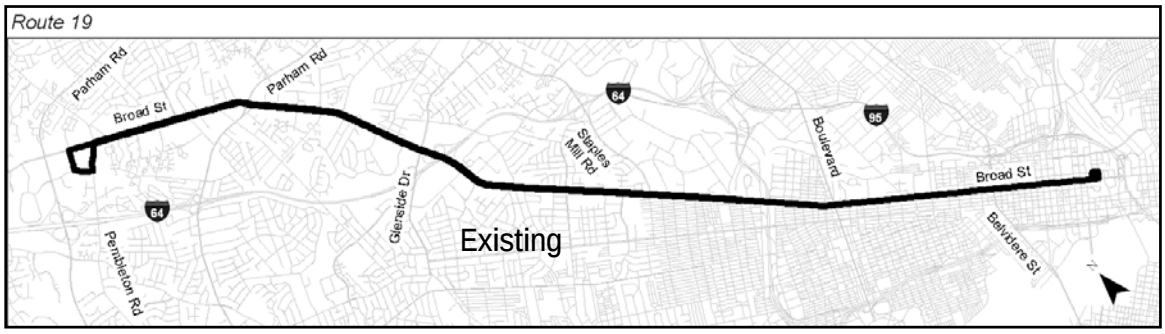
- West on Broad Street from downtown to Short Pump Town Center at Lauderdale Dr in Henrico County
- During peak periods, 3 trips should turn into Innsbrook Corporate Center at Cox Rd and then continue to Short Pump

Some type of limited-stop or closed door operation may be advisable for the portion of the Route east of Willow Lawn.

Marketing, both to potential passengers and to Henrico County officials, will be a key element in the implementation and success of this extension.

Route 19





Black Routes

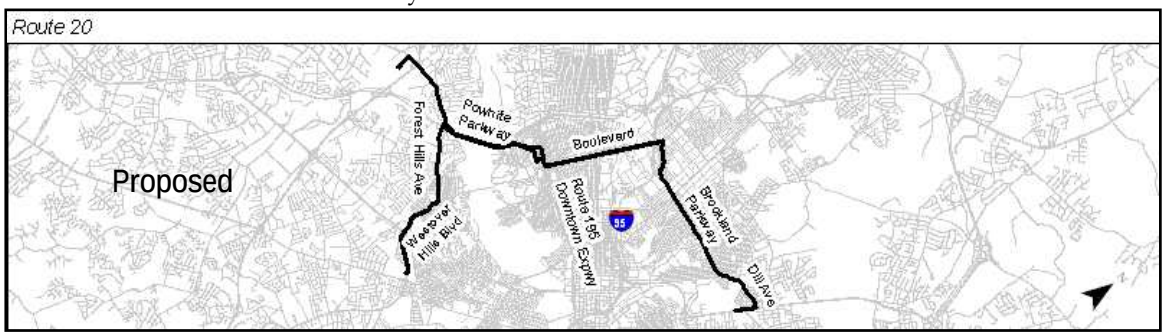
This section documents the recommended changes for the routes categorized in the Ride Guide as the 'Black Routes.' This group of routes generally serves the northern portion of the City of Richmond, although some routes do provide service to Henrico County.

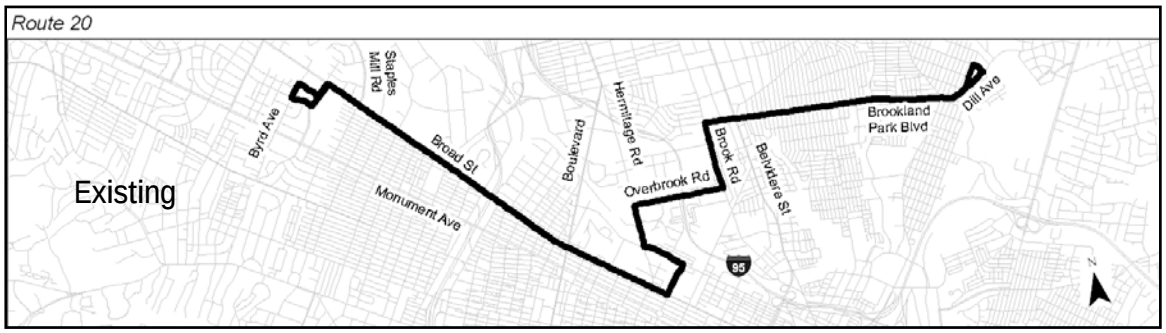
Route 20

Route 20 should be redesigned as a cross-town route to provide better service to more riders. This route will serve the new transfer center near Southside Plaza and the Greyhound bus station. Shopping destinations along Forest Hill Ave, including Walmart and Target could also be served. The northern end of this new route should be extended to provide service to a shopping center and grocery store located on Mechanicsville Pike. The new route should begin at the shopping center just south of Harvie Rd on Mechanicsville Pike and follow new routing west to Southside:

- North on Mechanicsville Pike – west on Dill Ave - west on Brookland Pkwy – south on Boulevard – west on route-195 – south on Powhite Pkwy – west on Forest Hills – south on Sheila - turn around at Walmart
- North on Sheila – east on Forest Hill – south on Westover Hills to Southside Transit Center at Hull & Belt

The route should operate all-day on 30-minute headways on weekdays and 60-minute headways on weekends.





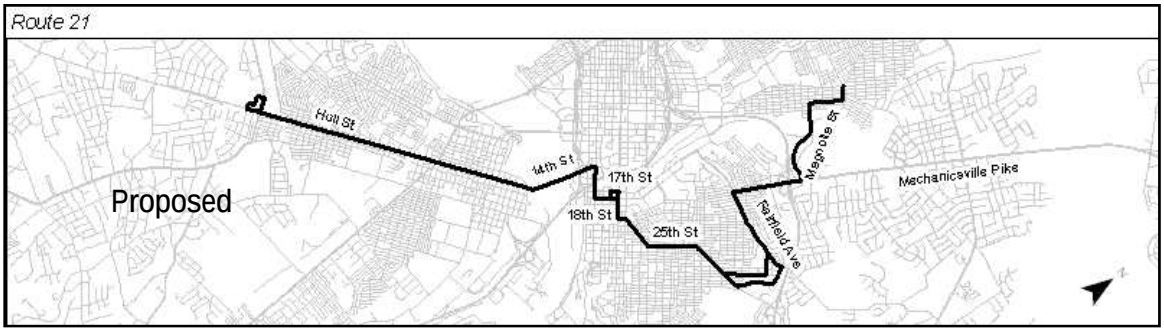
Route 21

As a compliment to the cross-town route proposed above for Route 20, Route 21 would provide a cross-town connection on the east side of the city by connecting Brookland Park Blvd with Fairfield Avenue and Hull Street, including service to the new transfer center at Southside Plaza. This route could operate either as an extension of the proposed Route 20, or as a separate cross-town route. Route 21 would travel the following southbound routing from the intersection of Brookland Park and Meadowbridge Rd:

- East on Meadowbridge – south on 4th Ave – east on Magnolia – south on Mechanicsville Pike – east on Fairfield – east on Newbourne – south on 29th – west on Nine Mile – south on 25th – west on Jefferson – south on 21st – west Broad – south on 17th east on Grace south on 18th – west on Main – south on 14th – south on Hull St to South Side Plaza at Hull St and Belt Blvd

The northbound routing follows the same paths with a few modifications:

- East on Main – north on 18th – east on Broad
- North on Nine Mile – north on Creighton – west on Phaup – west on Fairfield



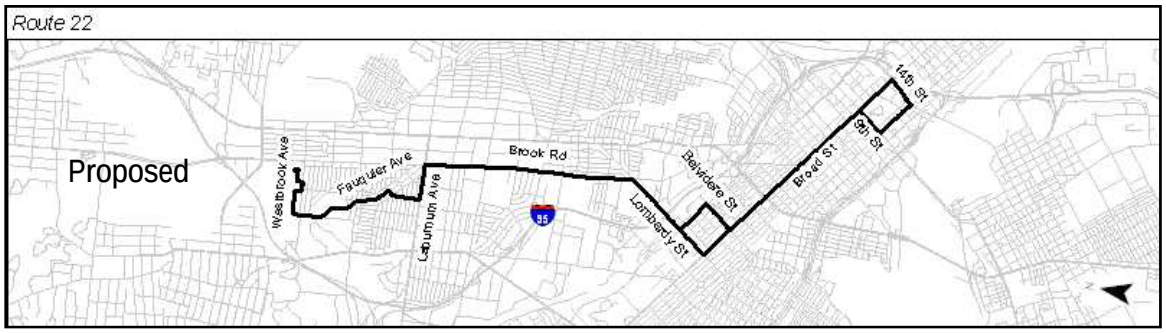
Route 22

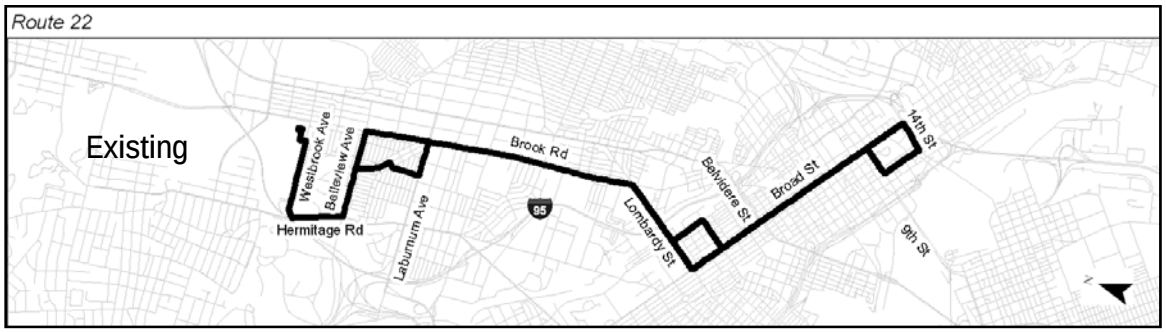
The only routing changes recommended for Route 22 are at the northern end; the southern portion of the route to Brook & Lombardy should remain as is. From this point, the routing should be as follows:

- North on Brook – west on Laburnum – north on Newport – north on Fauquier – north on Crestwood – south on Westminster Canterbury – east on Westbrook

This new route maintains service to the hospital facilities on Westminster Canterbury and removes a confusing routing that alternates service between Brook Rd & Fauquier Ave.

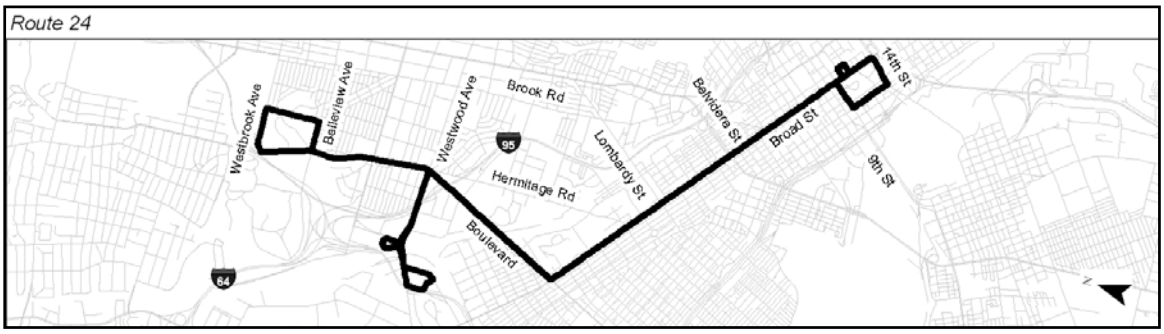
The headways on this route should be improved to 22 minutes all day. When creating the schedules for Routes 22 & 24, their arrivals at Westminster Canterbury should be offset as much as possible to provide the most frequent service to the area.





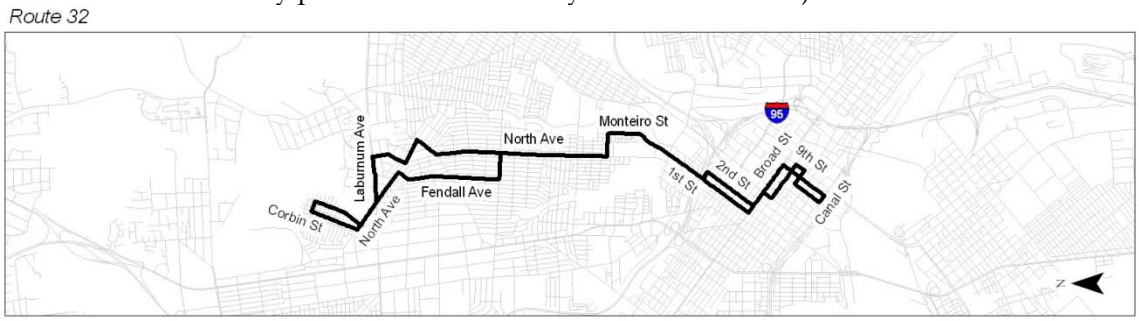
Route 24

No changes proposed. Scheduling of outbound trips should scatter arrivals at Crestwood & Westbrook with Route 22 arrivals.



Route 32

No changes proposed. (A southern extension to Byrd was considered, but is not easily possible due to one way streets in the area.)



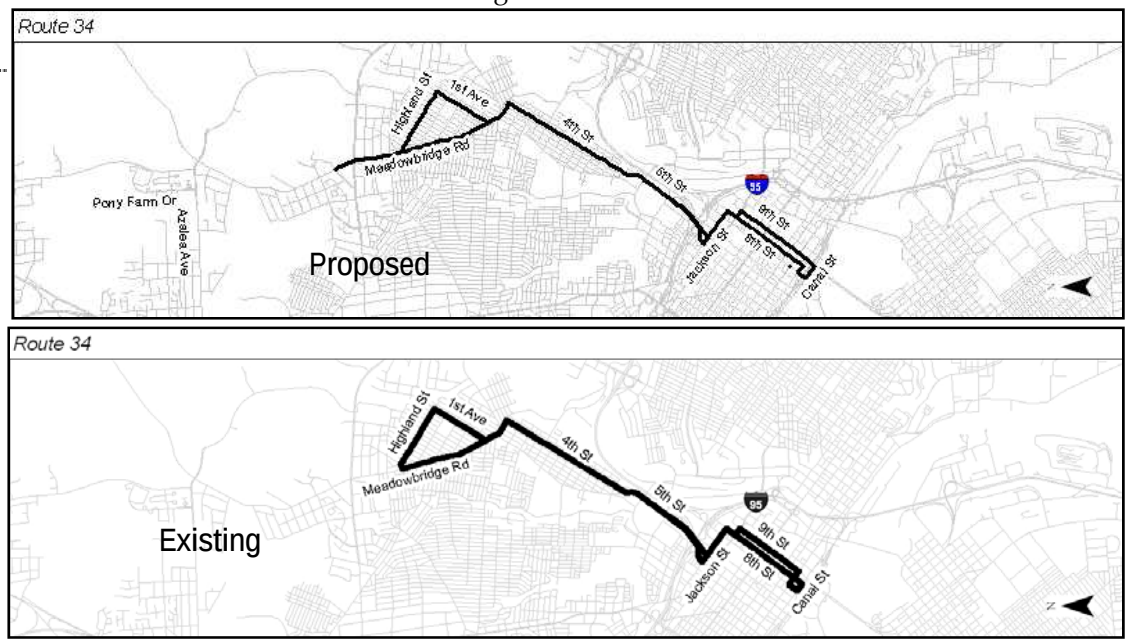
Route 34

Two changes are recommended to the routing of Route 34: extensions on both the northern and southern ends. The northern extension would provide service to the Fairgrounds Area, Richmond International Raceway parking and shopping destinations along the following route:

- West on Highland – north on Meadowbridge to Save-A-Lot parking lot past Laburnum – south on Laburnum and follows existing route south

The southern extension will serve new office buildings on Byrd St along the following route:

- From Jackson & 8th – south on 8th – west on Canal – south on 7th – east on Byrd – north on 9th – west on Leigh – north on 8th



Route 37

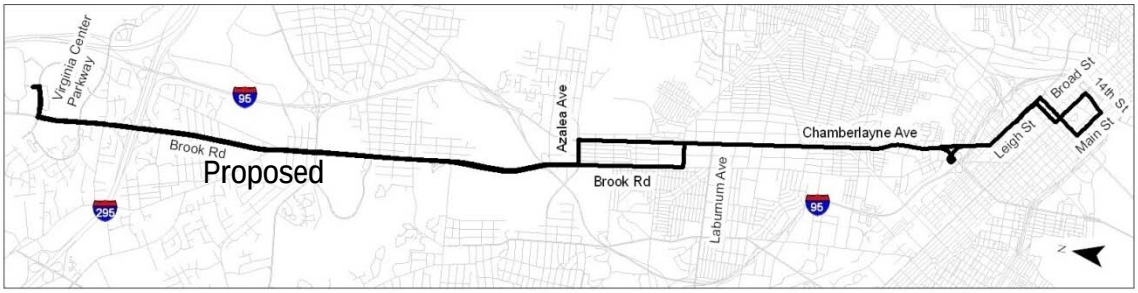
The northern portion of Route 37 should remain unchanged, except for an extension to Virginia Center Commons Mall. This extension should be operated one trip per hour. Additionally, the downtown portion of the route should be moved off Broad St to provide service to the neighborhoods along Leigh St. The northern extension should only be operated once an hour along the following route:

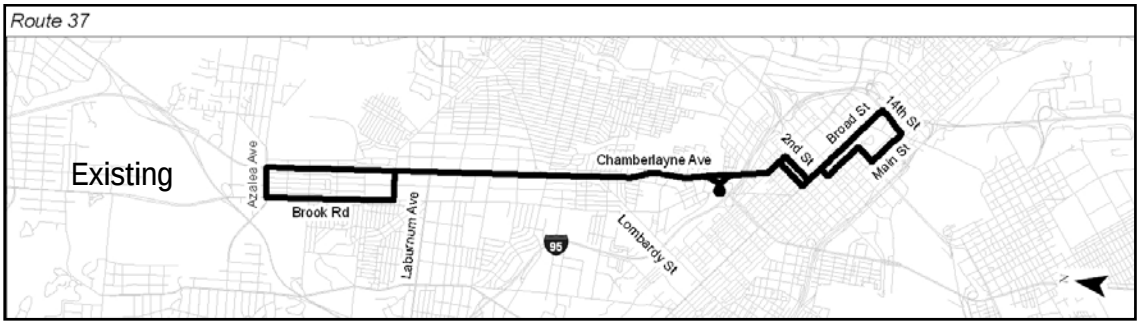
- North on Chamberlayne Rd – west on Claremont – north on Brook Rd to the Mall (near Jeb Stuart Pkwy) – south on Brook Rd – east on Azalea Ave – south on Chamberlayne

All other trips should follow the existing routing on the Northside. The route change in the downtown area would be a part of every trip, as follows:

- South on Chamberlayne – east on Leigh - south on 8th – east on Broad – south on 14th – west on Main – north on 9th – west on Leigh – north on Chamberlayne

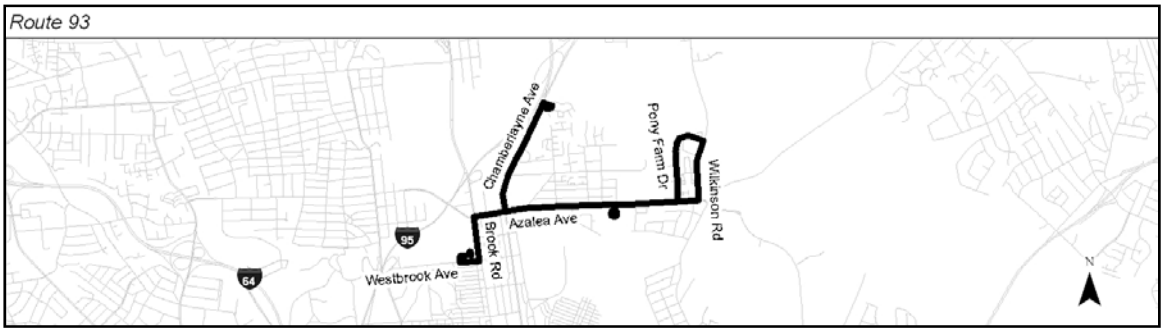
Route 37





Route 93

No changes proposed.

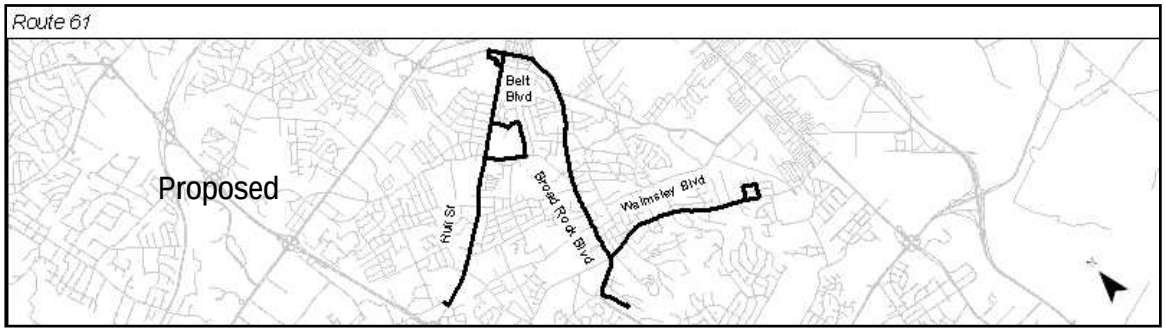


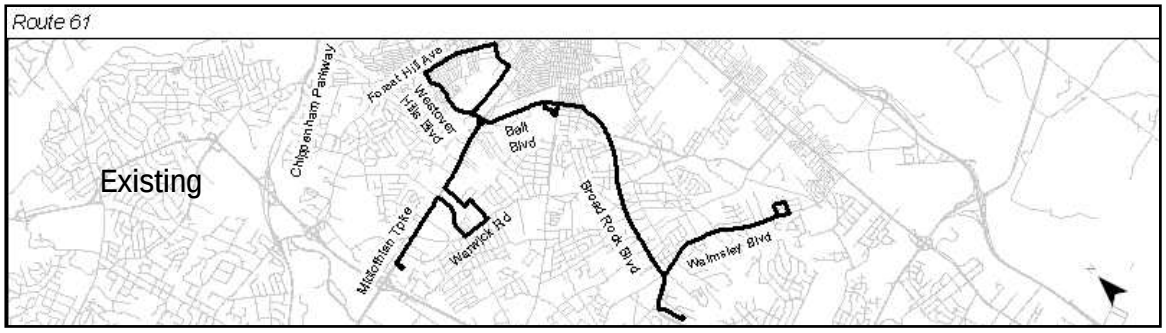
This section presents recommendations for the Ride Guide's 'Green Routes' group. The routes in this group serve the Southside of the City of Richmond, and almost all connect into downtown.

Route 61

The new Route 61 will provide service to Chippenham Mall, Walmsley Blvd and Southside Plaza seven days per week. The route will not enter downtown, and multiple transfers will be available at a Southside Transit Center near Hull & Belt. One vehicle should be devoted to this route, and headways should be determined by the cycle time along the route. In order to provide service to the Forest Creek senior citizen development, a smaller vehicle sized to fit the driveway will need to operate on this route. The span should be expanded to provide daily service from 6 am to 7 pm (possibly shorter on Sundays) along the following route:

- Chippenham Mall at Elkhardt & Hull – north on Hull – south on Warwick – east on Clarkson – north on Briary Dr – north on Southwood Pkwy – north on Hull – enter Southside Plaza on Hull St – north on Hull – east on Belt – into the VA Hospital at Broad Rock – south on Broad Rock – east on Walmsley – north on Banton – west on Dupont – south on Fluvanna – west on Walmsley -south on Broad Rock - south on Forest Haven
- To end of Forest Haven and back on Forest Haven - north on Iron Bridge (Becomes Broad Rock)
- Follows the same route back to Chippenham Mall, including stops at the VA Hospital, Southside Plaza and the Southside Transit Center





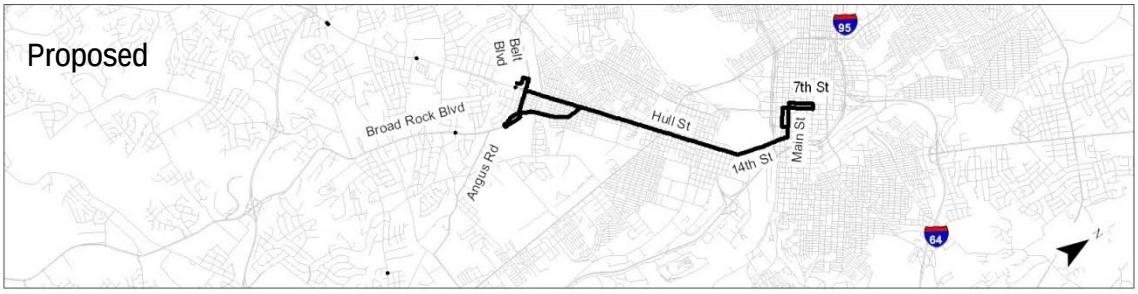
Route 62

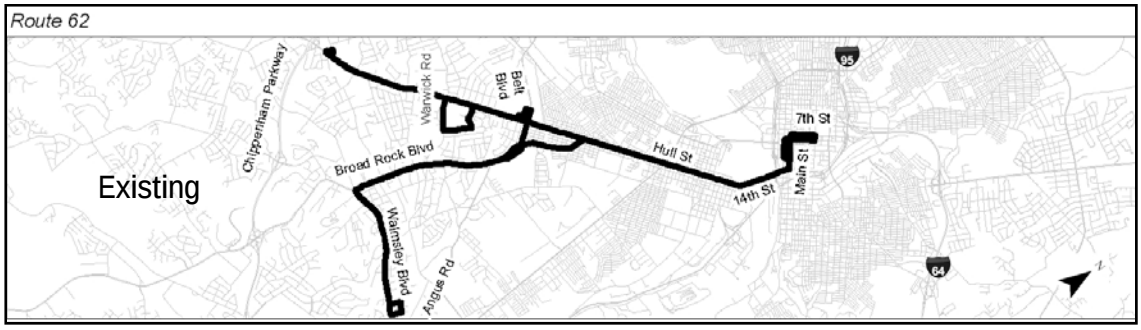
Routes 62 & 63 should be separated in the GRTC timetable to make the routing and schedules easier for passengers to understand. Route 62 should maintain the same routing through downtown and across the Mayo Bridge and then continue south on Hull St along the following route:

- South on Hull to Southside Transit Center – east on Belt to VA Hospital (includes all existing Hospital stops) – north on Broad Rock – north on Hull to downtown

The destinations at the end of the current Route 62 (Chippenham Mall & Walmsley Blvd) will now be served by the redesigned Route 61. The 20-minute headway currently provided on Route 62 should be maintained.

Route 62





Route 63

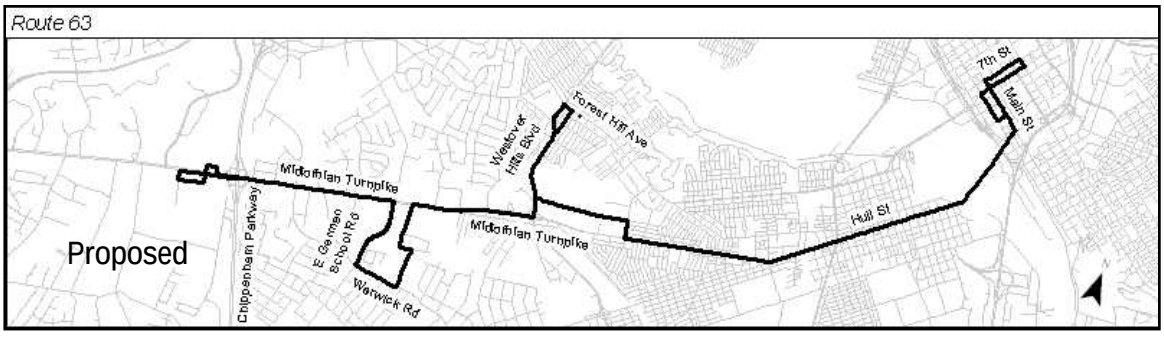
Routes 62 & 63 should be separated in the GRTC timetable to make the routing and schedules easier for passengers to understand. The same routing will be used downtown and across the Mayo Bridge to Hull St.

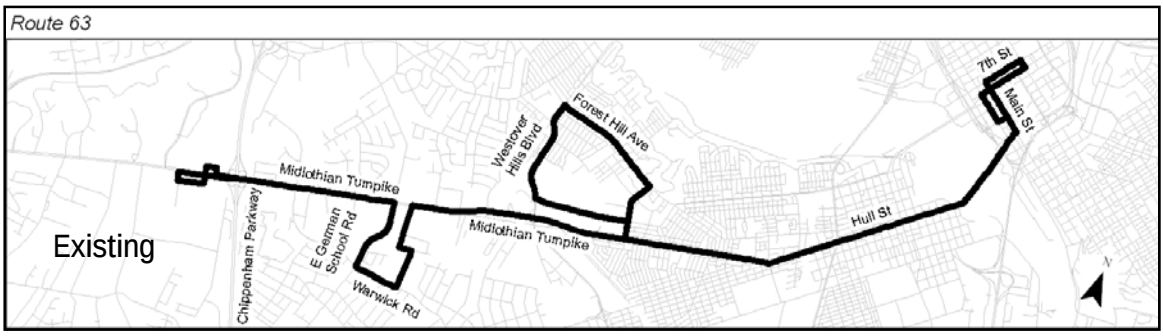
- Hull St to Midlothian Tpke – north on Roanoke – east on Crutchfield – north on Westover Hills – east on Forest Hill – south on 48th to Westover Hills – west on Midlothian – south on Giant Dr – east on Pride – south on Warwick Village – west on Warwick – north on German School – west on Midlothian to and along current routing to Cloverleaf and Beaufont Malls
- The same route should be followed back to downtown

Service should be provided seven days a week on the following headways:

- Maintain 20-minute headway on weekdays
- 30-minutes on Saturday
- 60-minute on Sunday

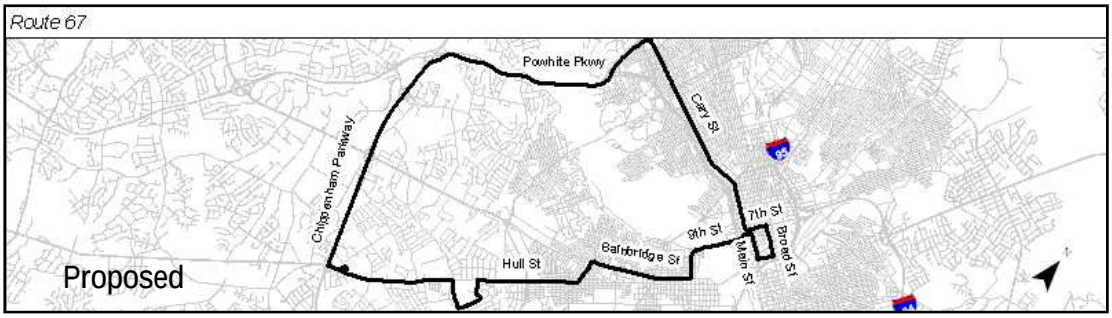
Due to safety concerns, until redevelopment occurs, there should be no stop at the Kmart on Carnation.

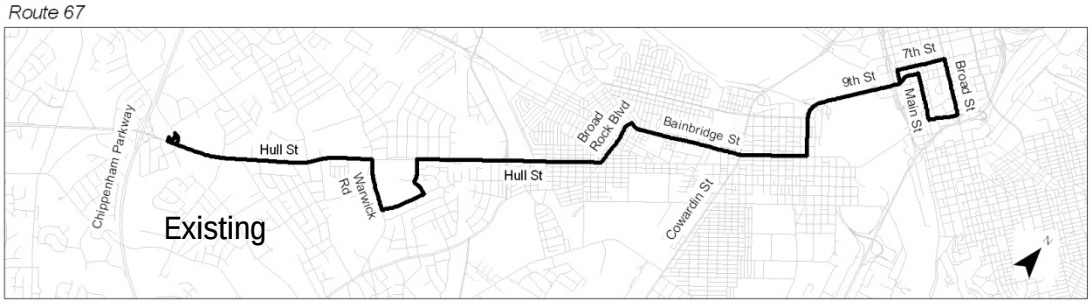




Route 67

This route should be altered to provide a quicker (express-type) service in the peak direction and local service that mostly copies the existing service in the off-peak direction. From the Chippenham mall the following route should be followed:



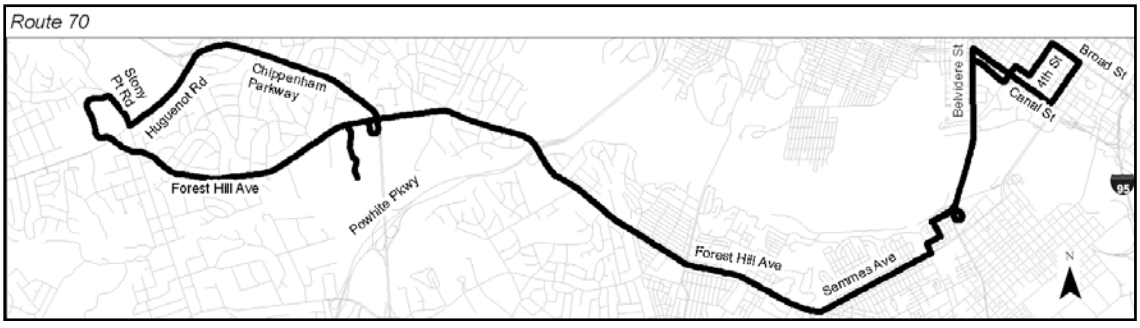


- North on Chippenham Pkwy – north on Powhite Pkwy – north on Thompson – east on Cary – north on 7th – east on Broad – south on 14th – west on Main – south on 8th across the Manchester Bridge along the existing routing

Route 70

No routing changes proposed. All trips on weekends should stop at the Wal-Mart on Sheila and Hugenot High School.

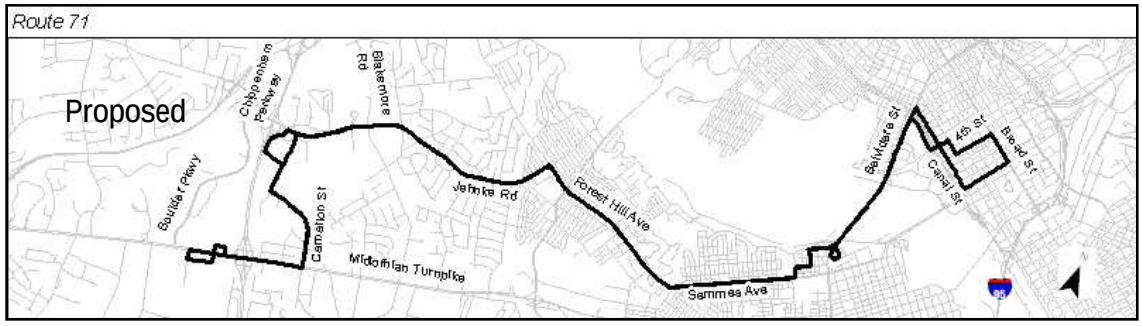
Routes 70 and 71 should be separated in the GRTC timetable to make the routing and schedules easier for passengers to understand.

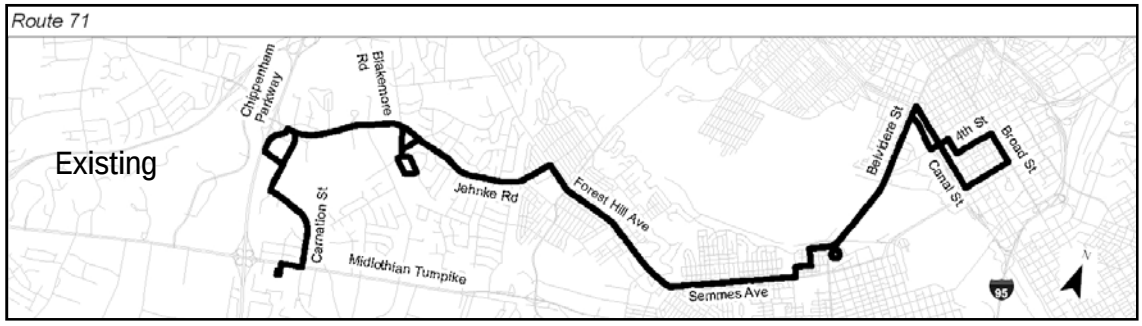


Route 71

Route 71 should be extended slightly west along Midlothian Tpke to provide service to Cloverleaf Mall (near Boulder Pkwy) and Beaufont Mall as in the existing Route 63. Additionally, the detour into Glenway Ct should be removed since boardings there are low and it is a walkable distance to Jahnke Rd. These two route changes should allow the headways to remain fairly constant.

The KM/CH designations on buses and in the schedules should be eliminated because they are confusing for new passengers. Finally, Routes 70 & 71 should be separated in the GRTC timetable to make the routing and schedules easier for passengers to understand.

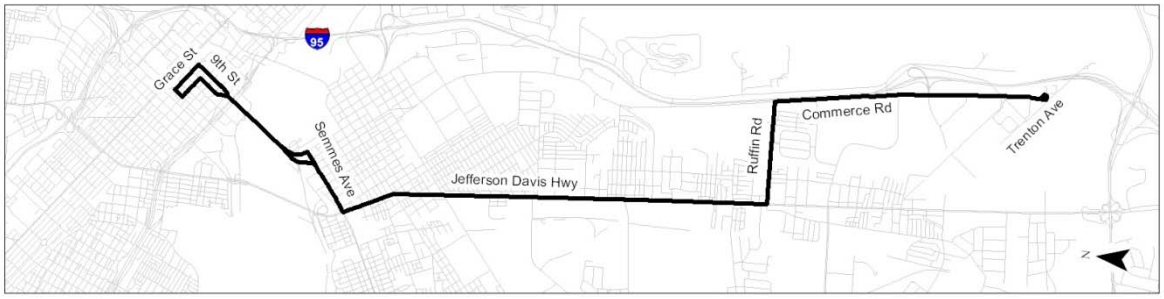




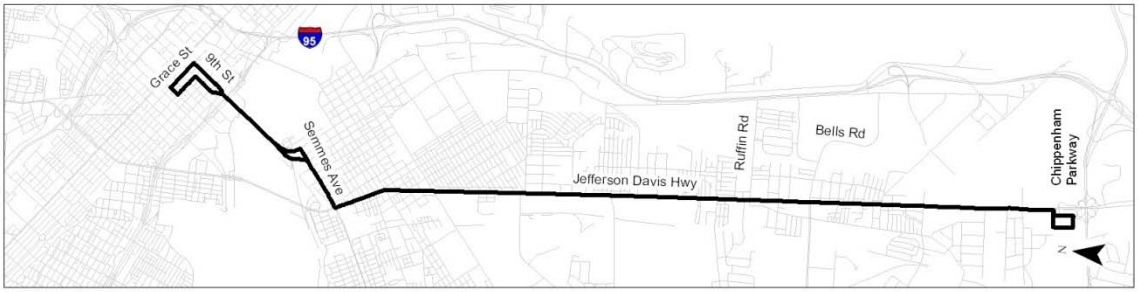
Routes 72/73

No routing changes proposed.

Route 72



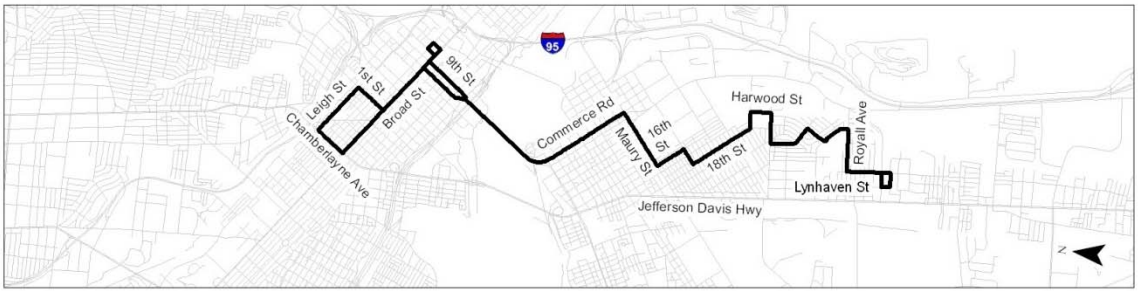
Route 73



Route 74

No changes proposed.

Route 74

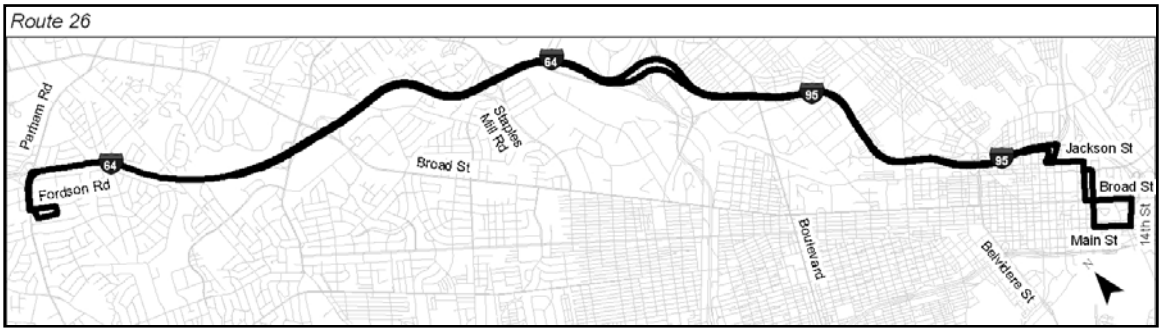


Express Routes

The few changes recommended to the Express Routes are described in this section. These routes generally serve park-and-ride or shopping facilities located some distance from downtown Richmond, and have very few stops on their way to the downtown core.

Route 26

Route should be eliminated and service to the Parham Road Park-and-ride should be provided by Route 29.



Route 27

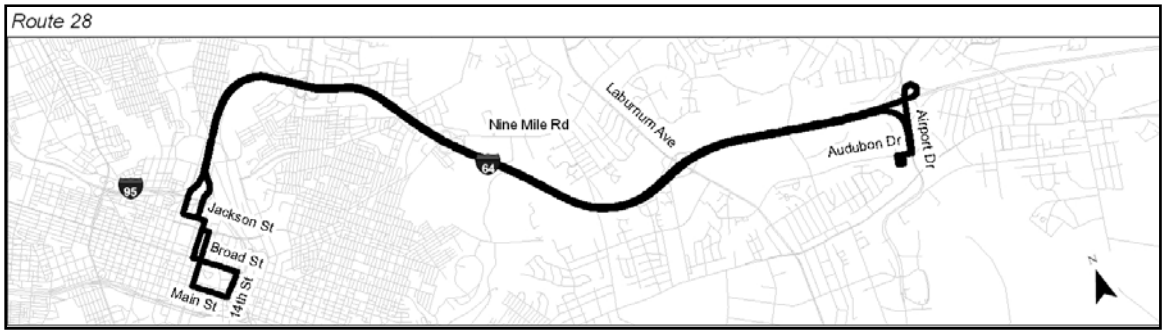
No routing changes proposed.
The headways should be adjusted to be more evenly spaced and every second trip should be removed from the schedule.

Route 27

Route 28

Because GRTC is no longer able to provide service to the Fair Oaks Park-and-Ride, Route 28 should no longer operate until an alternative park-and-ride location is established.

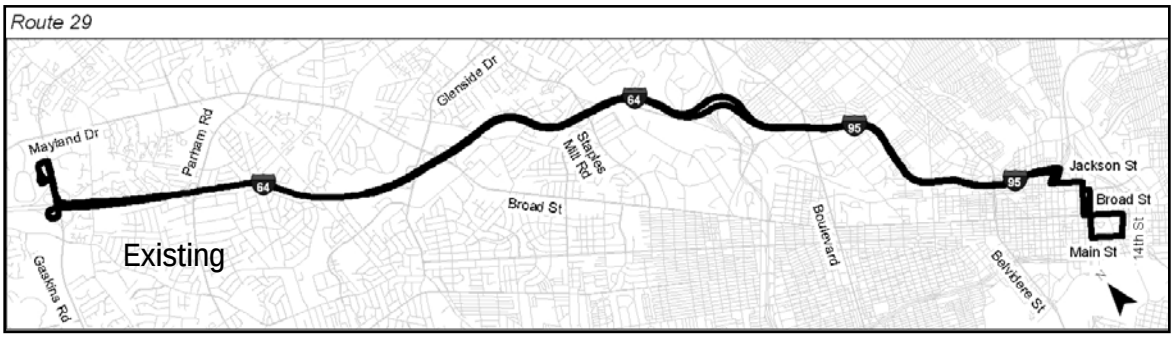
Route 28



Route 29

A stop will be added at the Parham Park-n-Ride to cover the service provided from the eliminated Route 26.

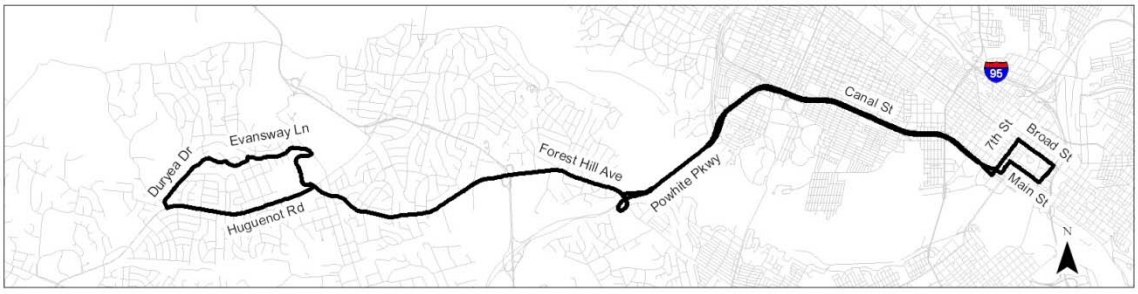
Route 29



Route 64

No routing changes proposed.
Frequency improvements scheduled for early 2008 should improve riderhip on this route. However, if increase do not occur, service should be thinned by removing every second trip.

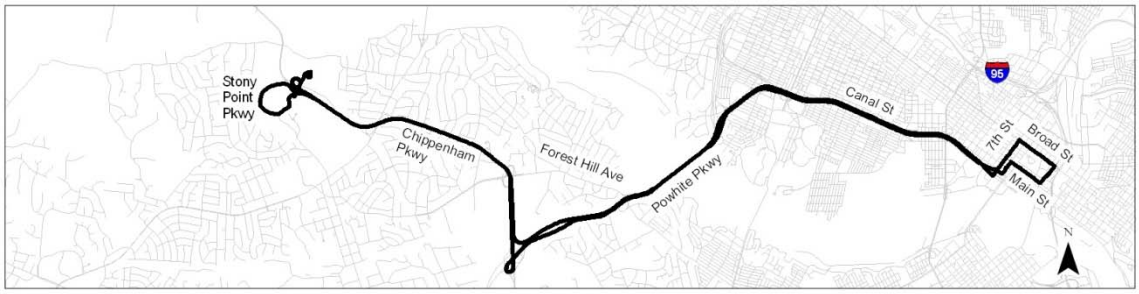
Route 64



Route 65

No routing changes proposed.
Service should be thinned by eliminating every second trip.
Improved marketing efforts to employees and shoppers at Stony Point Fashion Park and the Walmart will help improve ridership on this route.

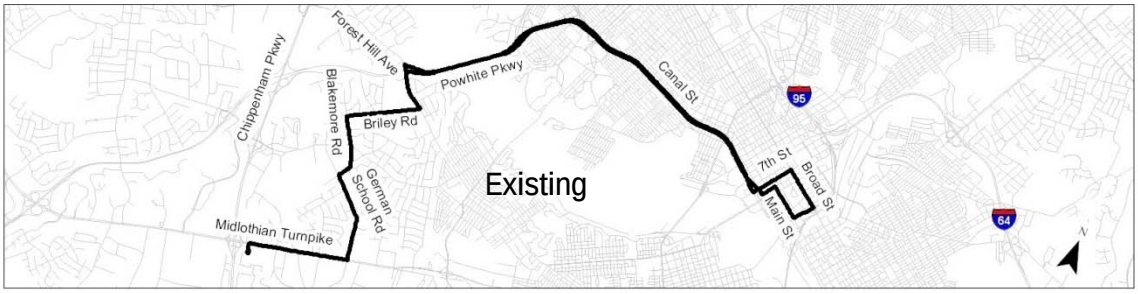
Route 65



Route 66

Due to safety concerns, the route will be terminating at Beaufont Mall instead of the Kmart.

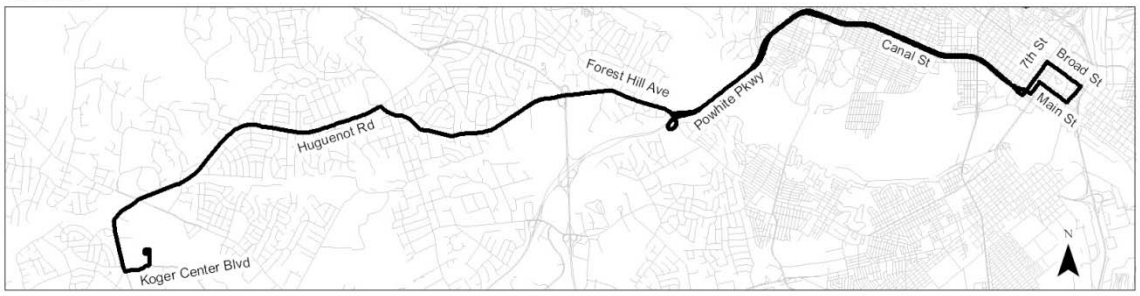
Route 66



Route 69

No changes proposed, however the route is planned for elimination in 2008.

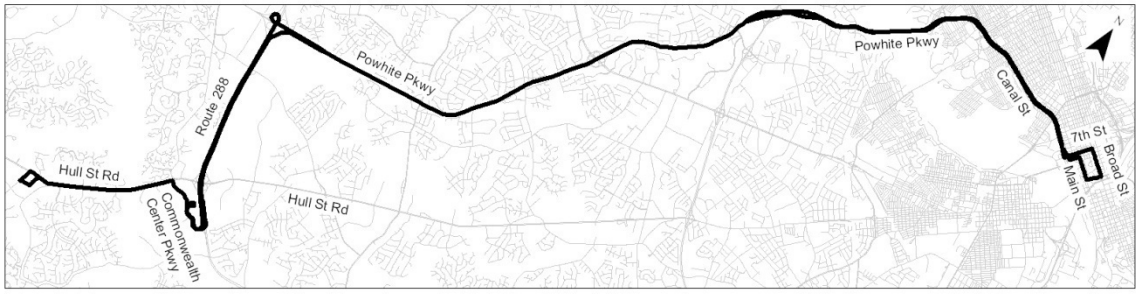
Route 69



Route 82

No changes proposed.

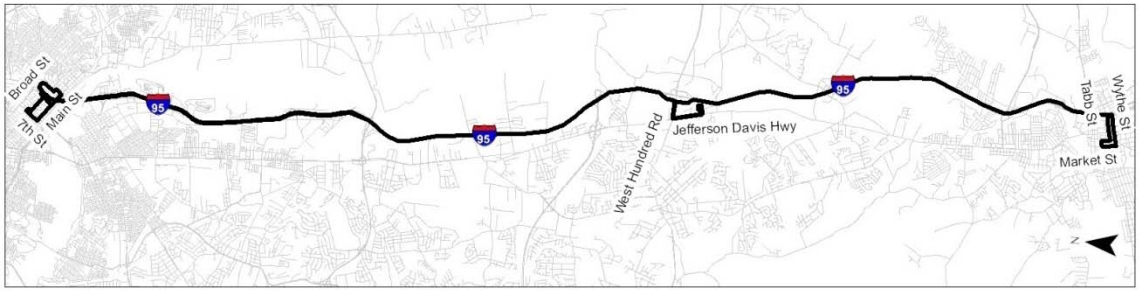
Route 82



Route 95

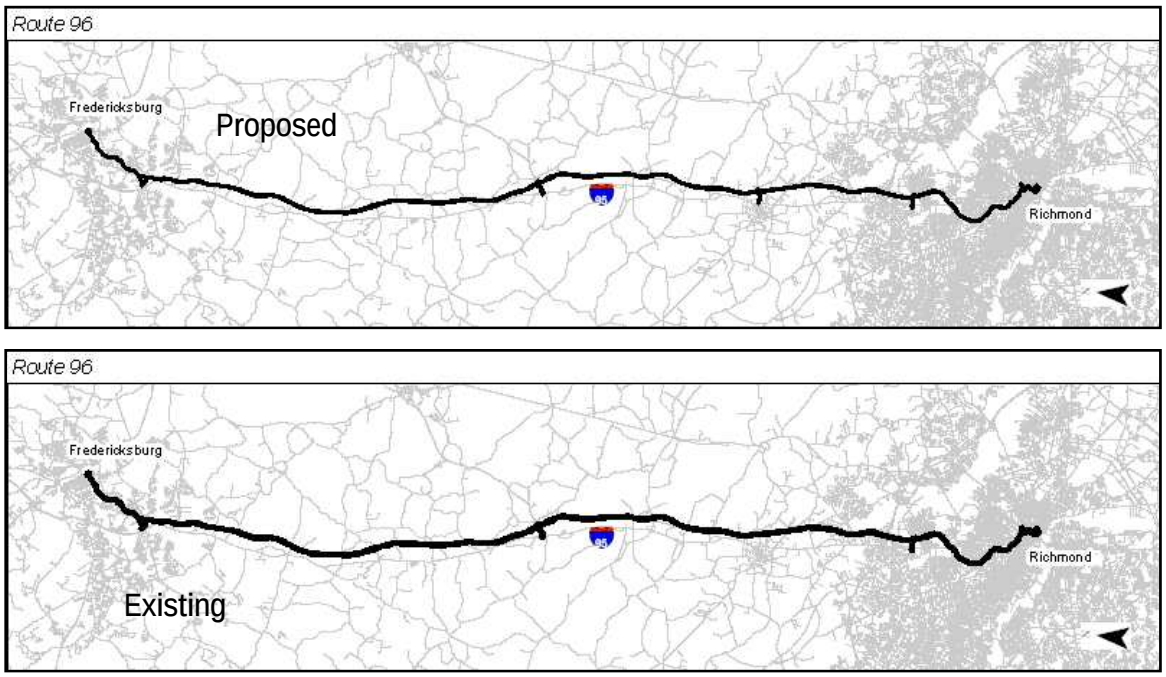
No changes proposed.

Route 95



Route 96

A stop at a Park-n-Ride lot in Ashland in Hanover County should be added to this route via route 54.



Phase II: Transfer Center Plans

Centralized transfer centers present many benefits to both transit operators and passengers as passenger and staff movements can be concentrated at a few select sites. Introducing transfer centers into the GRTC system may allow for better supervision of on-time performance, allow for coordinated scheduling, and provide off-street locations for vehicle layovers. Passengers are able to connect to a wide range of destinations at a single point without multiple transfers, often have shorter waits when transferring due to schedule coordination, and have a safe, weather-controlled place to wait for their bus. A system based on a series of transfer centers also removes the need for transfers at many other bus stops in the system so that passengers do not have to wait on the street for long periods of time.

The recommendations in this section are based on the routing recommendations presented in the previous section (Phase I). These initial recommendations have been designed to provide more appropriate service throughout the service area, and most will still be valid after the institution of any transfer centers.

This section identifies locations in the City of Richmond that could serve as transfer centers; two are located downtown, two on the Southside and one in the West End. Two options are presented: Option A includes two downtown Transfer Centers and Option B includes only one.

Each bus route should connect at one of the transfer points, if at all possible. Because the sites identified are scattered around the City, only minor re-routings will be necessary for most routes, while others already connect to one of the Transfer Centers. The necessary routing changes are illustrated in this section.

Additionally, new service may be necessary in the downtown area in order to connect the downtown Transfer Centers (in Option A) and to provide high quality service to the many destinations in the core of downtown. These shuttle routes would be very short and designed to run on a high frequency to make the transfer experience less cumbersome and unpleasant for passengers. These shuttle routes are also described and illustrated in the following sections.

Transfer Centers

The most passenger transfers occur where the most bus routes intersect. Under the current route structure, that location is in the middle of the downtown core at the intersection of Broad Street and 8th Street. To move waiting and buses from this crowded downtown area and to provide an improved environment for waiting passengers, new sites for potential transfer centers have been identified based on:

- Location of the site relative to bus routes;
- Route structure;

- Ease of access by passengers;
- Land use patterns (on the parcel and adjacent parcels);
- Compatibility with local zoning and development plans;
- Availability of land parcels; and
- Operational requirements (such as ease of access or turning radii).

Several potential sites throughout the City of Richmond were examined. Each of the transfer centers will be served by multiple routes and will allow passengers to make more direct connections than under the route structure proposed for Phase I.

The VHB team recommends the development of multiple transit transfer centers in the GRTC service area to enhance the delivery of transit services. Key sites where multiple bus routes intersect must be identified as potential locations for these facilities. To improve the passenger experience on the transit system, facilities that offer riders a safe and comfortable place to wait while transferring to other routes should also be included at these sites. A transit transfer center generally consists of one or more transit shelters or buildings where riders can congregate. Transfer centers range from small open-sided pavilions with informal seating, to larger fully enclosed air-conditioned/heated buildings with rest rooms, security staff, information kiosks and retail. In urban areas, transfer centers often offer multi-modal linkages between bus, rail and other forms of public transportation. The sites must provide easy bus access and egress and should provide sufficient space for simultaneous bus loading, unloading and layovers.

In Richmond there are several potential sites that meet these criteria including one or more in the downtown core and several neighborhood transfer hubs placed strategically along outlying but heavily traveled routes.

Downtown Transfer Centers

Many potential sites for a transit centers in downtown Richmond have been considered in prior studies. A 2001 study for the City of Richmond identified 13 possible locations and rated each according to 6 important factors. In the current study these sites were reassessed based on current conditions. Many of these earlier sites are no longer feasible or available. Other sites that had been recently identified due to changes in use or patterns of development were also analyzed. Each of these sites was assessed for availability, convenience for GRTC riders, impact on GRTC route operations, and consistency with downtown development objectives.

Based on the initial screening review three (3) alternative locations in the central downtown core of Richmond were identified for more detailed evaluation as potential transit transfer centers, as shown in Figure 118. These sites were selected with input from GRTC and City of Richmond staff. They are:

- Site 1- the block between Broad and Marshall, between 2nd and 3rd streets;
- Site 2 - the block between Broad and Marshall, between 7th and 8th streets; and
- Site 3 - several parcels of land adjacent and west of the Main Street Station located north of Main Street and south of Broad Street.

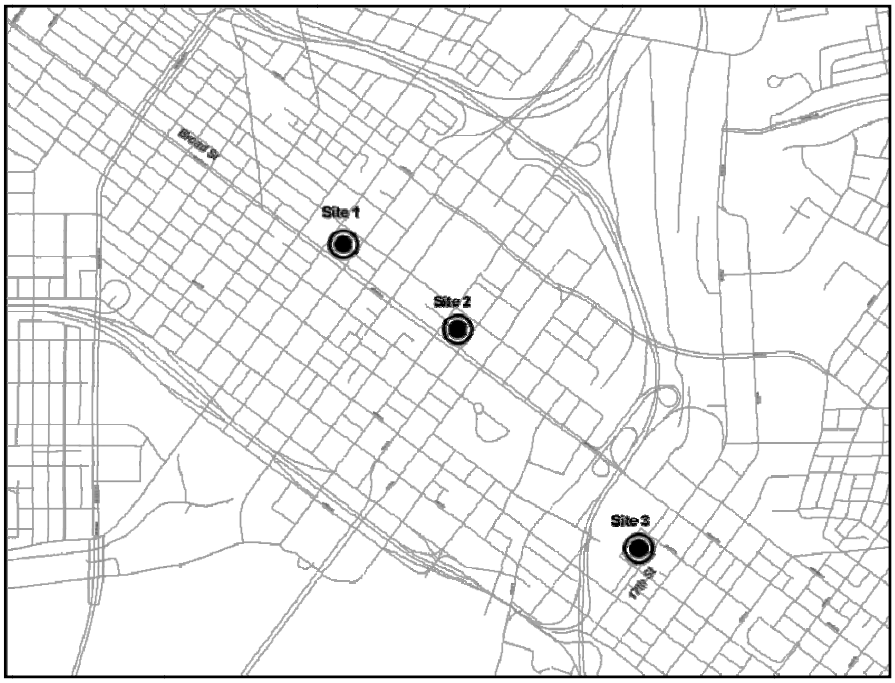


Figure 118: Potential downtown Transfer Center sites

Site 1 – Broad/Marshall/2nd/3rd Streets

The first site, located just west of the new downtown convention center currently consists of lower tier retail along Broad St and open parking lots on Marshall St. The retail storefronts are a mix of food service and clothing stores and include a group of three vacant buildings. The corner of Broad and 3rd Street holds the former United Way building which now houses an art gallery on the ground level and vacant offices above. The photos below show the condition of this block.

Retail on Broad and 2nd Street

Retail on Broad Street

The former United Way building is the largest structure on this block. It holds a prominent location on Broad and 3rd Street and should be retained and/or redeveloped. The surface parking lot to the north of the building is associated with this structure. A large alley runs east-west between the buildings on Broad and the parcels on Marshall. Smaller retail and service buildings are sited along 2nd Street at Marshall St.

The former United Way building on Broad

Parking lot north of the former United Way building

Assessment: Site 1 is well situated to serve as a primary downtown transit transfer center due to its physical size, the one-way configuration of the adjacent streets, and proximity to high volume bus routes and the major east-west corridor through the city. It could serve as a stand-alone center or as a smaller, western downtown center even though it is several blocks west of the heavily traveled 7th and 8th Street corridor. The mix of lower tier retail and vacant land uses offers the opportunity to redevelop the site in a way that would stimulate real estate values in the area and provide transit services to the adjacent convention center.

Pros:	*Cons:*
Location on Broad Street	Not ideal location to serve as the only downtown Transfer Center
High volume bus routes	West of the 7th and 8th street N-S corridor (4 blocks)
Ease of access via one-way streets	Former United Way building on site
Lower costs for property acquisition	
Adjacent to new civic center	
Good redevelopment potential	

Site 2 – Broad/Marshall/7th/8th Streets

This site is located just north of the new Federal Courthouse building under construction at Broad and 7th St. The parcels on Broad Street consist of upscale

development and redeveloped historic buildings including the Theatre Row Office Building. New construction is ongoing along the south side of Broad St.


Redevelopment along Broad Street between 7th and 8th (Theatre Row Building on left)

The north half of the block along Marshall St consists of an older parking garage between 7th and 8th streets. The lot is not heavily used at present, but this may change with the redevelopment of the properties along Broad Street. Creating a transfer center by re-using the garage would be challenging, and construction would likely require the demolition of the entire structure.


Parking deck on Marshall between 7th and 8th Street

Assessment: Site 2 is less suited to serve as a downtown transit transfer center than Site 1. It is in an excellent location to serve the existing GRTC bus routes that traverse 7th St, 8th St and Broad St (More than 20 local routes recommended in Phase I stop at Broad & 8th St.) However, the mix of high-value office and retail redevelopment, the adjacent new Federal Courthouse and the historic structures along the block make it unsuitable for a transit facility. The parking garage on Marshall could be razed and redeveloped as a multi-level transit center, but this would be a costly investment to fit on less than half a city block.

Pros:	Cons:
Location on Broad Street	Existing office and parking structures
High volume bus routes, especially along 7th and 8th streets	Buildings are historic and may be considered contributing structures
Ease of access via one-way streets	High costs for property acquisition
Adjacent to new Federal building	Redevelopment already occurring
	No vacant land on the site

Site 3 – Main Street Station East

The final site that was evaluated is located to the east of the downtown Main Street Station, a historic rail station located on the east edge of the downtown core. The City of Richmond is actively seeking proposals from private developers to improve the land parcels to the west of the station (between the station and 15th street). The City has depicted a small bus turn-around within this area on a concept plan, but it would not be of sufficient size or capacity to accommodate the volume of bus movements needed for a downtown transit transfer center. For the purposes of this evaluation, the parcels to the west of the station have been excluded until the City's redevelopment plan becomes clear.

The parcels to the east of the station consist of a mix of retail (restaurants and a farmer's market), residential (new condominiums) and light industrial (produce vendors and storage facilities). There are several vacant parcels that could be consolidated to provide sufficient space for a transit center. The biggest challenge in this area is the need to provide a north-south connection for buses from Broad Street to Main Street while avoiding land takings and minimizing impacts to the retail and residential development. The following photos show the existing land uses west of the Main Street station.

Site adjacent and west of the Main Street Station (looking north)

Assessment: Site 3 is a suitable location for an eastern downtown transit transfer center. It is well suited to serve the existing GRTC bus routes from the east end, the South Side and Church Hill, but it is not central enough to serve as the primary transit center for the entire downtown. The adjacent Main Street Station offers the

potential for unique multi-modal interaction for passengers. The site west of the station is too constrained for a transit center, while the sites to the east offer greater room for a transit center and access improvements. A primary constraint for either site is the lack of a suitable north-south bus connection from Main to Broad Street. The location of the I-95 overpass and Franklin Street exit ramp preclude a connection from Main to Broad west of the station unless it were built within the existing parking area. The land uses east of the station offer some opportunities to create this north-south connection, but it must be sited to avoid conflicts with the developing retail, food-service and condominium developments along 17th street.

Pros:	*Cons:*
Location on Main Street	Existing City plans for west of station
Adjacent to Main Street station offers a multi-modal opportunity	Poor connectivity from Main Street to Broad Street unless a new road is built
Good location for east-end routes	West site is too constrained
City owns some of the parcels	Redevelopment already occurring
	Condos and restaurants on 17th street

Site adjacent and east of the Main Street Station

Recommendation

Based on the available sites and the operating and programmatic elements required in a downtown transfer center, two options can be pursued. Option A would develop both sites 1 and 3 as Transfer Centers, each designed to accommodate a portion of the bus routes and provide transfer opportunities to passengers traveling in multiple directions. (Based on the route recommendations in the following sections, 18 routes will connect at Site 1 and 12 routes will connect at Site 3 in Option A.) Both transfer centers will be large enough to include some passenger amenities, staff waiting areas and vehicle layover space. Because of the distance between the two proposed transfer centers (just over one mile) and from the heart of downtown (between 8th and 14th), a transit link will be necessary to connect them. A pair of shuttle routes, described in more detail below, is recommended to provide this link and direct frequent service to the offices and destinations along Broad St and Main St.

Option B would develop only Site 1 as a downtown Transfer Center, with most of the routes in the system connecting at this point. This option would concentrate most of the transfers at one point, and allow GRTC to put all of its resources into a single facility. This facility would be large enough to include a wide range of amenities and would probably be able to attract some type of retail to the site and the adjacent area. Under this option, 25 local routes would connect at this Transfer Center. Both options would use Site 1 in some fashion, therefore we have developed schematic proposed site layouts for this parcel. Conceptual site layouts were not prepared for sites 2 and 3.

Proposed Concepts for Transit Center for Site 1

Site 1 located at 2nd, 3rd and Broad Streets offers the greatest opportunities for a transit transfer station with the least challenges (based on current information). As this study progresses new information may be uncovered during due diligence efforts that could revise this estimate. VHB has prepared two potential development schematics for this site. These are planning level concepts are not to be construed as based on engineered designs. Concept 1 shows a low-intensity development that retains the existing United Way building, but removes the remaining structures. Concept 2 is a higher-intensity development that retains the United Way building while creating a new hotel or office complex with the transit center at the ground level.

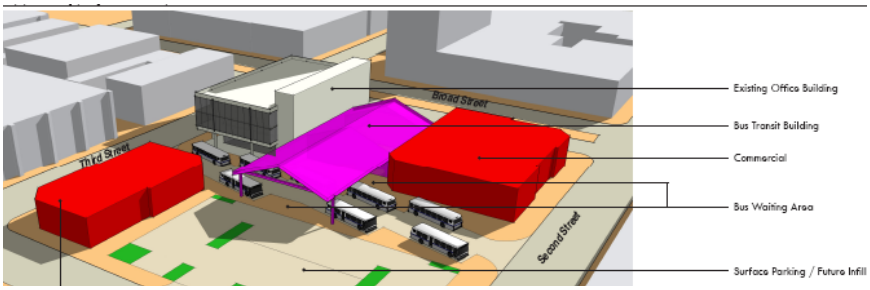
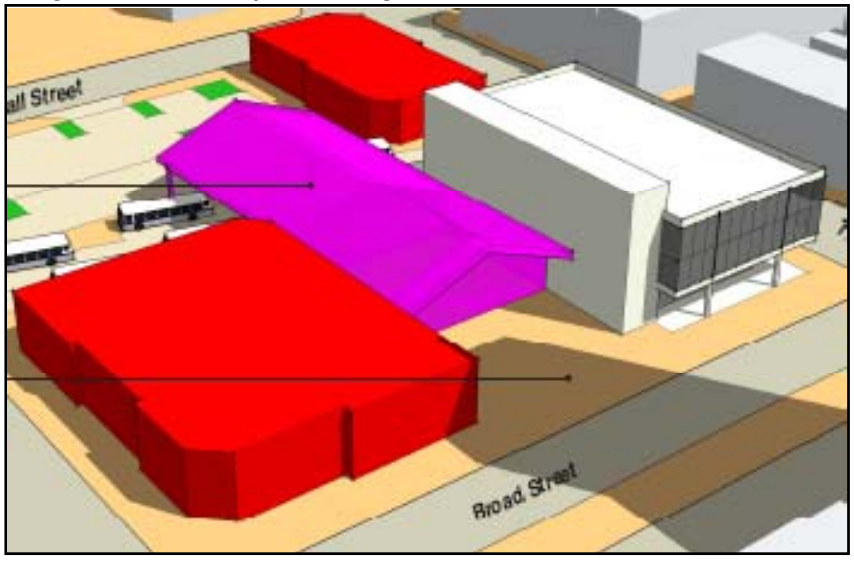
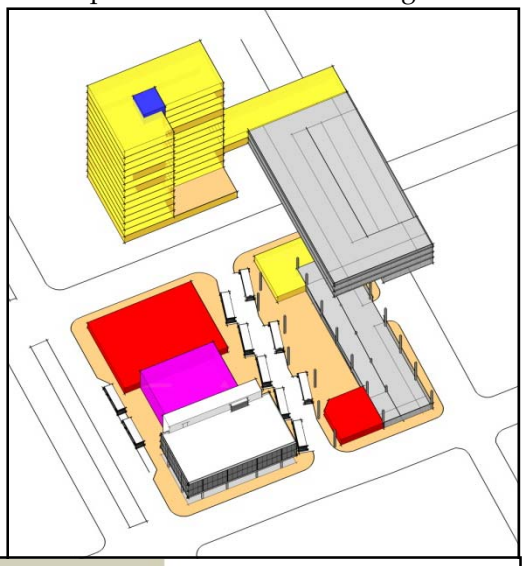


Figure 119: Conceptual Design 1 for Broad Street Transfer Center



Concept 1: This site concept shows a mid-block east-west bus loading lane as well as bus loadings on both Marshall and Broad. At the center of Broad and Marshall a bus transit center connects both streets with the center bus loading lane. The structure is shown as open to the air, but could be a fully-enclosed facility with interior finishes. It would offer GRTC riders a safe and secure place to wait while transferring to another route. The facility could include interior restrooms, information kiosks and electronic information displays showing the arrival and departure of buses. New retail developments (shown in red) would anchor the corner of Broad and 2nd Street, and Marshall and 3rd Street.

Concept 2: This site concept shows a new hotel or office building fronting on Broad Street at 2nd Street (shown in yellow). This concept would retain the existing former United Way building, but add a new parking structure along Marshall Street (gray). The proposed transit center would be placed on the ground level of the new development and would retain a similar configuration as concept one, above. Ground level retail in red would anchor the corner of Broad and 2nd Street. This type of high-intensity development would require a commitment from the City to assist in a joint development process to attract this type of investment from a private entity.



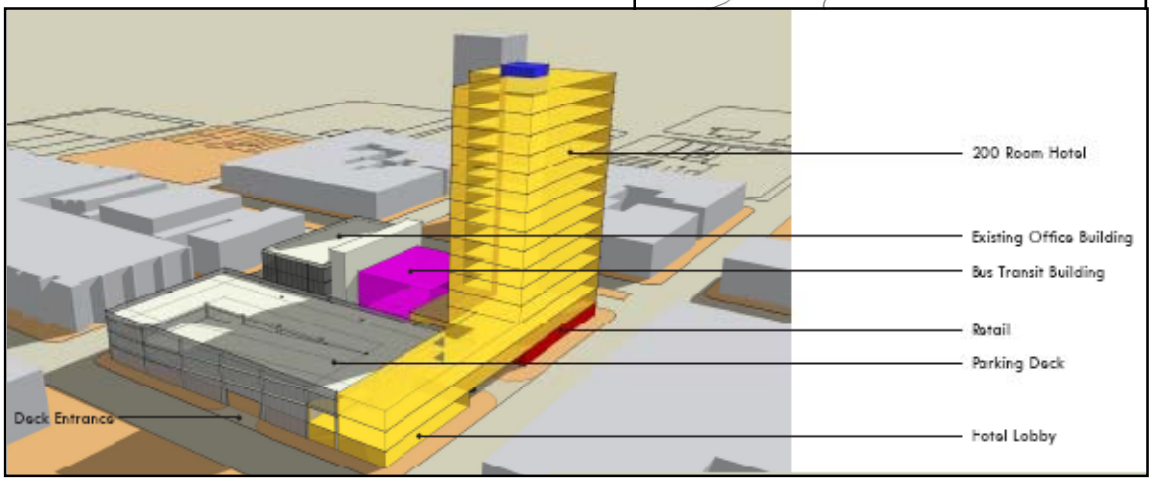


Figure 120: Conceptual Design 2 for Broad Street Transfer Center

Neighborhood Transit Centers

In addition to the downtown transfer centers, additional smaller centers should be developed to serve neighborhood centers with a significant transit presence. These neighborhood transfer centers would provide a safe place for transferring passengers to wait, but would not likely provide any of the additional amenities recommended for the downtown centers. These neighborhood centers can serve as a hub for future growth of the transit system in the surrounding areas. Also, due to their relatively small size and simplicity, additional transfer centers can be developed as the need becomes apparent. Two of these neighborhood transit centers already function in this way including Willow Lawn and Southside Plaza. Based on the proposed route

structure, route connections outside of downtown and the number of routes in each area of the city, three proposed locations for this type of transfer center have been identified: two on the Southside and one on the West End.

The Southside Plaza Transfer Center would be located at the eastern corner of the intersection of Belt Blvd and Hull Street Rd south of the James River. Southside Plaza, located at this site, is a major shopping destination for residents of the Southside and is conveniently located as a gateway to downtown Richmond. Under the existing route structure, most of the routes that serve the Southside already connect at this central location, limiting the amount of re-routing that would be necessary. Shelters are already provided at this site, however additional amenities would be appropriate based on the expected levels of passenger activity at that location. This site is not vacant, and an agreement would be necessary between GRTC and the owners before a structure could be built that would accommodate waiting passengers and vehicle layovers.

The Downtown-Southside Transfer Center would be located south of the James River near the intersection of Hull St and Commerce Rd. This location provides access across both of the major bridge connections into the downtown core: the Manchester Bridge and the Mayo Bridge. As the core of downtown continues to expand across the river into Southside, this Transfer Center will serve as an anchor to new development in the area.

The Willow Lawn Transfer Center is to be located at the Shops at Willow Lawn at the southeast corner of the intersection of Willow Lawn Dr and Broad Street on the West End of the city. Shelters already exist at this location, however additional amenities would be necessary to help formalize this location as a Neighborhood Transit Center, including lighting, expanded covered waiting areas and additional GRTC system information. This will be the smallest of the five proposed Transfer Centers and no routes will need to be re-routed to connect here. Any future service in the West End of the city or in western Henrico County should connect to this center as well.

Bus Routes

In order for all of the downtown routes to connect at one of the proposed Transfer Centers, slight re-routings will be necessary. These routing changes are small in most cases and ensure that an easy, seamless transfer is available to passengers to improve their transit experience. Conceptual changes for each of the routes proposed in Phase I are illustrated on the following pages. These changes do not represent final routing recommendations, but are simple routing changes that could be used to connect to the Transfer Centers without significantly increasing the length of any of the routes. The recommendations are presented according to the color groupings used in the current Ride Guide, although a different grouping system may be more appropriate after the changes have been implemented. All headway recommendations from Phase I would still be appropriate for the modified Phase II

routes, except where otherwise noted. Recommended routing changes for options A and B are presented separately, although many remain the same.

Option A: Two Downtown Transfer Centers

This section will explore the option of having two downtown transfer centers in addition to the three neighborhood transfer centers. One transfer center would be located on Broad Street between 2nd & 3rd Streets and the other would be located near Main Street Station close to the intersection of Main St & 17th. Based on the recommendations in Phase I, only slight re-routings would be necessary for most routes, and 17 routes would connect at the Broad St Transfer Center and 11 at the Main Street Station Transfer Center. In order to connect these two Transfer Centers, a pair of shuttle bus routes would be needed, that would provide direct service to the destinations along Broad St and Main St. These shuttle routes would provide a *free* frequent service between the two downtown Transfer Centers and would help alleviate any potential inconvenience caused by the introduction of the Transfer Center system.

Under the recommendations in this plan, the frequency of bus service in the downtown core portion of Broad Street actually increases slightly. This is due primarily to two factors:

- Additional bus routes using Broad Street to access the Broad Street Transfer Center
- The addition of six buses an hour to operate the Broad Street Shuttle between the two downtown transfer centers.

Alternative downtown routings that use streets other than Broad Street (i.e. Marshall or Grace) may be possible for some routes to reduce the congestion caused by these vehicles. Table 119 below shows that the frequency of eastbound bus service in the afternoon peak has now increased to 50 buses per hour, the equivalent of one bus every 72 seconds.

Table 119: Proposed Phase IIA Broad Street Frequency, buses per hour

Eastbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	14.00	44.73	15.13	10.40	21.07
Midday	12.62	40.53	14.90	10.17	19.55
PM Peak	15.80	50.03	16.73	12.00	23.64
Saturday	11.30	35.89	11.52	6.79	16.37
Sunday	9.05	28.73	9.73	5.00	13.13
Average	12.55	39.98	13.60	8.87	

Westbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	13.60	38.93	17.93	10.40	20.22
Midday	12.31	35.71	16.74	10.01	18.69
PM Peak	16.30	43.53	20.23	12.50	23.14
Saturday	11.47	31.89	13.23	6.79	15.84
Sunday	9.05	27.38	10.98	5.25	13.17
Average	12.55	35.49	15.82	8.99	

Based on a one-day sample of current GRTC transfer patterns, approximately 8,400 transfers occur throughout the system on an average day. The routing changes recommended in this section will change how some of the bus routes connect, by

bringing them together at specified transfer locations. Under the recommendations in this section, 69% of the existing transfers could be made at one of the five proposed Transfer Centers. Another 30% of the existing transfers would still be possible, but the connections would have to be made on the street. This results in 5,797 transfers combined at the transfer centers and another 2,520 transfers occurring on the street. Again, the route restructuring recommended primarily in Phase I will significantly alter the transfer patterns in some areas, eliminating the need for some and potentially creating the need for others. The 111 transfers that will no longer be possible result primarily from the elimination of certain express routes, and service (and single-transfer rides) will still be available to most of those passengers.

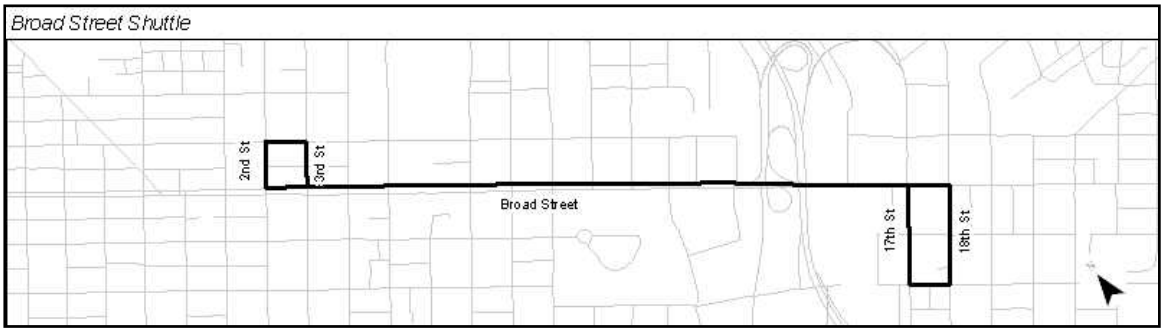
Shuttle Routes (Conceptual Only)

A direct connection between the two downtown Transfer Centers is necessary in order to ensure that all potential transfers can be made as easily as possible. Also, due to recommended changes in the route structure, high quality service will be necessary in the heart of the downtown core, between 8th St and 14th St due to the many destinations concentrated in this area. To solve both of these related issues, a pair of shuttle routes are recommended to provide frequent, high quality service to downtown while providing a connection between the two new transit hubs. These two routes are conceptually shown below, and serve the Broad St corridor on the north of downtown and the Main/Cary corridor south of the core.

Broad Street Shuttle

The Broad Street Shuttle will operate between the two downtown Transfer Centers and serve the office, government facilities, the convention center, hotels, restaurants, theaters and other destinations along Broad Street with potentially high demand for transit service throughout the day and on weekends. Due to this high level of demand, service should be provided on 10-minute headways. The shuttle will run via the following routing:

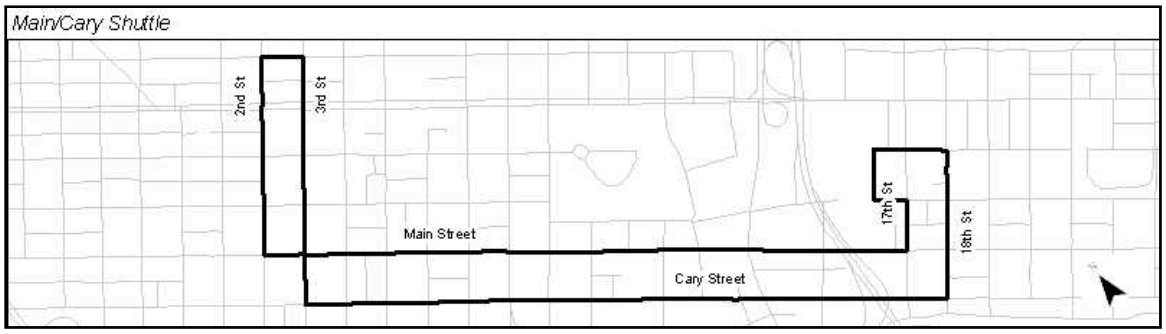
- West on Broad – north on 2nd – east on Marshall – south on 3rd – east on Broad – south on 17th – east on Franklin – north on 18th to Broad



Main/Cary Shuttle

The Main/Cary Shuttle will also operate between the two downtown Transfer Centers but will serve the southern portion of downtown. The route will operate on a ten-minute headway along the following loop:

- East on Cary – north on 18th – west on Grace – south on Ambler – east on Franklin – south on 18th – west on Main – north on 2nd – east on Marshall – south on 3rd to Cary



Blue Routes (Conceptual Only)

The group of Blue Routes generally serves the West End of Richmond, and most will therefore connect most easily to the Broad Street Transfer Center. A few routes go through the City and serve both downtown Transfer Centers, providing east-west service through the downtown core to supplement the recommended shuttle service and provide one seat rides for some passengers. Additionally, several routes will be able to make connections at the Willow Lawn Transfer Center. Table 120 highlights each route and which of the Transfer Centers they would serve under the proposed routings.

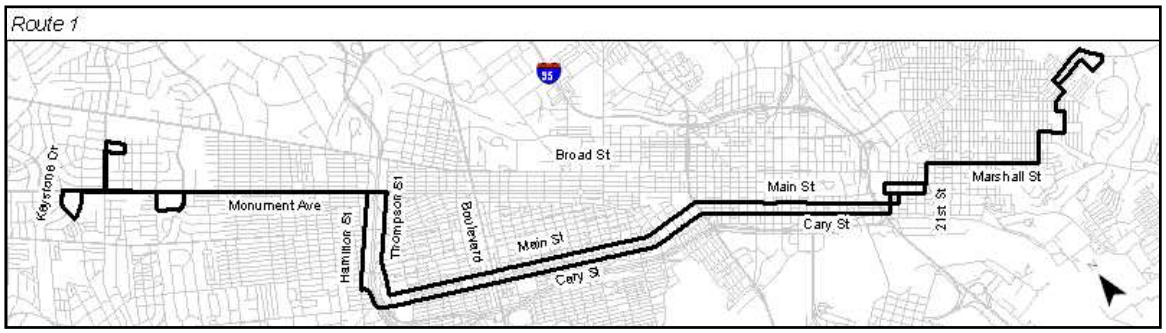
Table 120: Blue Route Connections

Route	Transfer Center Connections				
	Broad Street	Main Street Station	Willow Lawn	Southside Plaza	Southside - Downtown
1		X	X		
2	X	X			
3	X				
4	X				
6	X	X	X		
8	X				
10W	X				
10E	X				
11		X			
13		X			
16		X			

Route 1

A slight change in the proposed routing on the eastern end of the route will be necessary to ensure an easy connection for passengers transferring at the Main Street Station Transfer Center. The modification follows new routing:

- Eastbound: east on Cary – north on 17th – east on Grace – north on 21st to Marshall
- Westbound: West on Marshall – south on 21st – west on Grace – south on Ambler – east on Franklin – south on 18th – west on Main



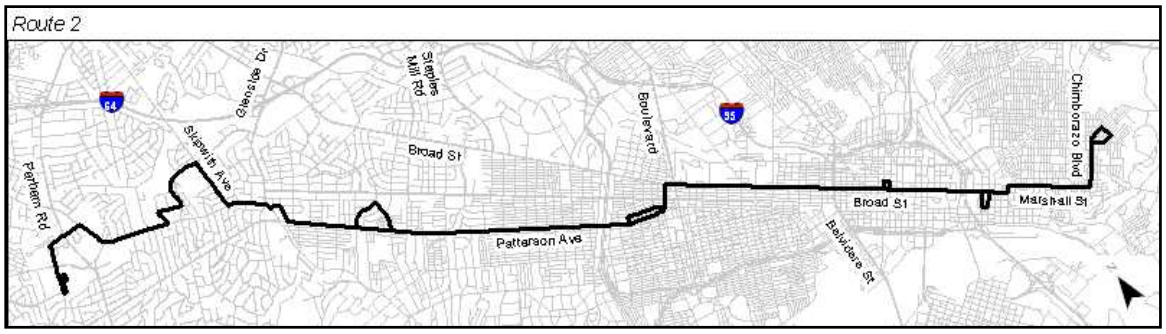
Route 2

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad

In addition, another small modification will allow a direct connection to the Main Street Station Transfer Center along the following routing from Broad St:

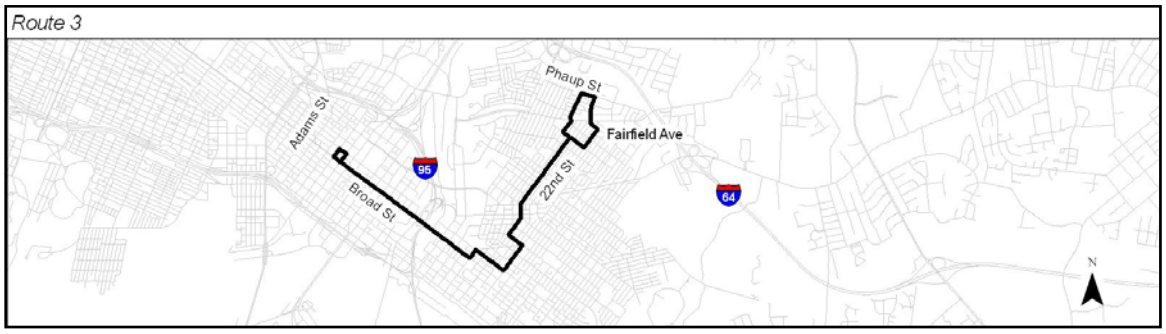
- South on 17th – east on Franklin – north on 18th to Broad St



Route 3

The proposed Route 3 could be shortened so that it turns around at the Broad Street Transfer Center, as follows:

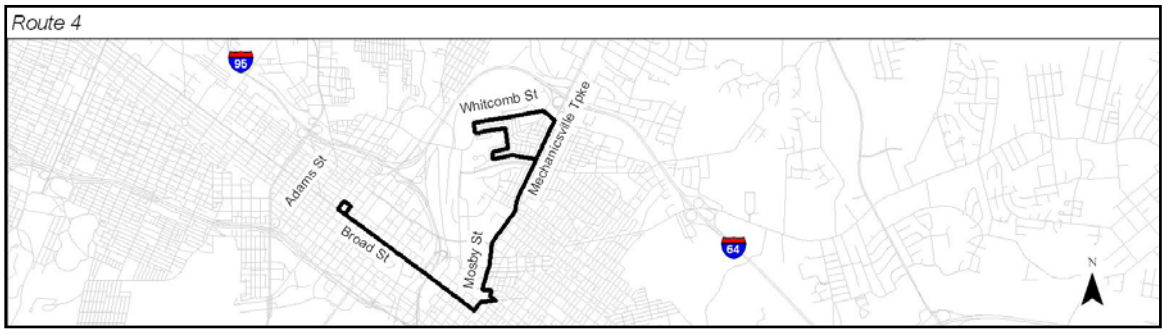
- West on Broad – north on 2nd – east on Marshall – south on 3rd – west on Broad



Route 4

The proposed Route 4 could be shortened so that it turns around at the Broad Street Transfer Center, as follows:

- West on Broad – north on 2nd – east on Marshall – south on 3rd – west on Broad



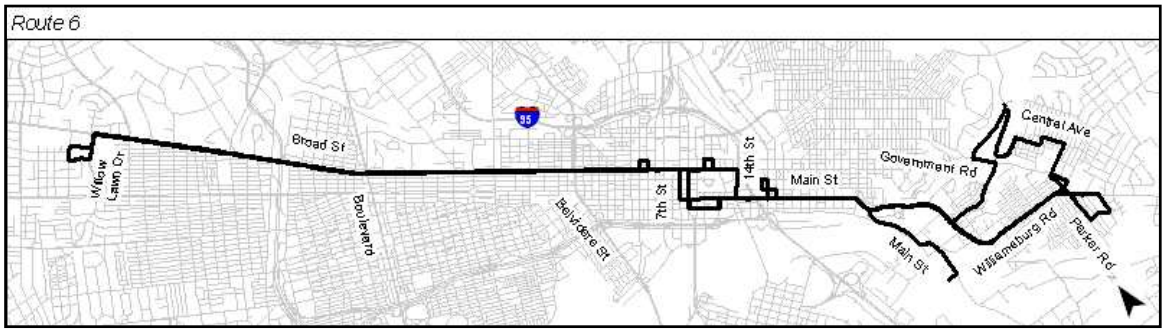
Route 6

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad

In addition, another small modification will allow a direct connection to the Main Street Station Transfer Center along the following routing from Main St:

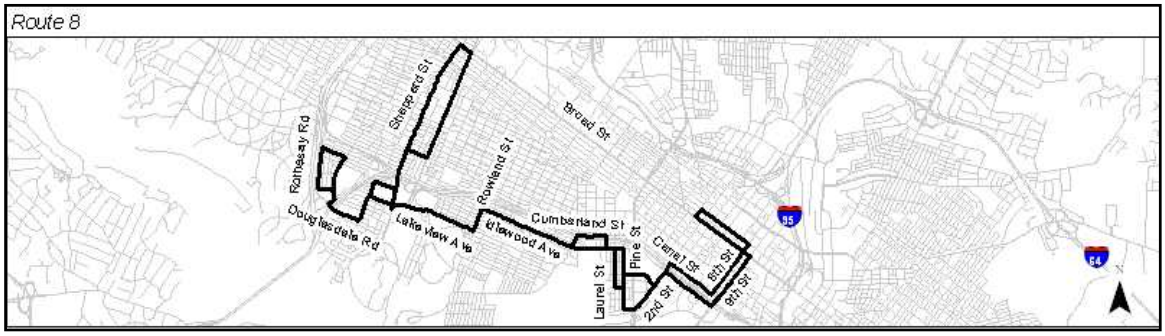
- North on 17th – west on Grace – south on Ambler – east on Franklin – south on 18th to Main Street



Route 8

In order to connect with one of the downtown Transfer Centers an extension of some length will be necessary. The route could be modified to serve either of the two proposed hubs; a conceptual routing to the Broad Street Transfer Center uses the following routing:

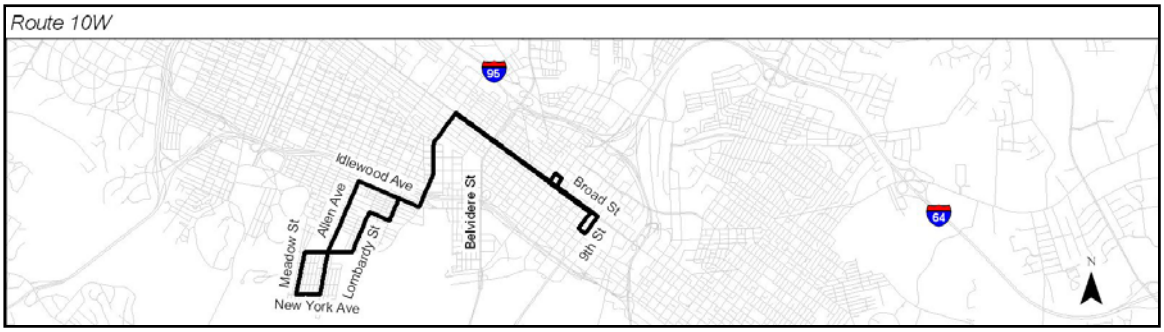
- North on 9th – west on Broad – north on 2nd – east on Marshall – south on 8th to Canal following previous routing recommendation



Route 10

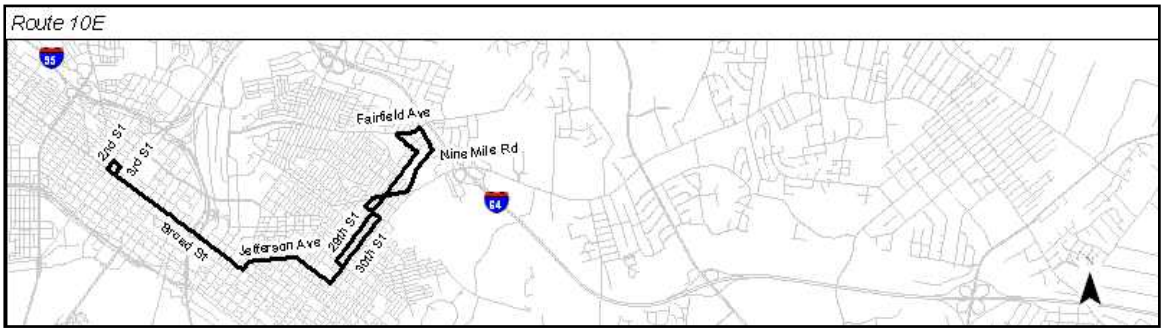
The east and west portions of this route should remain unlinked, however they could connect at the Broad Street Transfer Center. Route 10W requires a slight deviation around the Broad Street Transfer Station to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad



Route 10E should be shortened to turn around at the Broad Street Transfer Center, as follows:

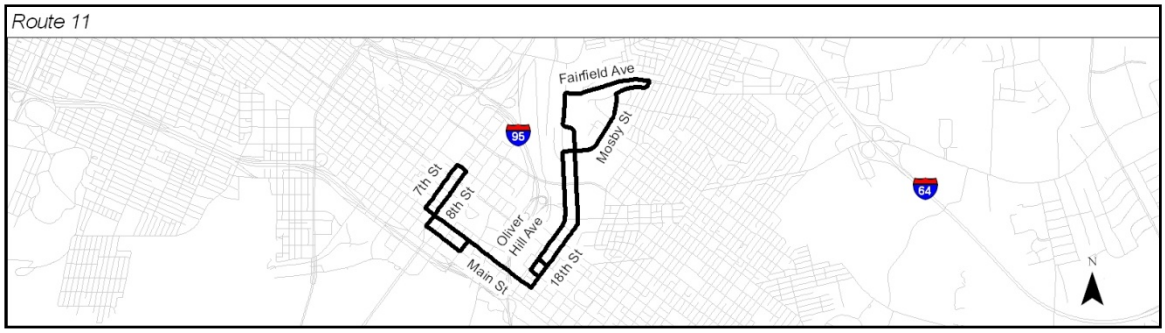
- West on Broad – north on 2nd – east on Marshall – south on 3rd – west on Broad



Route 11

Only slight modifications would be required for this route to connect to the Main Street Station Transfer Center.

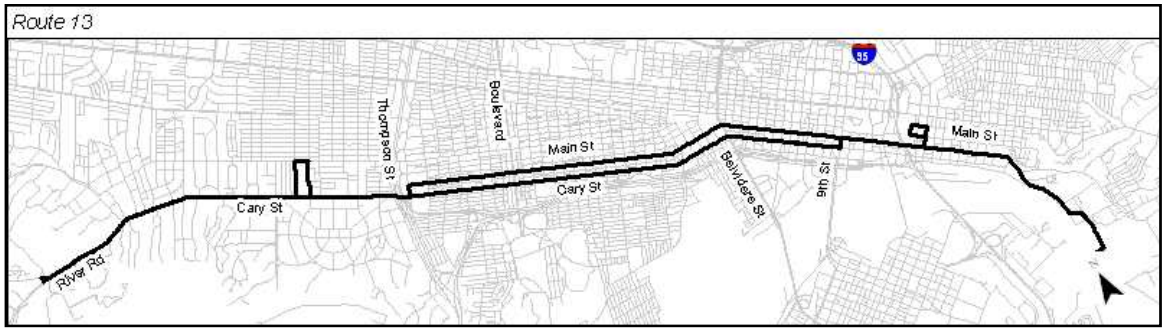
- Southbound: South on 17th – east on Franklin – south on 18th
- Northbound: north on 18th – west on Grace – south on 17th – east on Franklin – north on 18th



Route 13

A slight deviation from the Main Street routing on the eastern portion of the route would be sufficient to connect to the Main Street Station Transfer Center. The routing could be as follows from eastbound or westbound Main Street:

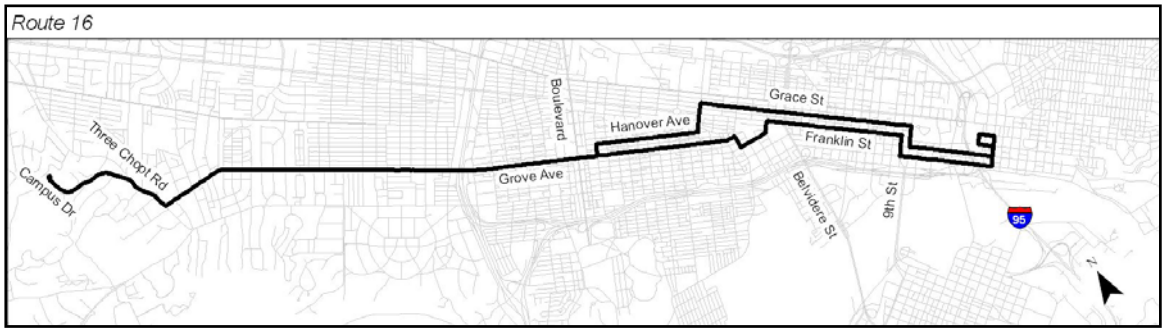
- North on 18th – west on Grace – south on Ambler – east on Franklin – south on 18th to Main St



Route 16

Route 16 should remain along the existing routing between downtown and the University of Richmond, with an extension at the eastern end to connect to the Main Street Station Transfer Center as follows:

- East on Cary – north on 18th – west on Grace – south on Ambler – east on Franklin – south on 18th – west on Main along the existing routing



Purple Routes (Conceptual Only)

The two Purple Routes serve the East End of Richmond and eastern Henrico County. Both routes could be connected easily to either of the downtown Transfer Centers with modest extensions. The concepts illustrated in this section show one route serving each of the downtown Transfer Centers, although alternative routings would be possible. Table 121 highlights each route and which of the Transfer Centers they would serve under the proposed routings.

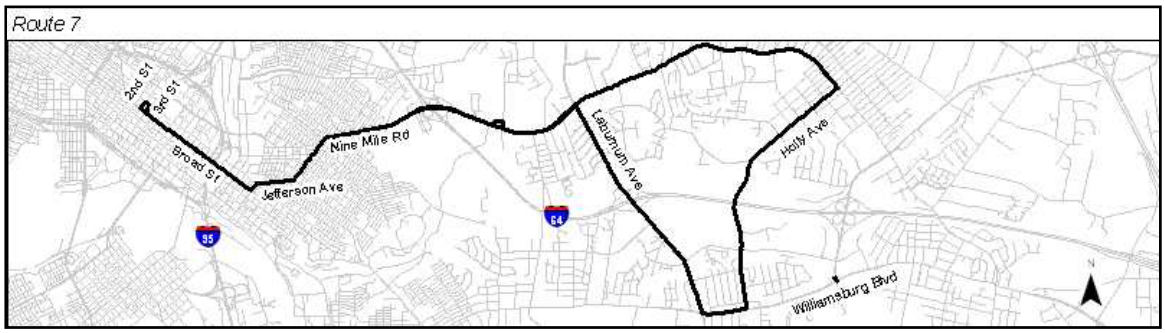
Table 121: Purple Route Connections

Route	Transfer Center Connections				
	Broad Street	Main Street Station	Willow Lawn	Southside Plaza	Southside - Downtown
7	X				
56		X			

Route 7

Service should remain the same on Route 7, with an extension west to connect at the Broad Street Transfer Center along the following route:

- West on Broad – north on 2nd – east on Marshall – south on 3rd – east on Broad



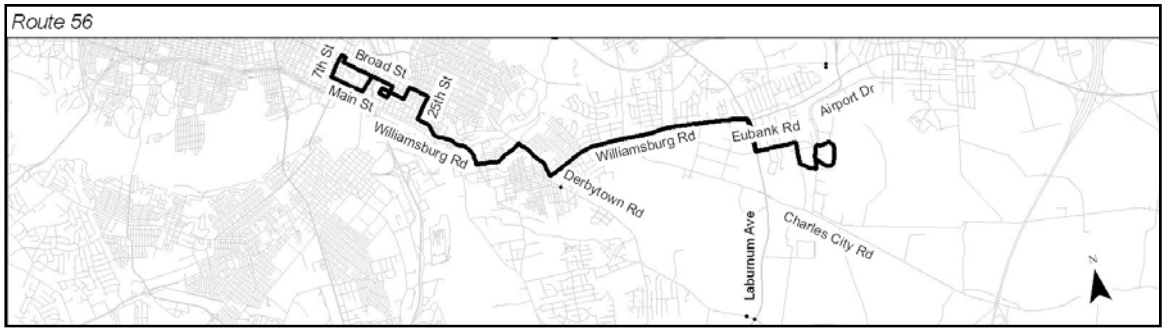
Route 56

A detour from the existing routing of Route 56 would allow it to connect to the Main Street Station Transfer Center along the following routing:

- South on 21st – west on Grace – south on Ambler – east on Franklin north on 18th west on Broad

Several potential options exist for the western end loop of the route including:

- Continue as in existing routing;
- An extension to the west could allow for an additional connection to the Broad Street Transfer Center; or
- Terminate the route at Main Street Station.



Orange Routes (Conceptual Only)

The two Orange Routes serve the western portion of Henrico County. Both routes have easy connections at Willow Lawn which allow passengers to transfer to reach other parts of Richmond. Table 122 highlights each route and which of the Transfer Centers they would serve under the proposed routings.

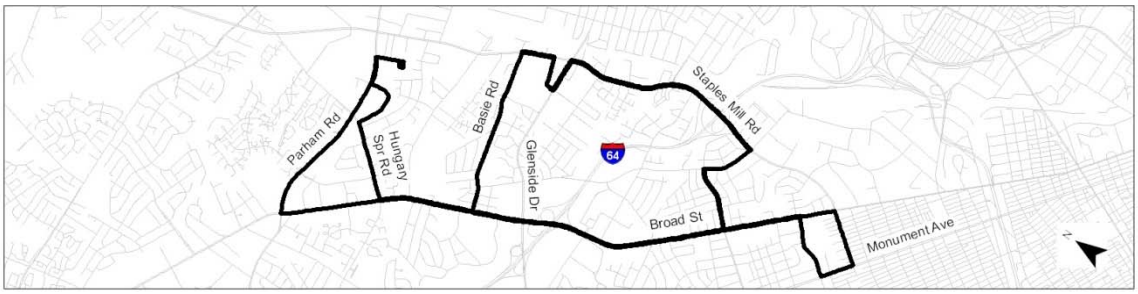
Table 122: Orange Route Connections

Route	Transfer Center Connections					Increase in Round Trip Length (mi)
	Broad Street	Main Street Station	Willow Lawn	Southside Plaza	Southside - Downtown	
18			X			
19	X		X			

Route 18

No changes proposed. Route 18 would connect to the Willow Lawn Transfer Center on its current routing.

Route 18



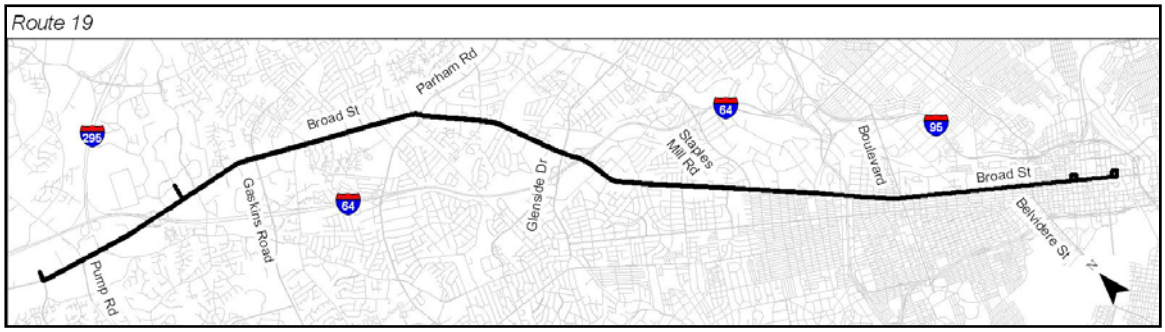
Route 19

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad

The westbound routing should remain as recommended in Phase I.

Route 19



Black Routes (Conceptual Only)

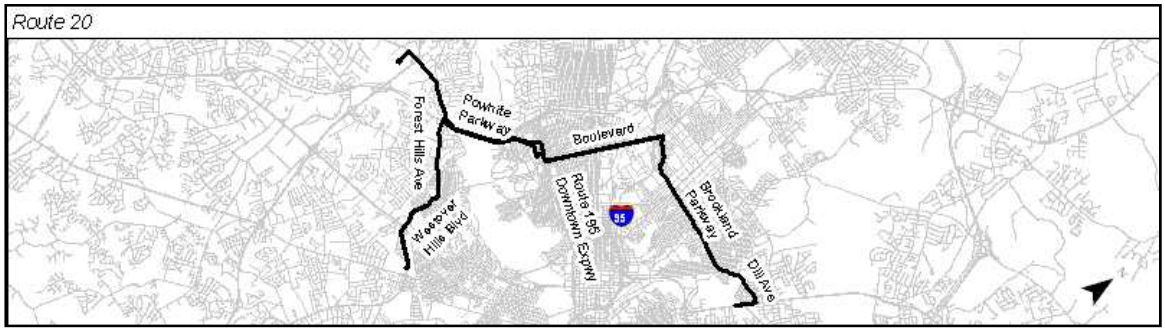
The group of Black Routes generally serves the northern portion of the City of Richmond, and also includes the two new cross-town routes. The cross-town routes do not provide much service downtown, and have few connections at the downtown transfer centers, while most of the other routes connect quite easily to the Broad Street Transfer Center. Table 123 highlights each route and which of the Transfer Centers they would serve under the proposed routings.

Table 123: Black Route Connections

Route	Transfer Center Connections					Increase in Round Trip Length (mi)
	Broad Street	Main Street Station	Willow Lawn	Southside Plaza	Southside - Downtown	
20				X		
21		X		X	X	
22	X					
24	X					
32	X					
34	X					
37		X				
93						

Route 20

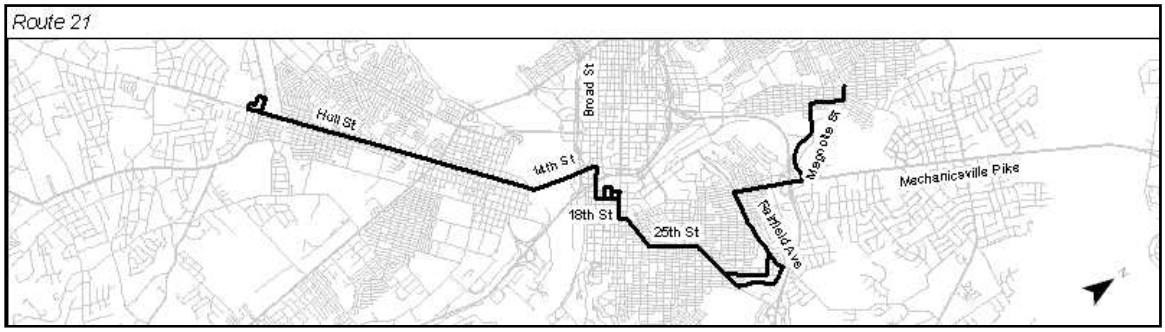
Route 20 is a cross-town route and does not connect to either of the downtown Transfer Centers. Without any re-routing it does connect to the Southside Transfer Center at Southside Plaza.



Route 21

Route 21 is also a cross-town route; however its current routing already brings it very close to the Main Street Station area. Only a small re-routing would be necessary to allow for easy transfers, as follows:

- Southbound: West on Broad – south on 17th – east on Franklin – south on 18th west on Main
- Northbound: North on 18th – west on Grace – south on Ambler – east on Franklin – north on 18th – east on Broad

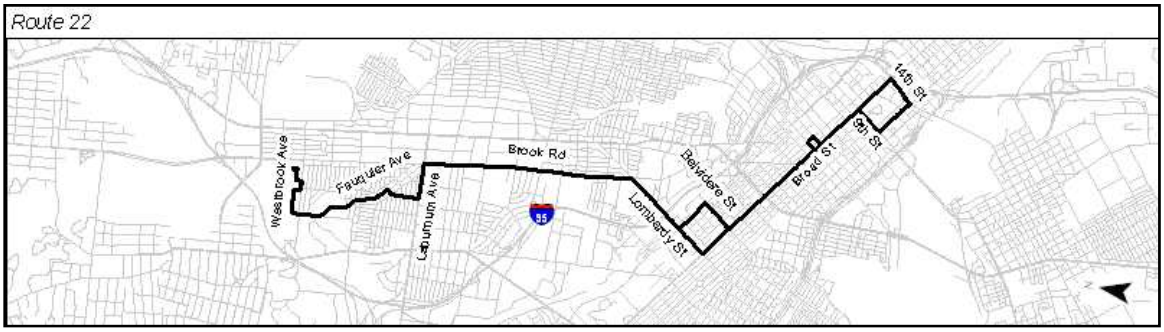


Route 22

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad

The westbound routing should remain as recommended in Phase I.

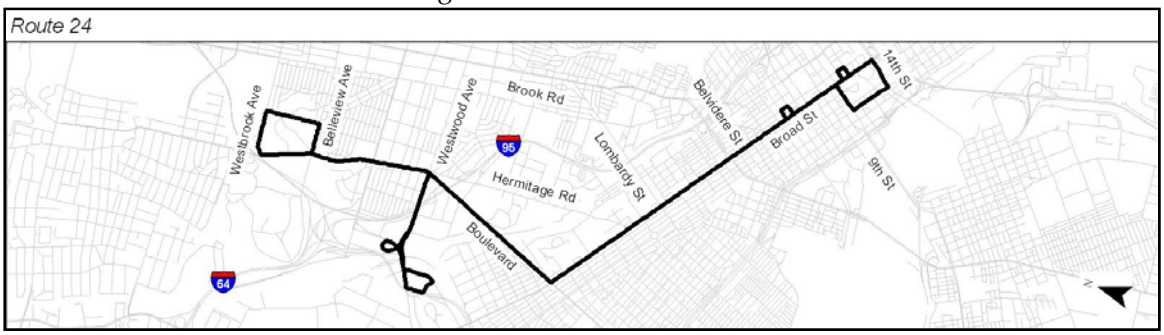


Route 24

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad

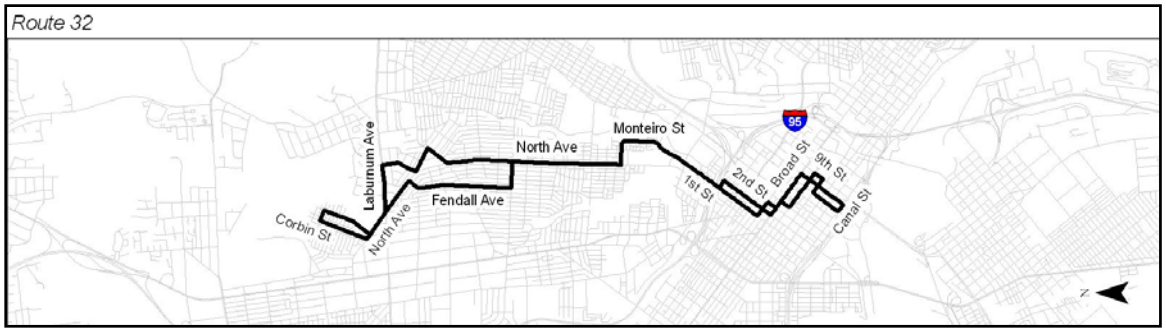
The westbound routing should remain as recommended in Phase I.



Route 32

Only a small deviation from the existing route would be necessary to provide easy connections to the Broad Street Transfer Center. The northbound routing would remain as is, and the southbound routing would change as follows:

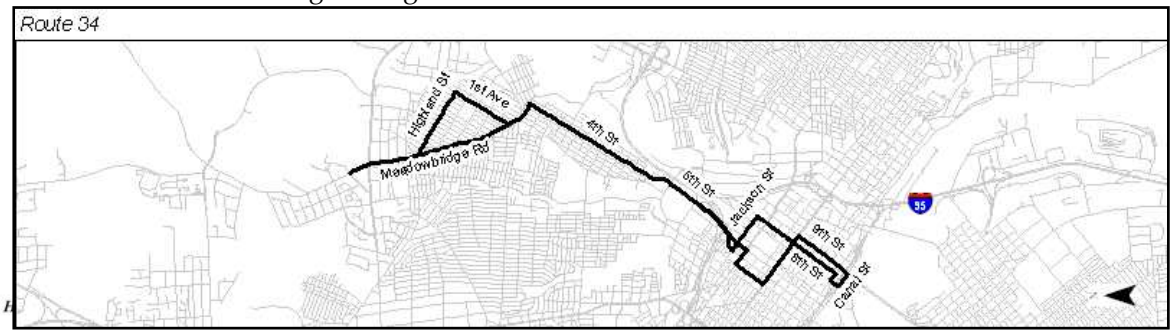
- South on 1st – east on Marshall – south on 3rd – east on Broad



Route 34

In order to connect Route 34 to the Broad Street Transfer Center, the routing through downtown must be changed. One potential re-routing is as follows:

- North on 9th – west on Broad – north on 2nd – east on Leigh – north on 4th along existing routing

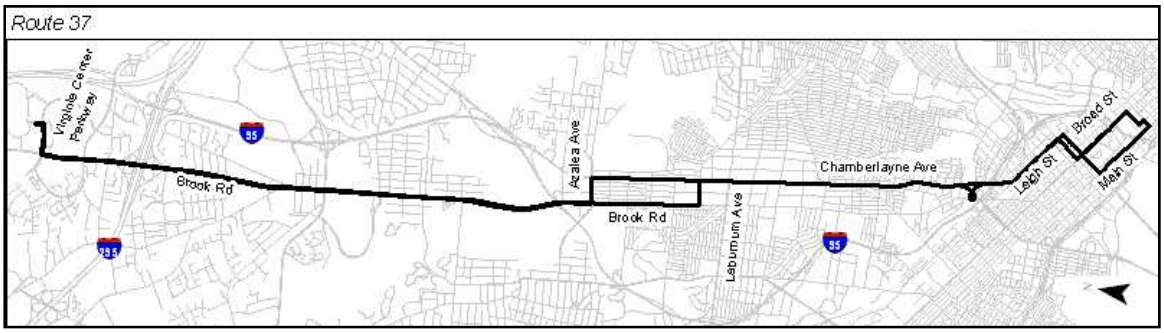


Route 37

A westward extension of Route 37 would allow a connection to the Main Street Station Transfer Center, as follows:

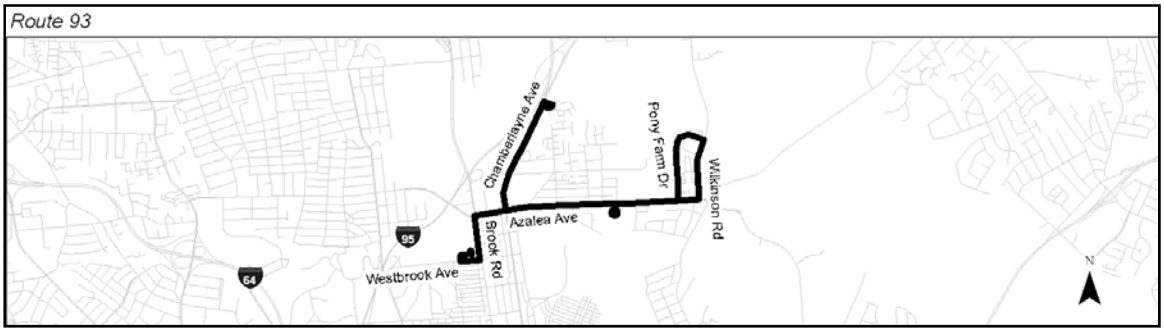
- East on Broad – south on 17th – east on Franklin – south on 18th – west on Main

It would also be possible to connect the route to the Broad Street Transfer Center further east if desired.



Route 93

No changes proposed.



Green Routes (Conceptual Only)

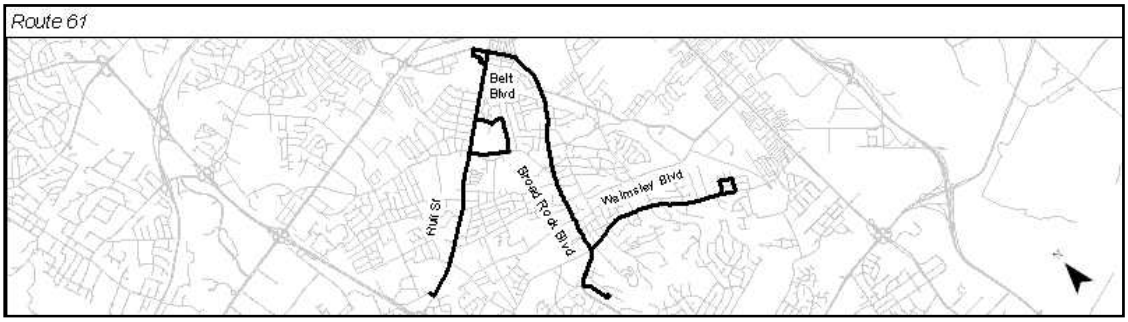
The group of Green Routes generally serves the South Side of the City of Richmond, and provides service across the James River into downtown. Most of these routes provide two transfer opportunities: one at one of the Southside Transfer Centers and a second at one of the downtown transfer centers. Table 124 highlights each route, which of the Transfer Centers they serve and the increase in round trip length required by the proposed routings.

Table 124: Green Route Connections

Route	Transfer Center Connections				
	Broad Street	Main Street Station	Willow Lawn	Southside Plaza	Southside - Downtown
61				X	
62		X		X	X
63		X			X
67		X		X	X
70	X				
71	X				
72	X				X
73	X				X
74	X				X

Route 61

No changes would be necessary to Route 61 as it already connects to the Southside Transfer Center and does not travel to downtown.



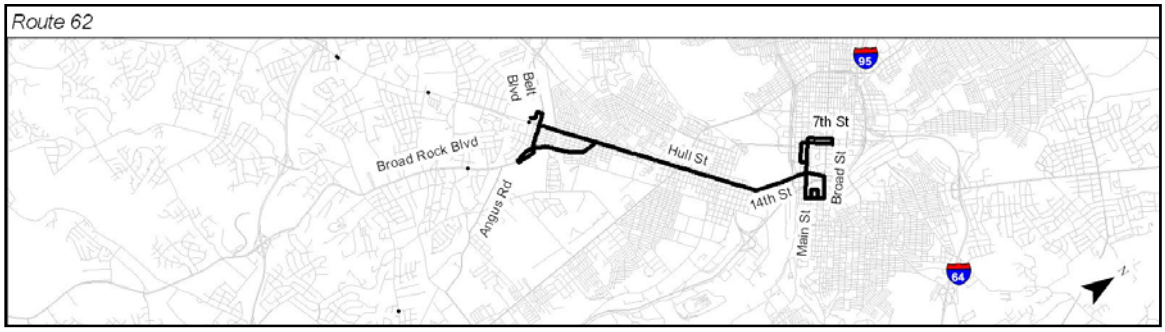
Route 62

The current routing includes a connection to the South Side Plaza Transfer Center. An extension to the east would allow another connection at the Main Street Station Transfer Center, as follows;

- North on 14th – east on Main – north on 18th – west on Grace – south on Ambler – east on Franklin – north on 18th – west on Broad – south on 14th – west on Main

There are several options for the western end of the downtown portion of this route, including:

- Remain the same (as shown in the map below);
- Continue in a loop along Broad Street to connect with the Broad Street Transfer Center; or
- Terminate at the Main Street Station Transfer Center.



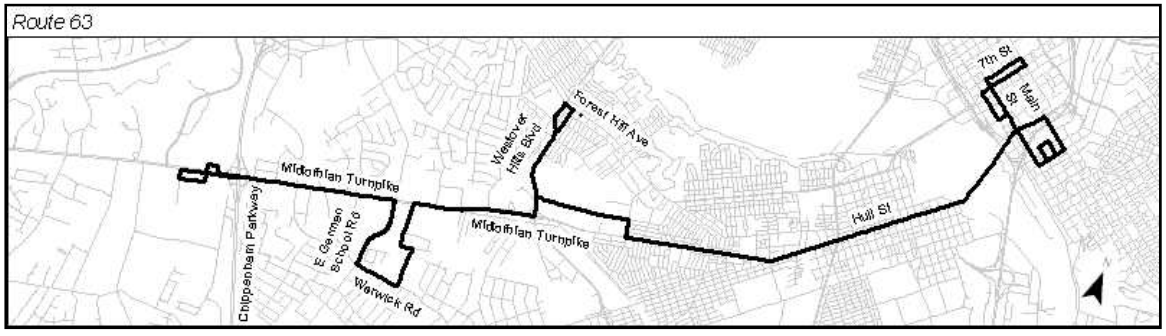
Route 63

An extension to the east would allow Route 63 to connect at the Main Street Station Transfer Center, as follows;

- North on 14th – east on Main – north on 18th – west on Grace – south on Ambler – east on Franklin – north on 18th – west on Broad – south on 14th – west on Main

There are several options for the western end of the downtown portion of this route, including:

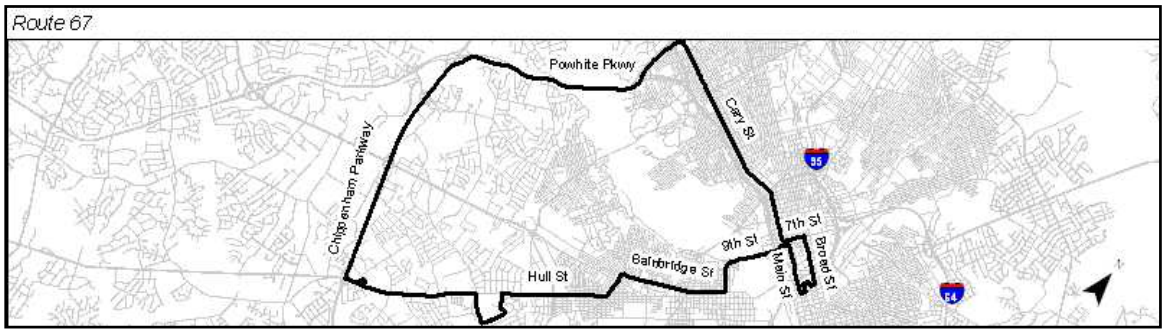
- Remain the same (as shown in the map below);
- Continue in a loop along Broad Street to connect with the Broad Street Transfer Center; or
- Terminate at the Main Street Station Transfer Center.



Route 67

An extension of the downtown loop to the east would allow for an easy connection at the Main Street Station Transfer Center. The routing would add some additional distance to the length of the route, as follows:

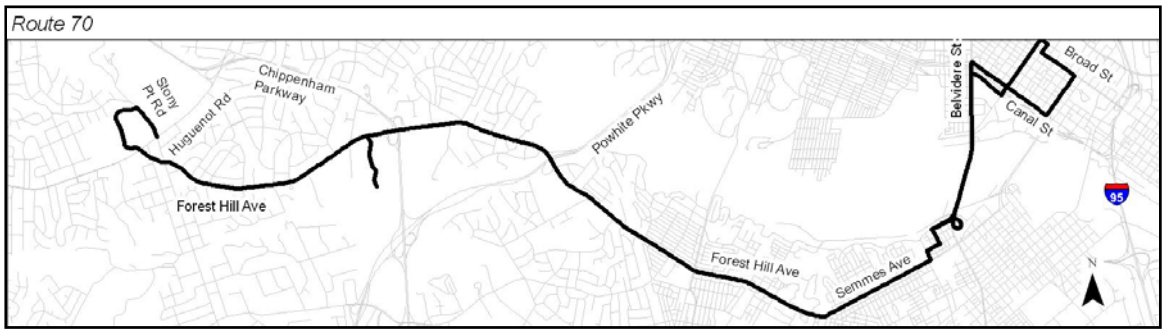
- East on Broad – south on 17th – west on Grace – south on Ambler – east on Franklin south on 18th – west on Main



Route 70

A small re-route through downtown will allow a direct connection to the Broad Street Transfer Center, as follows:

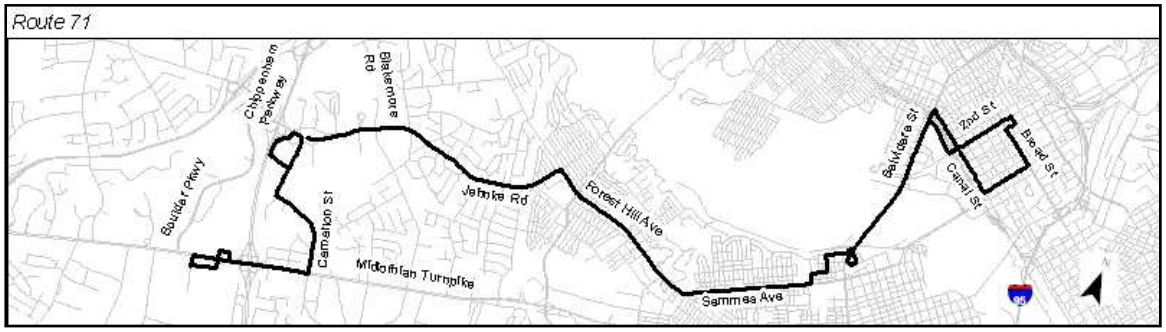
- North on 2nd – east on Marshall – south on 3rd – east on Broad



Route 71

A small re-route through downtown will allow a direct connection to the Broad Street Transfer Center, as follows:

- North on 2nd – east on Marshall – south on 3rd – east on Broad



Routes 72/73

A short extension in downtown will allow both of these routes to connect directly to the Broad Street Transfer Center, as follows:

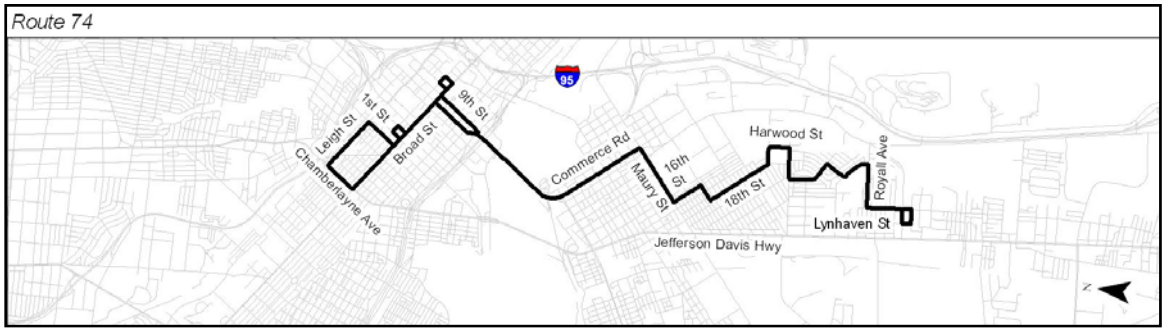
- West on Grace – north on 2nd – east on Marshall – south on 3rd – east on Franklin

Route 74

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad

The westbound routing should remain as recommended in Phase I.



Express Routes

Each of the express routes can easily be re-routed so that they terminate at one of the two downtown Transfer Centers. This will provide several benefits to both passengers and GRTC:

- Provides layover space for buses awaiting a return trip or a new route
- Allows easy transfers to all local GRTC bus routes
- Less dead-head as buses switching from an express route to a local route can do so at the Transfer Center

In order to determine the best potential downtown routing and the end point for each express route, transfer patterns and ridership patterns should be examined and current passengers should be surveyed. This type of analysis would help to determine if a route should end at the Broad Street Transfer Center or the Main Street Station Transfer Center.

Option B: One Downtown Transfer Center

It may be possible to implement a system with only a single downtown Transfer Center. By allowing GRTC to focus on the construction and operation of only one site, such a system could have several benefits. Fewer resources would need to be devoted to land acquisition and facility construction reducing both the additional capital and operating expenditures used while providing high quality amenities to riders. In addition, it removes the need for shuttle bus service between the Transfer Centers that was identified in Option A. While it is slightly to the west of the core of downtown, the Broad Street Transfer Center at 2nd and 3rd Streets could be developed as the sole transfer center for the downtown area. This would require that most of the routes that travel to and through a portion of downtown and may help spur development in the western portion of the downtown area. Additionally, all of the routes that serve Broad Street would be able to connect at this location. Under the recommendations in this section, 25 local routes would connect at the Broad Street Transfer Center, allowing passengers to make most of their transfers at a single, safe location.

Broad Street Service

Under the Option B recommendations in this plan, the frequency of bus service in the downtown core portion of Broad Street will still increase over the Phase I recommendations. More regular service buses will be routed along and near Broad Street at 2nd/3rd in order to access the downtown transfer center (offset by the fact that the Broad Street shuttle route would no longer be necessary.) Some alternative downtown routings that substitute another east-west route (i.e. Marshall or Grace) were used, and more may be possible for some routes to help ease the effects on Broad Street traffic. Table 125 below shows that the frequency of eastbound bus service in the afternoon peak would increase to 50 buses per hour, the equivalent of one bus every 72 seconds. In the westbound direction, service in the afternoon peak

would increase to 38 buses per hour, the equivalent of one bus every 95 seconds. In total, that is 88 buses along Broad Street in 1 hour.

Table 125: Proposed Phase IIB Broad Street Frequency, buses per hour

Eastbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	14.00	44.73	15.13	10.40	21.07
Midday	12.62	40.53	14.90	10.17	19.55
PM Peak	15.80	50.03	16.73	12.00	23.64
Saturday	11.30	35.89	11.52	6.79	16.37
Sunday	9.05	28.73	9.73	5.00	13.13
Average	12.55	39.98	13.60	8.87	

Westbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	13.60	32.93	17.93	10.40	18.72
Midday	12.31	29.71	16.74	10.01	17.19
PM Peak	16.30	37.53	20.23	12.50	21.64
Saturday	11.47	25.89	13.23	6.79	14.34
Sunday	9.05	21.38	10.98	5.25	11.67
Average	12.55	29.49	15.82	8.99	

Effects on Transfers

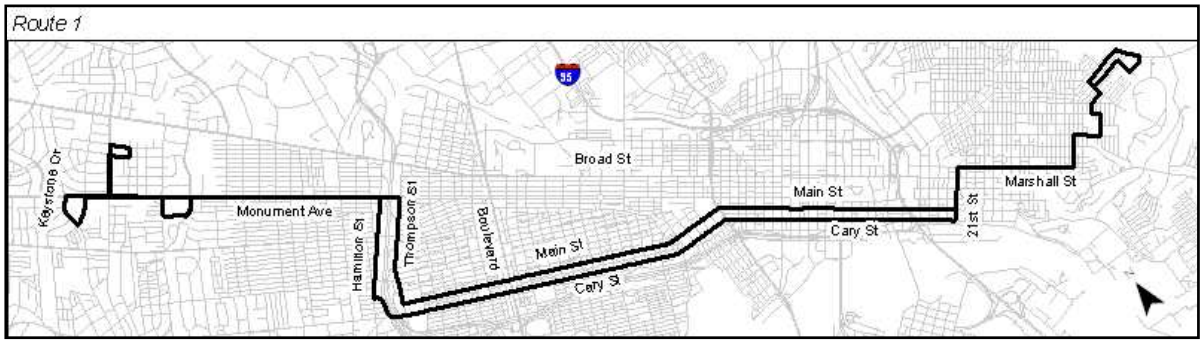
Based on a one-day sample of current transfer patterns documented by GRTC, approximately 8,400 transfers occur throughout the system on an average weekday. The routing changes recommended in this section will change how some of the bus routes connect, by bringing them together at specified transfer locations, specifically by ensuring that more than 75% of the local bus routes connect at the Broad Street Transfer Center. Under the recommendations in this section, 84% of the existing transfers could be made at one of the four proposed Transfer Centers. An additional 15% of the existing transfers would still be possible, but the connections would have to be made on the street. This results in 7,035 transfers combined at the transfer centers and another 1,267 transfers occurring at locations on the street. Again, the route restructuring recommended primarily in Phase I will significantly alter the transfer patterns in some areas, eliminating the need for some and potentially creating the need for others. The 99 transfers that will no longer be possible result primarily from the elimination of certain express routes (for whom alternative services will still be provided) and a few connections that could be made by walking a few short blocks.

Local Routes (Conceptual Only)

Most of the recommendations in Option A that re-routed buses to the Broad Street Transfer Center would remain valid under this option. Only a select number of routes (those that had previously been routed to the Main Street Station Transfer Center) will require additional re-routing under Option B. Those required changes are shown below. All routes not mentioned in this section will remain the same as recommended for Option A.

Route 1

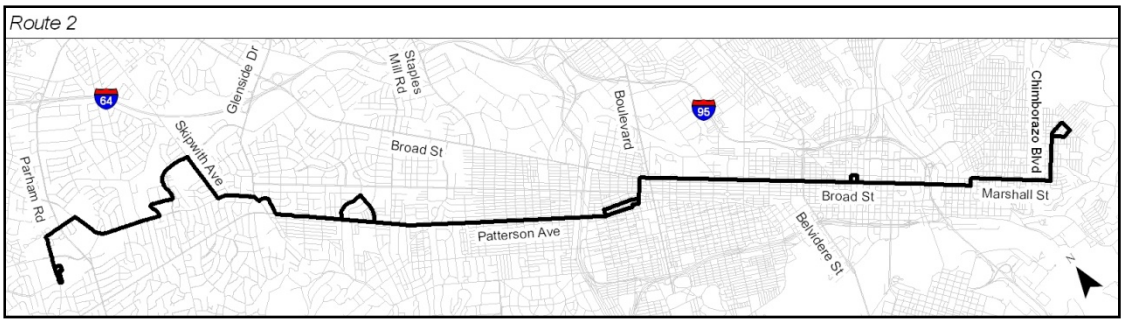
With the re-routing of Route 1 to Main/Cary from Broad Street, there is no convenient way to connect the route with the Broad Street Transfer Center. This route should remain as recommended for Phase I, and will connect only to the Willow Lawn Transfer Center. Many on the street transfers in the downtown area will still be possible.



Route 2

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

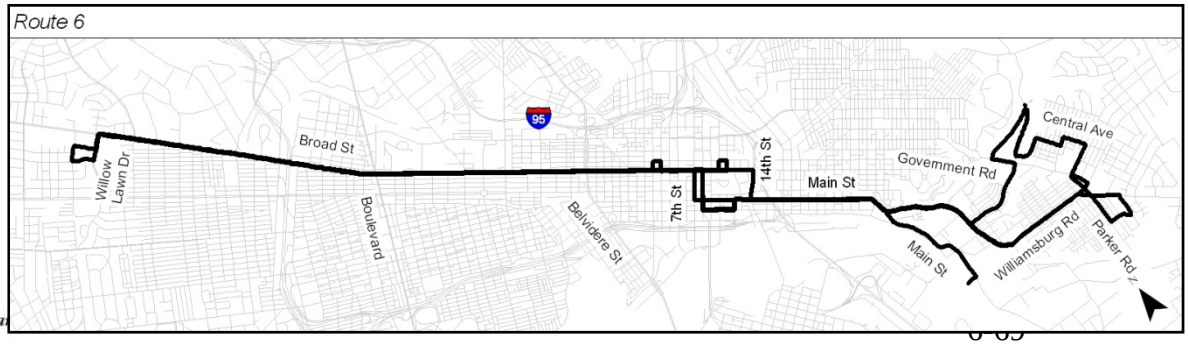
- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad



Route 6

A slight deviation around the Broad Street Transfer Station will be necessary to provide eastbound passengers with an easy transfer that does not require them to cross Broad Street. This addition is as follows:

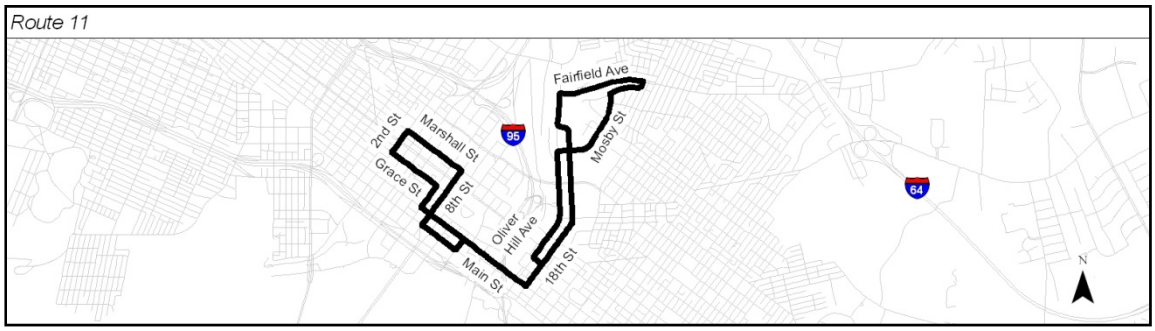
- East on Broad – north on 2nd – east on Marshall – south on 3rd – continue east on Broad



Route 11

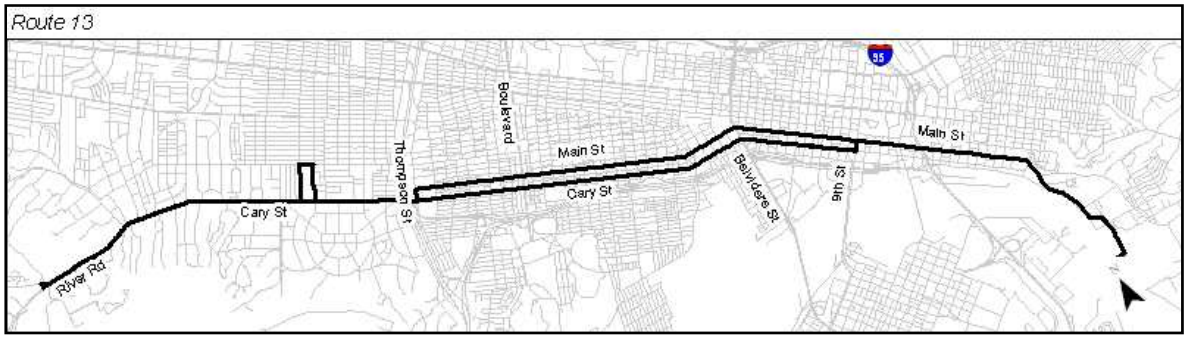
A small extension of the westernmost loop would be necessary to connect this route to the Broad Street Transfer Center. This routing would be as follows:

- West on Main – north on 7th – west on Grace – north on 2nd – east on Marshall– south on 8th to existing route



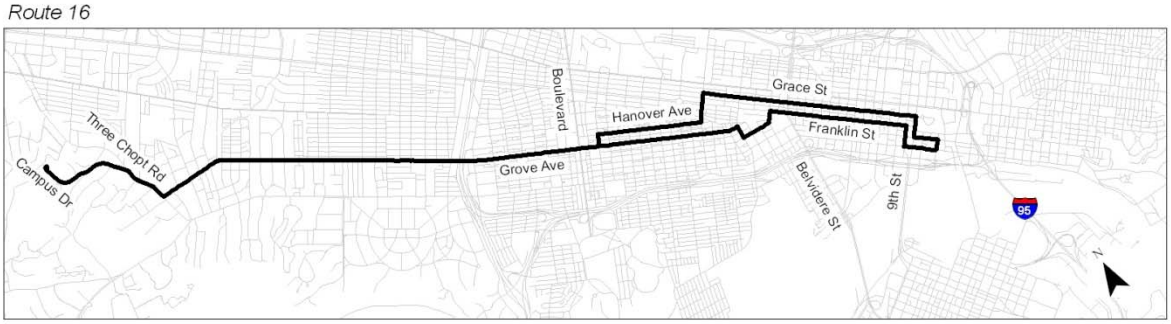
Route 13

There is no convenient way to connect Route 13 to the Broad Street Transfer Center without interrupting the service along Main and Cary St. Therefore, this route should remain the same as recommended in Phase I and will not connect directly to any of the main transfer centers.



Route 16

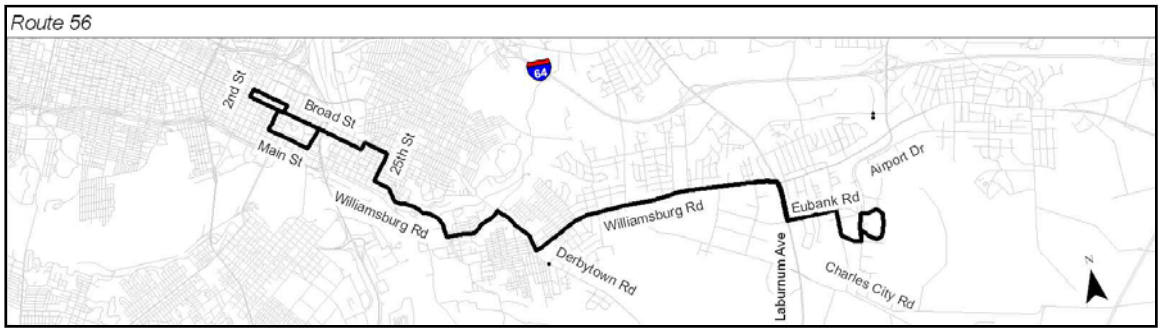
There is no convenient way to connect Route 16 to the Broad Street Transfer Center without slowing service. Therefore, this route should remain the same as recommended in Phase I, and will travel very close to the Broad Street Transfer Center, requiring a short one- or two-block walk for most transfers.



Route 56

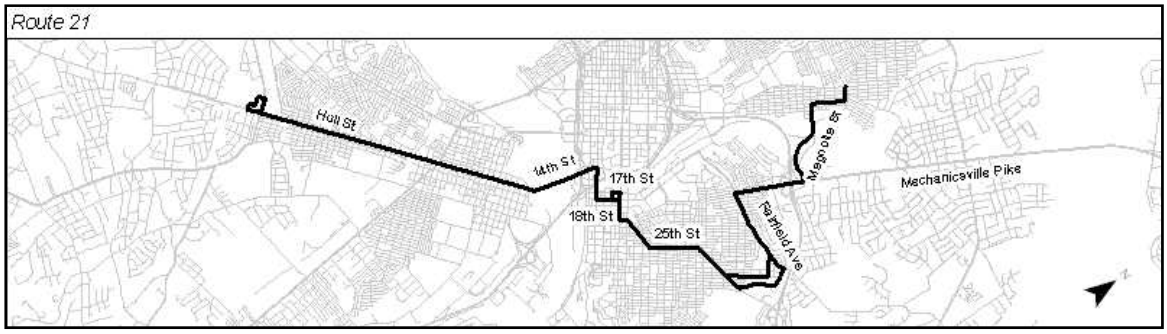
A short extension will be necessary to connect this route to the Broad Street Transfer Center along the following route:

- West on Broad – north on 2nd – east on Marshall – south on 8th to existing Phase I routing



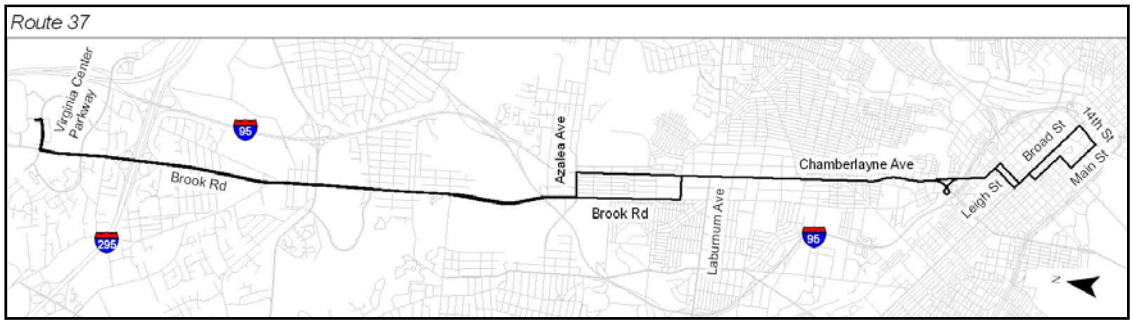
Route 21

As a cross-town route, Route 21 should not be re-routed to connect at the Broad Street Transfer Center. By following the routing recommended for Phase I, it will connect to the Southside Plaza Transfer Center while still providing intermodal connections very close to the Main Street Station.



Route 37

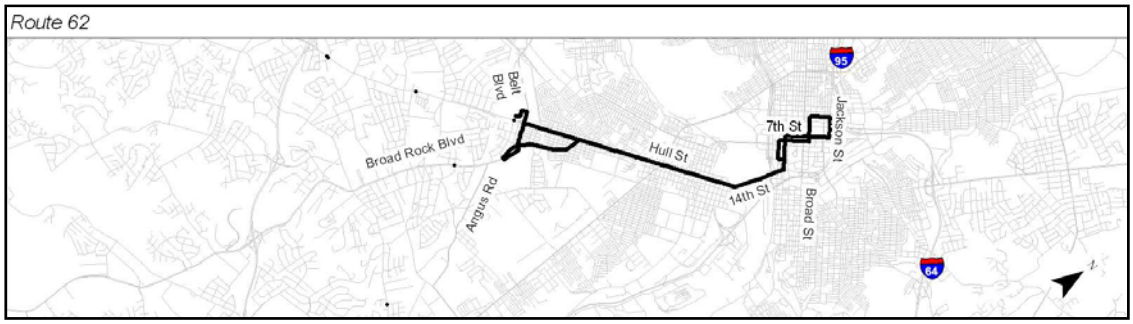
In order to provide a connection to the Broad Street Transfer Center, the southern portion of the route should be re-routed along the existing routing currently used by GRTC. The hourly extension to Virginia Center Commons should remain.



Route 62

A small extension to the west would allow for an easy connection to the Broad Street Transfer Center. This deviation could use the following routing:

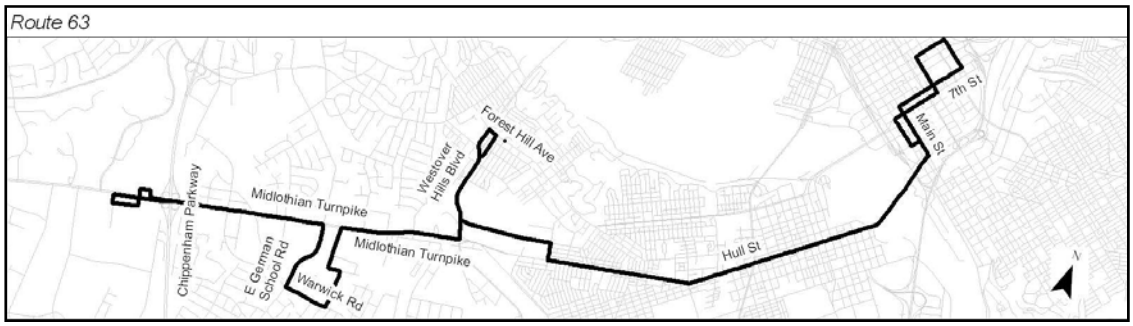
- North on 7th – west on Jackson – south on 3rd – east on Broad – south on 8th along recommended phase I routing.



Route 63

A small extension to the west would allow for an easy connection to the Broad Street Transfer Center. This deviation could use the following routing:

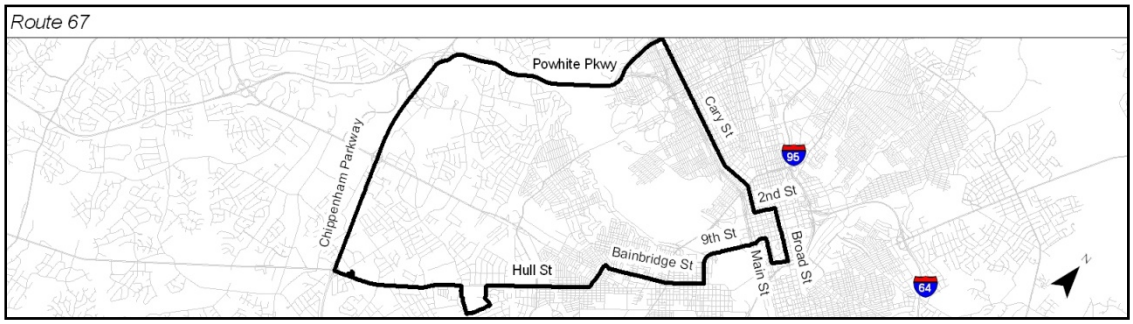
- North on 7th – west on Jackson – south on 3rd – east on Broad – south on 8th along recommended phase I routing.



Route 67

A slight modification of the recommended Phase I routing will allow Route 67 to connect to the Broad Street Transfer Center as follows:

- East on Cary – north on 2nd – east on Broad along recommended Phase I routing



Express Routes

Based on the transfer patterns and the ultimate destinations of passengers on each of the express routes, the final downtown routing should be determined. A connection at the Broad Street Transfer Center for each route would be possible, in addition to serving some other destinations downtown. However, before this policy is implemented, a careful study of the capacity of the transfer center will be necessary to ensure that the center is not overloaded during the peak hours when high numbers of local and express buses would be arriving there.

Phase III: Bus Rapid Transit

The VHB project team, in collaboration with GRTC staff, has developed a conceptual plan for a Bus Rapid Transit (BRT) line to augment service in the corridor with the highest transit ridership in Richmond. BRT typically seeks to provide some of the benefits of a traditional rail-based rapid transit system with a high quality bus service. A wide range of elements can be incorporated into BRT projects and the most appropriate combination for each situation must be determined. Several of the common elements of BRT that would be appropriate for use in Richmond include: bus branding, specialized vehicles, limited stop service, real-time next bus arrival information, high frequency service and possibly some form of bus prioritization (signal priority or dedicated bus lanes).

The Broad Street corridor in the City of Richmond is the City's major east/west route and shows the highest demand for transit service. This corridor currently has by far the highest transit ridership in the service area, although that ridership is spread over a number of different routes. Based on the most recent schedule[13], this corridor already has high quality service with 19 routes providing service along some length of Broad Street between 20th Street and Robinson Street. As was shown in Table 117, during the peak periods frequencies can be as high as bus every 75 seconds (or 48 buses each hour) in one direction. While service on Broad Street itself is very frequent, service to specific destinations served by these routes once they leave Broad Street is of significantly lower quality and often requires long waits for passengers to board the appropriate bus. In addition, congestion on Broad Street (which may be partially caused by the large number of transit vehicles serving the corridor) slows transit service, making bus trips even longer. By consolidating service along Broad Street into one main trunk route that provides fast, reliable and frequent service, other GRTC resources can be reallocated to better serve Richmond's neighborhoods and other important destinations.

The existing Route 6 (shown in Figure 121) has the highest ridership of any route in the GRTC system (over 3,600 daily boardings) and serves Willow Lawn, Broad Street, the downtown core and the East End via Main Street. (The loop in the East End is run less frequently and has significantly lower ridership than the rest of the route.) By using this route as a baseline, the VHB project team developed a proposal for a BRT

[13] GRTC Local Bus Schedule, Winter 2006

route that provides the highest quality service to the corridor with the highest transit demand. The addition of this high-quality service allows for the reallocation of some vehicle resources to other routes and can actually decrease the total number of buses on Broad St while decreasing the time spent by passengers waiting for the bus, and improving traffic conditions for all travelers.

Figure 121: Existing Route 6

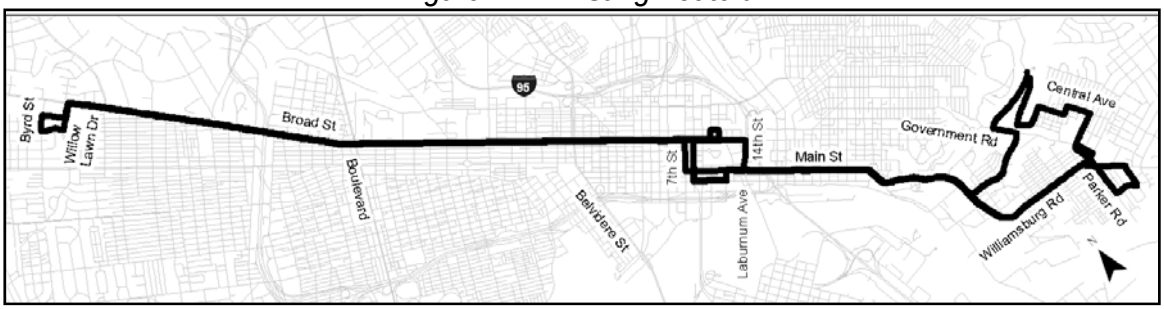
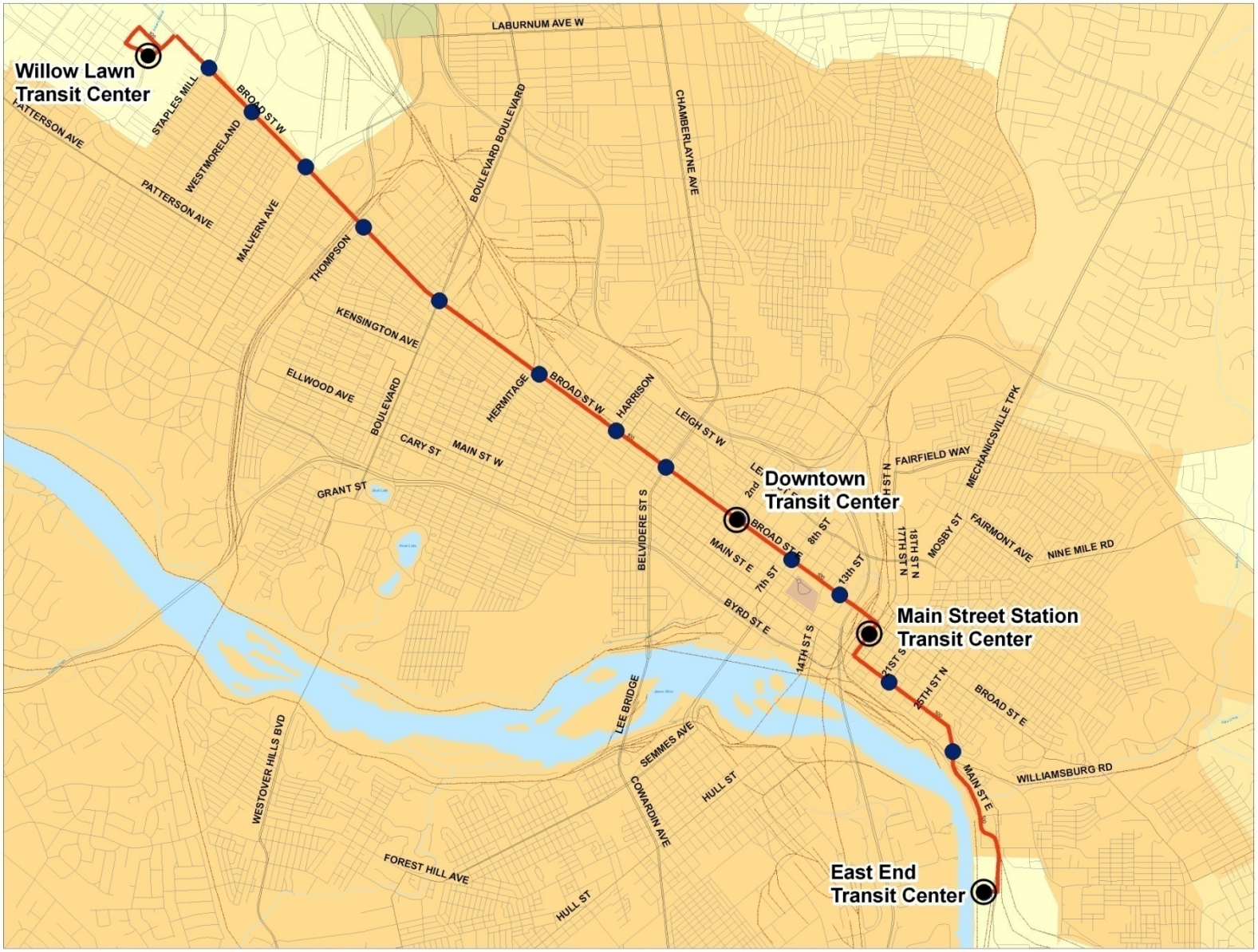


Figure 122 shows the routing proposed for the BRT line along Broad St, 17th St and Main St between Willow Lawn and Rocketts Landing. Running a bus every ten minutes will provide frequent service along the corridor that reliably arrives at easy-to-remember intervals and wouldn't require passengers to use or memorize a schedule. While the proposed routing does duplicate some of the service provided by other local routes, especially Route 6 and 13, these routes should not be eliminated. Local service that stops every quarter-mile is still necessary in the corridor, however it will be possible to decrease the frequency of some of the duplicative services and ultimately decrease the number of buses traveling on Broad Street. Other routes that currently operate some portion of their route on Broad Street may need to be revised to connect with one of the proposed BRT stops or Transfer Centers. This type of revision might remove portions of routes currently running on Broad Street in order to provide higher frequencies in other areas.

Figure 122: Proposed Broad Street Bus Rapid Transit Line



To increase the average speed of the route, stops on a BRT line should be less frequent than on a traditional bus line. For the proposed corridor, stops would be spaced between one-third and one-half mile apart, however when appropriate to serve major generators, longer or shorter distances may be necessary. There are 15 proposed stops along this 7.3 mile route, with an average spacing of 0.5 miles. The proposed routing serves three of the major transfer centers that are proposed for GRTC: the Willow Lawn Transfer Center at the Shoppes at Willow Lawn, the Broad Street Transfer Center at Broad St & 2nd St and the Main Street Station Transfer Center proposed for Grace St & 17th St. In addition, service would be provided to Rocketts Landing which could also potentially house a small transit center. Table 126 lists the proposed stops, their distance from each other, current ridership and potential transfer opportunities.

Table 126: Proposed BRT stops

	Distance to next stop (miles)	Current daily ridership		Transfer Opportunities
		Ons	Offs	
Willow Lawn Transit Center	--	531	363	1,18, 19
Broad & Staples Mill	0.46	102	148	19
Broad & Westmoreland	0.34	18	43	19
Broad & Malvern Ave	0.43	95	77	19
Broad & Thompson	0.46	45	36	19
Broad & Boulevard	0.59	256	169	2, 19, 20, 24
Broad & Hermitage	0.70	101	104	2, 19, 24
Broad & Harrison	0.54	400	306	2, 10W, 19, 22, 24
Broad & Belvidere	0.35	249	215	2, 10W, 19, 22, 24, 74
Broad & 2nd (Downtown Transit Center)	0.49	1,234	1,055	2, 3, 4, 8, 10W, 10E, 7, 19, 22, 24, 32, 34, 70, 71, 72, 73, 74
Broad & 7th/8th	0.37	272	466	2, 3, 4, 8, 10W, 10E, 11, 7, 56, 19, 22, 24, 32, 34, 37, 62, 63, 67, 70, 71, 74
Broad & 13th	0.34	216	313	2, 3, 4, 10, 10E, 7, 56, 22, 24, 37, 67
17th & Grace (Main Street Station Transit Center)	0.34	NA	NA	1, 11, 13, 16, 56, 37, 62, 63, 67
Main & 25th	0.40	17	20	13
Main & Williamsburg	0.56	5	5	13
Rocketts Landing (Transit Center)	0.96	NA	NA	13

If necessary, the BRT line can be implemented in stages, with the initial route running between Willow Lawn and the Main Street Station Transfer Center. Transit demand in the Rocketts Landing area will grow as the area continues to develop, and the BRT can be extended south via Main Street once sufficient development has occurred. Further into the future, an extension out to the Short Pump area in Henrico County would be possible by extending the route west of the Willow Lawn Transfer Center along Broad Street. This type of extension would serve shopping destinations along Broad Street in addition to providing an additional, higher-speed transit option

for Henrico County residents who commute into Richmond and for Richmond residents who work in the Innsbruck area.

The addition of the BRT line will affect all of the routes that serve any portion of Broad Street. How these routes will be modified has not been recommended as part of this plan; a separate study would be necessary. However, it is important to understand how BRT might affect the congestion and the level-of-service on Broad Street. The average frequency of service in the corridor was calculated for two extreme scenarios:

1. All local routes continue running as recommended in Phase IIA
2. All local routes (except a local Route 6 overlay) terminate at Broad Street where passengers will transfer to the BRT line.

The first scenario represents the best potential level-of-service to customers (although travel time may be affected by heavy traffic volumes) while the second represents a true trunk and feeder system with more frequent passenger transfers. Neither of these scenarios is ideal, and the ultimate solution will undoubtedly fall somewhere between the two. The Tables below indicate the average service frequency on Broad Street under each of these two scenarios.

Scenario One Broad Street Frequency

Eastbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	14.00	44.73	19.13	14.40	23.07
Midday	12.62	40.86	19.23	14.50	21.80
PM Peak	15.80	50.03	20.73	16.00	25.64
Saturday	11.30	37.60	17.23	12.50	19.66
Sunday	9.05	29.73	16.73	12.00	16.88
Average	12.55	40.59	18.61	13.88	

Westbound	20th St	8th St	Belvidere	Robinson	Average
AM Peak	13.60	36.93	21.93	14.40	21.72
Midday	12.31	34.04	21.08	14.35	20.44
PM Peak	16.30	41.53	24.23	16.50	24.64
Saturday	11.47	31.60	18.94	12.50	18.63
Sunday	9.05	28.38	17.98	12.25	16.92
Average	12.55	34.50	20.83	14.00	

Scenario Two Broad Street Frequency

	Headway (min)	Frequency (buses/hour)
AM Peak	7.50	8
Midday	7.50	8
PM Peak	7.50	8
Saturday	9.55	6
Sunday	12.00	5
Average	8.81	7

A result midway between these two extremes would result in a frequency of approximately 4.5 minutes, or 13 buses an hour during the peak period.

7

Implementation Plans

Phase I Implementation Plan

Each proposed routing change for Phase I has been assigned an implementation year (1, 2 or 3). If the change must be implemented simultaneously with a proposed change on one or more other routes, the route has also been assigned to a group (A-D) within that implementation year. If the change can be implemented independently of all other proposed changes, no group has been identified. Generally, routes within particular geographic areas have been assigned to the same year. Minor routing and schedule changes have been assigned to Year 1, as shown below.

Table 127: Phase I Implementation Plan

Sorted by Route Number				Sorted by Year and Group		
Route	Year	Group		Route	Year	Group
1	1	A		1	1	A
2	1	A		2	1	A
3	2	B		6	1	A
4	2	B		13	1	A
6	1	A		16	1	A
7	1	D		22	1	B
8	2	B		24	1	B
10	2	B		26	1	C
11	2	B		29	1	C
13	1	A		7	1	D
16	1	A		56	1	D
19	3	B		27	1	
20	2	A		28	1	
21	2	A		64	1	
22	1	B		65	1	
24	1	B		67	1	
26	1	C		70	1	
27	1			71	1	

Sorted by Route Number				Sorted by Year and Group		
Route	Year	Group		Route	Year	Group
28	1			96	1	
29	1	C		20	2	A
34	2			21	2	A
37	3	B		3	2	B
56	1	D		4	2	B
61	3	A		8	2	B
62	3	A		10	2	B
63	3	A		11	2	B
64	1			34	2	
65	1			61	3	A
67	1			62	3	A
70	1			63	3	A
71	1			19	3	B
96	1			37	3	B

- The routes serving the Main-Cary-Broad corridors to the west of downtown have been placed in year 1 since some of the changes would remove buses from Broad Street (which is a priority for GRTC). These routes (Routes 1, 2, 6, 13, 16) have been grouped since many of the changes proposed for these routes complement one another. Implementing these changes is not complicated by proposed changes to the east side of these routes. Only a minor change was proposed for Route 1 and no changes were proposed for Route 2 on the east side of downtown. The only change to Route 6 on the east side is the extension to Rockets Landing which could be implemented as Rockets Landing is developed.

- All other changes that involved minor scheduling modifications were assigned to year 1 since they require little planning and no added resources.
- The implementation of the proposed changes to Route 20 and Route 21 complement one another and were therefore grouped. The changes to Route 20 would be extensive and the Route 21 is a new route. Therefore, the implementation of these changes was assigned to year 2 since they may require some additional lead time.
- The change proposed to Route 34 was also assigned to year 2. The implementation of the proposed change does not rely on any other proposed changes. Therefore, it was assigned to year 2 simply to provide more evenly distributed phasing.
- Proposed changes to Route 19 and Route 37 both entail extensions of service further into Henrico County. To provide enough lead time to secure local support (i.e., financial and otherwise), these changes were assigned to year 3.
- Among the remaining changes, there were no clear priorities, therefore, routes were grouped and assigned to an implementation year in a manner that would allow for an evenly distributed phasing. The routes serving the area of

Richmond north of the river and south of the Downtown Expressway, as well as their counterpart routes on the east side, were assigned to year 2. The three routes serving the southern portion of the city were assigned to year 3.

Phase II Implementation Plan

Implementing a new development such as the proposed transit transfer centers requires GRTC to follow a detailed process that complies with local development codes, while meeting the requirements of federal and state agencies. If federal funding received under Section 5309 (Capital Grants and Loans) is used, the Federal Transit Administration (FTA) will require GRTC to comply with regulatory requirements prior to approving the project's funding. During initial planning the focus will be on the FTA's alternatives analysis and environmental documentation phase. GRTC will need to conduct a physical due diligence of the land prior to acquisition to protect the agency from unforeseen hazards. The City of Richmond will require GRTC's new facilities to comply with their comprehensive plan, and zoning codes. GRTC will prepare site designs and plans which will be reviewed by city staff prior to construction. A concise outline of implementation is described below.

1. **Initial Planning Phase** – in this phase GRTC will work closely with their funding agencies (FTA for federal, DRPT for state), with the City of Richmond, and with a technical consultant team of engineers, architects and planners who will supplement GRTC's in-house expertise.

   The major effort in this phase will be identification of an appropriate site or sites for the Centers. Even after sites are identified, reaching agreement on acquisition can be a lengthy process and GRTC or the City may need to find ways to hold sites (thorough formal options or other means) until full evaluation, due-diligence, and related pre-acquisition tasks can be completed. In this regard, sites that are already in public ownership or otherwise controlled by a public body, will be preferred. For sites not in public hands, negotiation with owners will be required to develop mutually beneficial agreements and to protect sites while negotiations are in progress.

   Tasks will start with the more general, and move to the specific as GRTC evaluates several sites and alternative conceptual layouts. Activities will include gathering information about the site, preparing surveys or existing conditions, completing an alternatives analysis study, preparing environmental documents, evaluating the costs of acquiring the land and building the facility, and conducting a physical due diligence of the site.

   a. Data and Mapping – GRTC will prepare an existing conditions base plan for each alternative site. This base plan will show current site features such as:

- Field location of property line monuments and other evidence of ownership;

- Deeds of record and tax list ownership for the property and it's direct abutters;

- Field locations of existing buildings, structures, and similar elements within and adjacent to the project limits;

- Field locations and elevations of existing surface utility structures such as storm and sanitary sewer manholes, drop inlets, water valves, and related;

- Spot elevations at critical locations and site topography suitable for producing one-foot contours intervals.

In addition mapping will provide initial information on environmental issues that will be useful in the following steps. This step will require two to three months of data collection and mapping to complete.

b. Programming and Concept Plans – GRTC will use the base plans prepared in the first step to create conceptual programs and site layouts for each of the alternatives. Programs refer to the space planning that occurs prior to a site being designed. For example, a new transit transfer center may require enough interior space for seating 30 customers, room for customers to move through the structure, restrooms or similar amenities. Defining these space requirements will be the first step to preparing a conceptual layout. These conceptual layouts can be adapted to fit the configuration of the alternative sites. If one site is constrained the layout may reduce the program needs to fit the facility onto the parcel. This step can take several months to complete.

   - Programming will define the needs of the facility and will include size, amenities, utilities, and interior space uses;

   - Conceptual layouts will occur when the site program is defined. Using the alternative sites being evaluated engineers and architects will create concept sketches to determine the best means of fitting the space needs into the site boundaries;

   - Feasibility – the conceptual layouts are tested to determine their functionality. For example, a layout will be tested to determine if GRTC buses can easily enter and exit the site. Can passengers alight and board buses safely and efficiently? How will the layout affect local traffic flows, impact adjacent properties and GRTC customers? and

- LEED – this acronym stands for Leadership in Energy and Environmental Design which is part of the Green Building Rating System™. LEED encourages the use of sustainable green building designs by their creation of a rating system for specific "green" design practices. GRTC may wish to use LEED design criteria for their facility. The LEED criteria must be indentified early on at this stage of planning.

c. Alternatives Analysis and NEPA – the FTA has a clearly identified process that requires projects to comply with the National Environmental Policy Act (NEPA) including an analysis of alternatives leading to the selection of the proposed action. The alternatives analysis will require GRTC to compare and contrast several sites and configurations of facilities on those sites. Sites can be compared and screened using selected criteria. NEPA [per 49CFR611.37 (b)] will require the completion of an environmental document before any federal actions can be taken (such as deciding to fund a transit transfer center). NEPA documents can take several forms:
   - ***Environmental Impact Statement*** (EIS) – this is the most intensive type of NEPA document and is reserved for projects of great complexity, impact or of public concern;

   - ***Environmental Assessment*** (EA) – this is the second tier and most common type of NEPA document. In some cases transit providers have started with an EA document only to discover additional complexities or find the public is concerned and vocal about the project. In those cases the EA is advanced to the more detailed EIS document; or

   - ***Categorical Exclusion*** (CE) – this is the least complex type of NEPA document and is used on projects with minor impacts to the natural or built environment and raise minimal public concerns.

   The alternatives analysis and NEPA documentation can take from a minimum of six months up to several years depending on the size, cost and potential impacts of the project.

d. Real Estate and Due Diligence – this step can occur alongside the previous planning and NEPA activities. Once GRTC begins to narrow its range of options it can begin due diligence on the top candidate parcels. Due diligence is a process that requires a potential buyer to research the history of a land parcel, through deeds and tax maps research, and to conduct an Environmental Site Assessment (ESA). The purpose is to protect the buyer (GRTC) from unforeseen hazards such as buried hazardous materials or environmental issues such as asbestos used within an existing building. It also serves to identify any constraints that may be placed on the buyer's full use of the property, such as legal rights-of-way or easements for utilities, access by adjacent owners or even limits on the nature of development. These will require an American Land Title Association (ALTA) survey, the

ESA, and any additional analysis that is warranted by the initial findings. The due diligence can be completed quickly on smaller parcels with a "clean" history, or may take several months if initial research indicates a need to conduct more extensive testing, including sub-surface borings to evaluate soil conditions, or air and water testing for ambient hazards on the parcel. If the due diligence is satisfactory then GRTC may move to acquire the site.

e. Site Acquisition – GRTC, with the assistance of real estate professionals, can acquire the property for the selected project site. A private real estate transaction is relatively simple: a process of negotiation results in an agreement to sell a parcel for a set price within a set period of time. GRTC must complete several other tasks prior to the sale. For example, the Uniform Relocation Act (and the Assistance and Real Property Acquisition Act of 1970) guides all property transactions that involve federal funds, and requires a lengthy review of the property value and potential effects. Displacing residents or active businesses must be documented as part of the NEPA document. These additional steps will add time and complexity to the transaction and may deter some land owners from selling their property to GRTC. The amount of time required for this transaction should not be underestimated.

f. Cost and Funding – this step will assist GRTC in evaluating the financial feasibility of their preferred site or sites. As the feasibility studies of the alternative sites and concepts are being prepared in the earlier steps, GRTC's technical team will create initial estimates of project costs. These are planning level estimates and are not used for construction estimates (which come in the following project development phase). GRTC will compare these capital costs to their internal expectations or capital plans, and to FTA funding expectations. FTA funding programs have specific limits or thresholds that may require adjustments to the concept plans at this stage. If significant changes are made they must be reflected in the NEPA document.

2. **Project Development Phase –** by this phase of the project GRTC has completed their initial planning, and has identified their preferred alternative, which may be one or more sites. In the project development phase they will begin to prepare the design documents for the facilities, complete a process called "value engineering", and prepare for the project construction phase.

   a. Confirm the Site Master Plan – in the earlier phase a preferred site conceptual layout was created. After months of completing NEPA documents and other initial planning tasks this conceptual layout may have been altered by GRTC, the City, or their technical design team. Before GRTC commits to the expense of preparing the considerable design documents it is important to revisit those earlier layouts and confirm the space program and site configurations. In this way all parties to the project have a final

opportunity to evaluate their earlier designs and, if they so choose, to make minor amendments. At the end of this task GRTC must "freeze" the site master plan and lock out further adjustments (unless they are critical to the projects feasibility or success). The technical team will prepare a written memorandum of agreement that creates a commitment to proceed with design of the current site master plan.

b. Operations Plan – After selection of a preferred site (or sites), GRTC must initiate changes to many aspects of daily operations. The recommended routing changes presented in the previous section will need to be refined and communicated to the public. In addition, some changes to staffing, interlining operations, vehicle assignments, schedules and block assignments will be necessary to accommodate the new route structure.

c. 30% Site Design – GRTC will direct their design team of engineers and architects to prepare site plans to a thirty percent level of completion. Plans will be prepared for the physical site (civil engineering) and for the buildings and structures (architectural design). Specific tasks will build from the survey and conceptual documents prepared in the earlier phase. Tasks may include:

- Prepare site civil design documents for grading, stormwater management and site utilities;
- Prepare site access plans (roadways and walkways);
- Prepare landscape plans, which may include lighting, walkways and other hard surfaces;
- Prepare architectural drawings of floor plans and conceptual elevations (exterior views) of buildings; and
- Prepare quantity estimates and cost estimates.

Design documents at this stage will go through several reviews by the client (GRTC) and may be discussed with appropriate City staff to confirm the intent of the design. After several reviews and changes the design documents can be progressed to a higher level of completeness. This initial design stage can take three to eight months to complete.

d. Value Engineering (VE) – Value Engineering evaluates the function of systems, equipment, facilities for the purpose of achieving the required function at the lowest total cost. VE is required by the FTA and should occur prior to completion of the final design documents. Generally an outside VE team is brought into a project to look at all aspects of the design and future operations. Considerations are given to effective ownership consistent with requirements for performance, reliability, quality, maintainability and safety.

The VE process takes several weeks to implement, and can have important impacts on final design solutions.

e. Construction Documents – GRTC will build upon the recommendations of the VE team to complete their design documents for the project. Design documents will progress to 100% completion similarly to those identified in the 30% step. Final design documents can be used to advertise for construction bids in order to select a vendor or contractor who will construct the final project. From VE to complete final design can take six to 10 months of effort. Final reviews by the City of Richmond may extend that time if significant changes are required before approval is granted.

3. **Project Construction Phase** – the final phase of any large capital project is to select a suitable vendor to construct the facility from the design documents. There are several discrete tasks within this phase.

   a. Advertise for bids – once a design is finalized and the City has approved their plans GRTC can advertise for bids. In this way they are able to select from numerous teams of private firms who will compete to build the facility at the lowest cost to GRTC. Some vendors may act as a general contractor (or overall project manager) with several subcontractors who provide specific construction services. For example, a large firm may bid for the project and bring in smaller specialty firms that will provide concrete, lay carpets, or paint the interior walls. A contract is signed with the lowest cost and responsive bidder. GRTC has extensive, recent experience with this bidding process.

   b. Construction – during this step the project is constructed by the selected contractor and his team of subcontractors. GRTC may wish to hire a specialty firm to provide construction administration or oversight during this phase. This firm will act as GRTC's agent to monitor the contractor and ensure compliance with the design documents.

   c. Additional steps – GRTC may wish to separate other procurements from the overall construction bid documents. For example, in order to save money they may seek an independent bid to provide and install office equipment or communication systems. It is important that this separate contract be closely meshed with the construction of the facility so that furniture does not get delivered and installed before the interior is painted or carpeting installed.

   d. Testing and Acceptance – after construction has advanced to a certain point GRTC can begin to test systems within the main facility. For example, prior to moving in they may test the electrical, mechanical, HVAC and plumbing systems, and test signage, pavement and landscaping. GRTC's technical team will test all sub-systems and the building and grounds prior to formal acceptance and approval of the contractor's final payment.

e. Move In – once the site is completed and formally tested and accepted GRTC will move in and begin operations. The FTA may require additional studies (before and after plans) depending on the program that funded the facility. Finally GRTC and their technical team should complete a formal review of the process and prepare a "lessons learned" document to facilitate future capital developments.

Many of the tasks described in this section can occur simultaneously and are not cumulative. An initial step in implementing the project would be to incorporate these milestones into a project schedule (using software tools such as *Microsoft Project*).

Phase III Implementation Plan

Implementation of the BRT plan will require significantly more effort than the phase I recommendations, especially as GRTC attempts to acquire FTA funding for the project. The following steps will provide the structure necessary to complete this process.

- Step 1 – Alternatives Analysis
  - Conceptual engineering and design study to define costs and provide initial environmental scan (March 2008)
  - Long range plan effort for RRPDC will provide analysis of benefits (e.g. ridership) and potential relief for I-64 congestion. This leads to selection of the project as the Locally Preferred Alternative (LPA) and incorporation in the region's Long Range Plan (April or May 2008)
  - Current GRTC COA provides information on "strategy to address transportation problem" (e.g. Bus volume on Broad Street) (Completion January 2008)
- Step 2 – Meetings
  - Meet with FTA Region 3 (late February or March 2008). Inquire about Letter of No Prejudice to continue planning while awaiting Project Development Funding.
  - Meet with Congressional Delegation (April 2008); Seek earmark for FY 2009 [note: 49CFR611.37 (d)(3) "A PCGA (Project Construction Grant Agreement) shall not be executed for a project that is not authorized for construction by Federal law."]
- Step 3 – Project Planning

    - Do NEPA scoping process (if not eligible for categorical exclusion) (June 2008 – September 2008)
    - Develop Before and After study plan (Fall 08)
    - Develop preliminary project financial plan (April – August 2008)
- Step 4 – Submit request for founding to FTA (September 2008)
- Step 5 – Receive Project Development Funding (December 2008)
- Step 6– Project Development Studies (phase 1) (January – May 2009)
- Step 7 – Project Development Studies (phase 2) – after FONSI or ROD (May – December 09)
    - Operations Planning (January – August 2009)
    - Engineering Design (to 90%) (January to August 2009)
    - Prepare specifications and bid documents (September –October 2009)
    - Preliminary bus procurement (develop specs/identify possible vendors) (October – December 2009)
- Step 8 – Submit request to FTA for Project Construction Grant Agreement (PCGA) (August 09)
- Step 9 – Sign PCGA (February 2010)
- Step 10– Solicit/select contractors for project construction (January - March 2010)
- Step 11 – Vehicle procurement (March – May 2010)
- Step 12 – Collect "Before" data (March 2010)
- Step 13 – Project construction (May 2010 – May 2011)
- Step 14 – Receive vehicles (March 2011)
- Step 15 – Initiate service (May 2011)
- Step 16 – Collect "After' Data (November 2011)
- Step 17 – Project close-out and Before and After report (June 2012)

Conclusion

It can be a challenging task to build stakeholder consensus within the funding constraints imposed on transit systems. GRTC has managed to find success in this difficult situation and continuously increase its ridership by refining and improving service within its budget. The operation of any transit system requires balancing the needs of riders, the taxpaying public, the transit operator, local governments, and funding sources. Undertaking a COA is an important step in evaluating all aspects of the system to ensure that GRTC is operating the most efficient system possible that is capable of meeting the transportation needs of as many regional residents as possible.

The observations presented in this COA identify aspects of the bus network that require consideration of service changes when planning future service and several options for improving service in the City of Richmond. The phased service improvements and the implementation plans provide direction to help guide the evolution of GRTC's service to include a robust network of bus service, centralized transfer centers and a high-capacity, high-quality Bus Rapid Transit line. This vision of improved service, based on substantial large-scale data collection and analysis efforts should be pursued by GRTC and the City of Richmond. However, sustaining GRTC's success in the future will require constant reevaluation of the services offered compared to the ridership demand and customer desires.

Appendix A

Raw Data Provided by Peers

	GRTC Richmond, VA	Albany, NY	Indianapolis, IN	Tampa, FL	Memphis, TN	Madison, WI
Square Miles	227	1,760	373	254	288	60
Population	449,572	794,293	791,926	578,252	888,627	234,294
Passenger Fares (Revenue)	8,854,657	5,335,780	7,220,799	8,453,598	7,309,454	7,348,403
Total Modal Expenses	27,885,019	44,580,781	32,530,269	42,349,724	37,503,722	32,974,246
Directional Route Miles	445.0	1,895.0	737.4	893.9	1,862.0	405.9
Vehicles Operated in Maximum Service	145	198	120	151	149	167
Time Service Begins Weekday	4:45	4:30 AM	4:09 AM	4:10	4:23	5:03
Time Service Begins Saturday	4:58	5:00 AM	5:46 AM	6:20	4:28	6:05
Time Service Begins Sunday	4:45	5:45 AM	6:32 AM	6:15	6:45	7:02
Time Service Ends Weekday	1:17	2:40 AM	12:37 AM	23:10	0:42	1:49
Time Service Ends Saturday	1:07	4:10 AM	12:41 AM	22:24	22:30	3:06
Time Service Ends Sunday	1:17	1:15 AM	10:06 PM	20:44	19:48	1:49
# of Vehicles in Operation AM Peak	135	172	114	151	145	162
# of Vehicles in Operation Mid-Day	68	93	78	113	74	59
# of Vehicles in Operation PM Peak	145	172	120	151	147	167
Total Actual Vehicle Revenue Miles	4,480,961	6,252,371	5,832,929	6,716,394	7,003,649	4,675,350
Total Actual Vehicle Revenue Hours	402,243	553,673	414,416	542,002	482,104	364,491
Unlinked Passenger Trips	12,415,055	11,392,802	8,486,044	11,041,918	10,882,883	11,475,597

	Hartford, CT	Austin, TX	Tucson, AZ	Charlotte, NC	Lansing, MI	Dayton, OH
Square Miles	664	572	226.65	445	136	247
Population	851,535	727,000	535,732	681,310	380,073	559,062
Passenger Fares	10,683,491	4,123,458	7,644,164	10,031,021	3,081,883	6,836,561
Total Modal Expenses	39,024,831	79,919,356	28,959,152	58,088,228	21,689,010	43,884,972
Directional Route Miles	968.8	885.9	582	1611.1	371	948.7
Vehicles Operated in Maximum Service	186	228	155	247	85	161
Time Service Begins Weekday	04:00	0:00	5:00 AM	4:49	5:35	4:15

	GRTC Richmond, VA	Albany, NY	Indianapolis, IN	Tampa, FL	Memphis, TN	Madison, WI
Time Service Begins Saturday	04:00	04:38	5:50 AM	5:30	8:00	4:20
Time Service Begins Sunday	04:00	05:06	6:30 AM	5:30	9:00	4:54
Time Service Ends Weekday	01:34	24:00	9:00 PM	2:38	2:00	1:33
Time Service Ends Saturday	01:05	04:05	7:30 PM	2:45	15:00	1:32
Time Service Ends Sunday	01:05	23:34	7:15 PM	2:30	19:20	1:36
# of Vehicles in Operation AM Peak	181	221	152	238	76	156
# of Vehicles in Operation Mid-Day	89	186	119	124	85	78
# of Vehicles in Operation PM Peak	186	228	155	247	76	151
Total Actual Vehicle Revenue Miles	6,233,247	10,146,870	6,913,227	10,609,862	3,010,708	7,284,132
Total Actual Vehicle Revenue Hours	470,864	824,130	541,532	740,223	223,072	514,565
Unlinked Passenger Trips	12,508,700	22,994,816	16,236,219	16,778,677	8,932,953	11,779,951

Formulas for Calculations

System Size	**Hours per Square Mile**	Revenue Hours	/	Area
	Miles per Square Mile	Revenue Miles	/	Area
	Peak Vehicles per Square Mile	Peak Vehicles	/	Area
	Population of Service Area	NTD		
	Area of Service Area	NTD		
	Density of Service Area	NTD		
Social Effectiveness	**Boardings per Capita**	Passenger Trips	/	Population
	Boardings per Square Mile	Passenger Trips	/	Area
Transportation Efficiency	**Miles per Hour (Speed)**	Revenue Miles	/	Revenue Hours
Vehicle Efficiency	**Peak to Base Ratio**	AM or PM Peak Vehicles	/	Mid-Day Vehicles
	Miles per Peak Vehicle	Revenue Miles	/	Peak Vehicles
	Hours per Peak Vehicle	Revenue Hours	/	Peak Vehicles
	Miles per Direction Route Miles	Revenue Miles	/	Directional Route Miles
Financial Efficiency	**Cost per Revenue Mile**	Operating Expenses	/	Revenue Miles
	Cost per Revenue Hour	Operating Expenses	/	Revenue Hours
	Cost per Peak Vehicle	Operating Expenses	/	Peak Vehicles
Service Effectiveness	**Passengers per Mile**	Passenger Trips	/	Revenue Miles
	Passengers per Revenue Hour	Passenger Trips	/	Revenue Hours
	Passengers per Peak Vehicle	Passenger Trips	/	Peak Vehicles
Service Provided per Capita	**Revenue Miles per Capita**	Revenue Miles	/	Population
	Revenue Hours per Capita	Revenue Hours	/	Population
	Peak Vehicles per 10,000 people	Peak Vehicles	/	Population/10000
Cost Effectiveness	**Cost per Passenger**	Operating Expenses	/	Passenger Trips
	Farebox Recovery	Fares Earned	/	Operating Expenses
	Subsidy per Trip	Expenses - Revenue	/	Passenger Trips
	Subsidy per Capita	Expenses - Revenue	/	Population
	Cost per Capita	Operating Expenses	/	Population
Revenue Generation	**Revenue per Hour**	Passenger Fare Funds	/	Revenue Hours
	Revenue per Mile	Passenger Fare Funds	/	Revenue Miles
	Revenue per Peak Vehicle	Passenger Fare Funds	/	Peak Vehicles
	Revenue per Boarding (Average Fare)	Passenger Fare Funds	/	Passenger Trips
Service Span	**Weekday Service Span**	End Time	-	Start Time
	Saturday Service Span	End Time	-	Start Time
	Sunday Service Span	End Time	-	Start Time

Appendix B

Dear Transit Rider:

This questionnaire of GRTC bus riders will help provide important information needed to support transportation planning in the area. Please take a few minutes to answer all of the following questions. Please return your completed questionnaire to the attendant on the bus. If you cannot complete the questionnaire before you leave, please fold it as indicated and drop it in the mail. Postage is prepaid. All your responses will remain confidential and will be combined with other transit users in the study.

Bus Route # where you received this form: _____

Boarding Date _____ Boarding Time _____

If you've already completed a Transit Onboard questionnaire in the past month on paper or via interview, please check here and continue filling out this questionnaire. ☐

==========

Estimado Usuario del Tránsito:

Este cuestionario de usuarios de autobús de GRTC ayudará a suministrar información importante para la planificación del transporte en el área. Tome unos minutos por favor para contestar todas las preguntas siguientes. Regrese por favor su cuestionario completado al asistente en el autobús. Si usted no puede completar el cuestionario antes de bajar del autobús, por favor lo dobla como indicado, y lo envía en el correo. El franqueo es prepagado. Todas sus respuestas serán confidenciales y serán combinadas con otros usuarios del estudio de tránsito

Numero de Ruta donde usted recibió este formulario _____

Fecha de Abordar _____ *Hora de Abordar* _____

Si usted ya ha completado un cuestionario de tránsito en el mes pasado en papel o vía entrevista, por favor marque aquí y continúe llenando este cuestionario. ☐

1. Where did you come from before boarding a vehicle for this trip? (select only one)
¿Antes de abordar el vehículo para este viaje, de donde vino usted? (escoge una sola)

☐ Work *Trabajo* ☐ College/University *Colegio/Universidad* ☐ School (K-12) *Escuela*

☐ Shopping *Tienda/compras* ☐ Medical *Medico*

☐ Home *Casa* ☐ Other *Otro*_____

1a. Where is this location? Please provide the address or nearest intersection to this location. Please use complete street names such as "W. Broad St." not just "Broad".

Suministre por favor la dirección o el cruce más cercano del lugar de donde usted vino. Por favor suministre el nombre completo de la calle, por ejemplo, "W. Broad St.." en ves de "Broad".

Exact Address, including street number and street name
Dirección exacta, incluyendo el numero de la calle y el nombre de la calle

OR Intersection *O Cruce*

Street 1 *Calle 1*

Street 2 *Calle 2*

City *Ciudad* ZIP Code *Código de ZIP*

If this place was a location other than a single family residence, please provide the NAME of the PLACE or BUILDING: (e.g., Transit Center, City Hall, etc.)

Si este lugar no es una casa de familia, por favor suministre el NOMBRE del LUGAR o el EDIFICIO: (por ejemplo, Centro de Transito, City Hall, etc.)

For Official Use Only *Para uso oficial*

Record Number *Numero de registro*

2. Where did you board this vehicle on the one-way trip you are making? Please provide the address or intersection where the bus stop is located. Please use complete street names, such as "W. Broad St." not just "Broad."

¿Donde abordo usted el primer vehículo de transito en este viaje de una sola dirección que usted hace ahora? Por favor suministre la dirección o el cruce donde la parada de bus o la estación esta localizada. Por favor suministre el nombre completo de la calle, por ejemplo, "S Main St." en ves de "Main."

Exact Address or Place Name, including street number and street name

Dirección exacta o Nombre del Lugar, incluyendo el numero de la calle y el nombre de la calle

OR Intersection *O Cruce*

Street 1 *Calle 1*

Street 2 *Calle 2*

City *Ciudad*

3. How did you get to this vehicle?

¿Cómo llega usted a la parada de bus o la estación en el principio de su viaje?

☐ Walked (#) _____blocks *Camino ____cuadras*
☐ Rode bicycle *Bicicleta*
☐ Transferred from route # _____ (Please answer question 3a) *Transborde de ruta #_____*
☐ Drove by myself and parked *Manejé yo solo y estacioné el vehículo*
☐ Dropped off by someone *Me trajo alguien*
☐ Drove/Rode with someone else and parked *Manejé y estacioné el vehículo*
☐ Other *Otro* _____

3a. Since you transferred from another route to this one, how did you get to that previous route?

¿Si hizo un transborde, cómo llega usted a la parada de bus o la estación de el primer bus de su viaje?

☐ Walked (#) _____blocks *Caminé ____cuadras*
☐ Rode bicycle *Bicicleta*
☐ Transferred from route # _____
☐ Drove by myself and parked *Manejé yo solo y estacioné el vehículo*
☐ Dropped off by someone *Me trajo alguien*
☐ Drove/Rode with someone else and parked *Manejé con alguien y estacioné el vehículo*
☐ Other *Otro* _____

4. Do you qualify for a reduced fare due to:

¿Califica usted para una tarifa reducida debido a su edad o incapacidad?

☐ Age? *¿Edad?* or ☐ Disability? *¿O incapacidad?*

5. Where will you get off this bus on the one-way trip you are making right now? (Please provide the address or intersection where the bus stop is located)

¿Dónde se bajara usted del ultimo bus en este viaje de una sola dirección que usted esta haciendo ahora? (Por favor suministre la dirección o el cruce donde la parada de bus o la estación de bus esta localizada)

Exact Address or Place Name, including street number and street name

Dirección Exacta o el Nombre del Lugar, incluyendo el numero de la calle y el nombre de la calle

OR Intersection *O Cruce*

Street 1 *Calle 1*

Street 2 *Calle 2*

City *Ciudad*

6. What type of location is your final destination on the trip you are making now? (select only one)

¿Que tipo de ubicación es este? (escoja solamente una)

☐ Work *Trabajo* ☐ College/University *Colegio/Universidad* ☐ School (K-12) *Escuela*

☐ Shopping *Tienda/Compras* ☐ Medical *Medico*

☐ Home *Casa* ☐ Other *Otro*_____

6a. Where is this location? Please provide the address or nearest intersection. Please use complete street names such as "W. Broad St." not just "Broad".

¿Dónde esta esa ubicación? (Por favor suministre el nombre completo de la calle, por ejemplo, "W. Broad St." en ves de "Broad".)

Exact Address, including street number and street name

Dirección Exacta o el Nombre del Lugar, incluyendo el numero de la calle y el nombre de la calle

OR Intersection *O Cruce*

Street 1 *Calle 1*

Street 2 *Calle 2*

City *Ciudad* ZIP Code *Código de ZIP*

If this place was a location other than a single family residence, please provide the NAME of the PLACE or BUILDING: (e.g., Transit Center, City Hall, etc.)

Si este lugar no es una casa de familia, por favor suministre el NOMBRE del LUGAR o el EDIFICIO: (por ejemplo, Centro de Transito, City Hall, etc.)

7. How will you travel when you leave this vehicle on your trip to your final destination?

¿Cómo viaja usted de la ultima parada del bus en su viaje hasta su destino final?

☐ Walk (#) _____ blocks *Camino _____ cuadras* ☐ Ride Bicycle *Bicicleta*

☐ Transfer to route # _____ (Please answer question 7a) *Transborde de ruta #_____*

☐ Drive by myself using vehicle parked at location

Manejo yo solo usando un vehículo estacionado

☐ Drive/Ride with someone else using vehicle parked at location

Manejo con alguien usando un vehículo estacionado

☐ Be picked up by someone ☐ Other *Otro* _____

Alguien me recoge

7a. Since you will transfer to another route, how will you get from that route to your final destination?

¿Cómo llega usted a la parada de bus o la estación en el principio de su viaje?

☐ Walked (#) _____blocks *Caminando ____cuadras* ☐ Rode bicycle *Bicicleta*

☐ Transfer to route # _____ *Transborde de ruta #_____*

☐ Drove by myself and parked *Manejando yo solo y estacioné el vehículo*

☐ Dropped off by someone *Me trae alguien*

☐ Drove/Rode with someone else and parked *Manejando con alguien y estacionando el vehículo*

☐ Other *Otro* _____

8. In what jurisdiction do you live?

¿En cual jurisdicción vive usted?

☐ City of Richmond ☐ Henrico County ☐ Chesterfield County ☐ Hanover County

☐ Other (Please Specify) *Otro (Por Favor Suministre)* _____

9. Please list all of the routes for the buses that you are taking on this one-way trip

Por favor suministre todos los números de las rutas que usted ha usado en este viaje de una sola dirección

1st route _____ 2nd route _____ 3rd route _____

4th route _____ 5th route _____ 6th route _____

10. How often do you use the route on which you received this questionnaire? (check only one)

¿Con que frecuencia usa usted la ruta donde recibió este cuestionario? (escoja solamente una)

☐ 7 days per week *7 dias a la semana* ☐ 6 days per week *6 dias a la semana*

☐ 5 days per week *5 dias a la semana* ☐ 4 days per week *4 dias a la semana*

☐ 3 days per week *3 dias a la semana* ☐ 2 days per week *2 dias a la semana*

☐ 1 day per week *1 dia a la semana* ☐ 2 times per month *2 veces al mes*

☐ 1 day per month *1 día al mes* ☐ Occasionally *Raramente*

11. Do you have a valid driver's license? ☐ Yes *Si* ☐ No

¿Tiene usted una licencia de conducir válida?

12. Was a private vehicle available for you to make this trip? ☐ Yes *Si* ☐ No

¿Tenia usted un vehículo privado disponible para hacer este viaje?

13. Are you...? *¿Es Usted...?* ☐ Female *Mujer* ☐ Male *Hombre*

14. What is your age? ¿Cuál es su la edad? _____

15. How many working vehicles (autos, trucks, motorcycles) are available to your household?

¿Cuántos vehículos funcionales (autos, camiones, motocicletas) están disponibles en su casa?

☐ None *Ninguno* ☐ One *Uno* ☐ Two *Dos*

☐ Three *Tres* ☐ Four *Cuatro* ☐ Five or more *Cinco o mas*

16. Of the people in your household, how many work outside the home?

¿Cuántas de las personas que viven en su casa trabajan....?

☐ One *Una* ☐ Two *Dos* ☐ Three *Tres*

☐ Four *Cuatro* ☐ Five *Cinco* ☐ Six or more *Seis o mas*

17. What category best describes the combined total income (before taxes) in 2005 for everyone who lives in your household? *¿Cual categoría describe mejor los ingresos totales combinados (antes impuestos) en 2005 para todos que vive en su casa?*

☐ Under $25,000 Menos de $25,000
☐ $25,000 - $49,999
☐ $50,000 - $74,999
☐ $75,000 and more $75,000 o más

18. Which racial/ethnic group do you consider yourself a member of?

¿De cuál grupo étnico/ racial se considera usted mismo un miembro?

☐ African/American *Africano/Americano*
☐ Asian/Pacific Islander *Asiático/ Isleño Pacífico*
☐ American Indian *Indio Americano*
☐ Hispanic *Hispano*
☐ White *Blanco*
☐ Other *Otro*

19. Do you use GRTC on the weekends? ____Yes ____No

If yes, about how often?

¿Utiliza usted el servicio de GRTC en los fines de semana?_____ Si _____ No

¿Si lo usa, con cual frecuencia lo usa?

☐ Every weekend *Cada fin de semana*
☐ 1 to 2 weekends per month *1 o 2 fines de semana al mes*
☐ A few times per year *Unas cuantas veces al año*

Appendix C

Telephone Survey Conducted by DECISION DC for the VHB/GRTC Transit System Study

Hi, this is _____ calling on behalf of GRTC Transit System. We are conducting a brief survey of residents in the Greater Richmond area to study the need for public transit. The survey takes less than 10 minutes to complete. We'd like to include your household's responses, and I need to speak with someone in the household who is 18 years old or older. Would that be you?

IF NO, ASK:

May I please speak with someone who is 18 or older?

IF NOT AVAILABLE, ARRANGE A CALLBACK TIME.

1. First, in which one of the following areas do you live?

A. City of Richmond
B. Hanover County
C. Henrico County
D. Chesterfield County

USE ARROW KEYS TO SCROLL TO ANSWER, THEN ENTER

2. What is the Postal ZIP Code of your residence?

ANSWER =

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

3A. What are the names of the streets or roads that form the intersection nearest to your home?

STREET #1: _____

TYPE IN ANSWER, HIT ENTER TO TYPE IN STREET #2

3B. What are the names of the streets or roads that form the intersection nearest to your home?

STREET #2: _____

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

4. How many people are there in your household who are…

A. Age 15 or younger
B. Age 16 to 59
C. Age 60 to 64
D. Age 65 to 74
E. Age 75 or older

ANSWER =

TYPE IN ANSWER, HIT ENTER TO GO TO CONTINUE

5. How many people in your household have a driver's license?

ANSWER=

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

6. How many people in your household, including you, have jobs outside the home?

ANSWER=

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

7. Is anyone in the household…
(READ LIST – CHOOSE ALL THAT APPLY)

A. a student at a local area College or University
B. a member of a local College or University teaching faculty
C. a member of a local College or University staff
D. or affiliated with a local College or University in some other way that I haven't mentioned (Specify)
E. NONE OF THE ABOVE (SKIP TO Q.8)

USE SPACE BAR TO SELECT CHOICE

7A. Which University or College are you referring to….
(READ LIST – CHOOSE ALL THAT APPLY)

1. Virginia Commonwealth University Monroe Park Campus
2. Virginia Commonwealth University Medical Center Campus
3. University of Richmond
4. Virginia Union University
5. J. Sergeant Reynolds Community College
6. John Tyler Community College
7. OTHER (Specify)

USE SPACE BAR TO SELECT CHOICES

8. In total, how many motor vehicles, in working condition, are available to members of your household on a daily basis? Please include passenger vehicles of all types: trucks, vans, motorcycles, and so forth.

ANSWER=

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

9. Is there anyone in your household that has a disability that makes it difficult or impossible for them to drive?

1. YES
2. NO
3. REFUSED/NO RESPONSE

10. Is there anyone in your household that has a disability that makes it impossible for them to leave home without assistance?

1. YES
2. NO
3. REFUSED/NO RESPONSE

11. Within the past month, have you provided transportation for someone else, over age 16, (family member or other) because they could not drive?

1. YES
2. NO
3. REFUSED/NO RESPONSE

12. I'm going to read a list of transportation services that are available in the Greater Richmond Area. Please indicate by saying yes or no whether anyone in your household has used any of these services or agencies in the past [three years]. First, what about ….
(READ LIST – CHOOSE ALL THAT APPLY)

A. GRTC Local Bus
B. GRTC Express Bus
C. CARE Van Service
D. C-VAN Transportation Service
E. VCU Student Pass Program
F. RideFinders Commuter Service
G. Lunch Time Express
H. OTHER (Specify)
I. NONE OF THE ABOVE

USE SPACE BAR TO SELECT CHOICES

13. How do you travel to work and/or school, on a typical day?
(READ LIST – CHOOSE ALL THAT APPLY)

A. Driver of a car/vanpool (ASK Q.13A)
B. Passenger in a car/vanpool (ASKQ.13A)
C. Drive Alone
D. Bus
E. Railroad
F. OTHER (Specify)
G. Not employed or attending school (SKIP TO Q.23)

USE SPACE BAR TO SELECT CHOICES

13AA. Including yourself, how many people are typically in your car/vanpool?

ANSWER=

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

14. Is your work and/or school located in….
(READ LIST – CHOOSE ALL THAT APPLY)

A. City of Richmond
B. Hanover County
C. Henrico County
D. Chesterfield County
E. NONE OF THE ABOVE.

USE SPACE BAR TO SELECT CHOICES

15. What time do you start work and/or school?

USE W= TO INDICATE WORK AND S= TO INDICATE SCHOOL
BE SURE TO SPECIFY AM OR PM

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

16. What time do you leave work and/or school?

USE W= TO INDICATE WORK AND S= TO INDICATE SCHOOL
BE SURE TO SPECIFY AM OR PM

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

17. How long does it take you to get to work and/or school on a typical day?

USE W= TO INDICATE WORK AND S= TO INDICATE SCHOOL
BE SURE TO USE MINUTES

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

18. Is your workplace and/or school location served by GRTC public transit services?

1. YES
2. NO (SKIP TO Q.19)
3. NOT SURE/DK (SKIP TO Q.19)

18A. By which Bus Route?

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

19. Do you use GRTC transit services to get to your workplace and/or school location?

1. YES
2. NO (SKIP TO Q.20)
3. REFUSED/NO RESPONSE (SKIP TO Q.20)

19A. How many days per week?

ANSWER= (SKIP TO Q.21)

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

20. Would you consider using the bus for travel to and from work and/or school?

1. YES
2. NO
3. NOT SURE/DK

21. What would be a reasonable one-way fare to and from work and/or school?

USE W= TO INDICATE WORK AND S= TO INDICATE SCHOOL
BE SURE TO USE $.

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

22. What would be a reasonable one-way fare to and from work and/or school if it was an express service?

USE W= TO INDICATE WORK AND S= TO INDICATE SCHOOL
BE SURE TO USE $.

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

23. Would you consider using the bus for trips to other locations?

1. YES
2. NO
3. NOT SURE/DK

24. How far is it from your home to the nearest bus stop?

ANSWER=

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

25. Do you have a park and ride lot within 2 miles of your home?

1. YES
2. NO
3. NOT SURE/DK

26. Please indicate by saying yes or no whether the following statements apply to you. I have, or would have, difficulty using the bus because ……
(READ LIST – CHOOSE ALL THAT APPLY)

A. I don't know how to use the bus
B. There is no service where I live
C. The hours of service don't meet my schedule
D. The bus doesn't run often enough
E. The bus doesn't go where I want to go
F. It's too far from my home to the bus stop
G. It's too far from my job/school to the bus stop
H. There is no safe place to walk to/from the bus stop
I. There is no safe place to walk to/from the bus stop near my job/school
J. There is no safe place to wait for the bus
K. There is no safe place to wait for the bus near my job/school
L. NONE OF THE ABOVE

USE SPACE BAR TO SELECT CHOICES

27. Would you like to have bus service available for use near your home?

1. YES
2. NO (SKIP TO Q.28)
3. NOT SURE/DK (SKIP TO Q.28)

27A. Where are some of the places that you would like to be able to go on the bus?

TYPE IN ANSWER, HIT ENTER TO GO TO THE NEXT QUESTION

28. Do you think the city/county in which you live should provide financial support for public transit service?

1. YES
2. NO
3. NOT SURE/DK

29. Now I have a just few more questions about you and your household that will help us in understanding and interpreting the survey results. Please stop me when I read the category that includes your age. Is it… (READ LIST)

1. 18 to 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. 65 to 74
7. 75 or older
8. REFUSED

30. How long have you lived in the Greater Richmond Area?

1. less than one year
2. one to four years
3. five to nine years
4. ten years or longer
5. REFUSED

31. For statistical purposes only, with which racial or ethnic group do you identify? (READ LIST – CHOOSE ALL THAT APPLY)

A. American Indian [includes Alaskans]
B. Asian [includes Pakistanis, Indians or Pacific Islanders]
C. Black [includes Jamaicans, Bahamians & other Caribbeans or Africans but not Hispanic or Arabian decent]
D. Hispanic [includes persons of Mexican, Puerto Rican, Central or South American or Spanish origin or culture]
E. White [includes Arabian]
F. or some other group I haven't mentioned
G. NO ANSWER/REFUSED

USE SPACE BAR TO SELECT CHOICES

32. Finally, what was the total income for you household in 2005? Was it….. (READ LIST)

1. Less than $18,000
2. $18,000 to $24,999
3. $25,000 to $34,999
4. $35,000 to $49,999
5. $50,000 to $74,999
6. $75,000 to $99,999
7. $100,000 to $149,999
8. $150,000 or more.
9. REFUSED

That concludes the survey. Thanks for your time and cooperation. Have a good evening.

Appendix D

Household Survey Responses by Jurisdiction

Question 1: Home Jurisdiction

Jurisdiction	Percentage
Chesterfield	31.9%
Hanover	10.6%
Henrico	32.7%
Richmond	24.9%
Total	100.0%

Question 2: Postal ZIP Code

	Richmond	Hanover	Henrico	Chesterfield	Total
21211	0.0%	0.0%	0.1%	0.0%	0.1%
22146	0.0%	0.1%	0.0%	0.0%	0.1%
22220	0.1%	0.0%	0.0%	0.0%	0.1%
22322	0.1%	0.0%	0.0%	0.0%	0.1%
22323	0.1%	0.0%	0.0%	0.0%	0.1%
22325	0.1%	0.0%	0.0%	0.0%	0.1%
22327	0.0%	0.0%	0.1%	0.0%	0.1%
23005	0.0%	1.3%	0.0%	0.0%	1.3%
23015	0.0%	0.2%	0.0%	0.0%	0.2%
23024	0.0%	0.0%	0.0%	0.0%	0.0%
23047	0.0%	0.1%	0.0%	0.0%	0.1%
23055	0.0%	0.0%	0.0%	0.0%	0.0%
23059	0.0%	0.4%	2.5%	0.0%	3.0%
23060	0.0%	0.0%	4.0%	0.0%	4.0%
23069	0.0%	0.2%	0.0%	0.0%	0.2%
23075	0.0%	0.0%	0.8%	0.0%	0.8%
2311	0.0%	0.1%	0.0%	0.0%	0.1%
23111	0.0%	3.8%	0.0%	0.0%	3.8%
23112	0.0%	0.0%	0.0%	5.0%	5.0%
23113	0.0%	0.0%	0.0%	1.6%	1.6%
23114	0.0%	0.0%	0.0%	1.7%	1.7%
23116	0.0%	3.0%	0.0%	0.0%	3.0%
23120	0.0%	0.0%	0.0%	0.1%	0.1%
23146	0.0%	0.2%	0.0%	0.0%	0.2%
23150	0.0%	0.0%	1.3%	0.0%	1.3%
23162	0.0%	0.0%	0.0%	0.0%	0.0%

	Richmond	Hanover	Henrico	Chesterfield	Total
23192	0.0%	0.5%	0.0%	0.0%	0.5%
23219	0.1%	0.0%	0.0%	0.0%	0.1%
23220	3.0%	0.0%	0.0%	0.0%	3.0%
23221	1.8%	0.0%	0.0%	0.0%	1.8%
23222	2.3%	0.0%	1.5%	0.0%	3.8%
23223	2.4%	0.0%	2.3%	0.1%	4.8%
23224	2.9%	0.0%	0.0%	0.4%	3.2%
23225	3.5%	0.0%	0.0%	0.1%	3.7%
23226	0.9%	0.0%	0.3%	0.0%	1.1%
23227	2.3%	0.0%	1.5%	0.0%	3.8%
23228	0.0%	0.0%	2.4%	0.0%	2.4%
23229	0.0%	0.0%	4.9%	0.0%	4.9%
23230	0.6%	0.0%	0.3%	0.0%	0.8%
23231	0.9%	0.0%	3.8%	0.1%	4.8%
23232	0.2%	0.0%	0.0%	0.0%	0.2%
23233	0.1%	0.0%	2.9%	0.0%	3.0%
23234	0.7%	0.0%	0.0%	2.6%	3.3%
23235	1.0%	0.0%	0.0%	3.6%	4.5%
23236	0.2%	0.0%	0.1%	2.7%	3.0%
23237	0.0%	0.0%	0.0%	1.6%	1.6%
23238	0.1%	0.0%	3.1%	0.1%	3.4%
23239	0.1%	0.0%	0.4%	0.0%	0.5%
23240	0.1%	0.0%	0.0%	0.0%	0.1%
23255	0.1%	0.0%	0.0%	0.0%	0.1%
23294	0.1%	0.0%	1.4%	0.0%	1.5%
23299	0.0%	0.0%	0.1%	0.0%	0.1%
23305	0.0%	0.0%	0.0%	0.0%	0.0%
23323	0.0%	0.0%	0.1%	0.0%	0.1%
23325	0.1%	0.0%	0.0%	0.1%	0.2%
23327	0.0%	0.0%	0.1%	0.0%	0.1%
23336	0.0%	0.0%	0.0%	0.1%	0.1%
23382	0.0%	0.0%	0.0%	0.1%	0.1%
23803	0.0%	0.0%	0.0%	0.4%	0.4%
23813	0.0%	0.0%	0.0%	0.1%	0.1%
23831	0.0%	0.0%	0.0%	3.2%	3.2%
23832	0.0%	0.0%	0.0%	3.8%	3.8%
23834	0.0%	0.0%	0.0%	0.1%	0.1%
23836	0.0%	0.0%	0.0%	0.9%	0.9%
23838	0.0%	0.0%	0.0%	2.2%	2.2%
28264	0.1%	0.0%	0.0%	0.0%	0.1%
32146	0.0%	0.0%	0.0%	0.0%	0.0%
32326	0.0%	0.0%	0.0%	0.1%	0.1%
33059	0.0%	0.0%	0.1%	0.0%	0.1%
33225	0.1%	0.0%	0.0%	0.0%	0.1%
99999	0.3%	0.1%	0.1%	0.2%	0.8%

Question 3: How many people are there in your household are:

	Richmond	Hanover	Henrico	Chesterfield	Total
Age 15 or younger	4.4%	2.0%	7.8%	5.9%	20.1%
Age 16 to 59	12.2%	5.9%	19.1%	18.0%	55.2%
Age 60 to 64	1.9%	0.7%	2.5%	2.8%	7.9%
Age 65 to 74	1.9%	1.3%	3.4%	3.2%	9.7%
Age 75 or older	2.6%	0.6%	1.9%	2.0%	7.1%

Question 4: How many people in your household have a driver's license?

	Richmond	Hanover	Henrico	Chesterfield	Total
0	4.4%	0.1%	1.8%	0.2%	6.5%
1	7.5%	1.5%	8.2%	5.0%	22.2%
2	10.0%	6.4%	18.7%	19.4%	54.5%
3	1.6%	1.6%	3.9%	4.8%	11.9%
4	0.5%	0.6%	1.5%	1.6%	4.2%
5	0.2%	0.1%	0.1%	0.1%	0.6%
6	0.1%	0.0%	0.0%	0.0%	0.1%

Question 5: How many people in your household have jobs outside the home?

	Richmond	Hanover	Henrico	Chesterfield	Total
0	8.1%	2.8%	8.8%	7.2%	27.0%
1	7.5%	2.0%	10.2%	9.2%	28.9%
2	6.5%	4.3%	11.7%	11.5%	34.1%
3	1.1%	0.8%	2.4%	2.5%	6.8%
4	0.7%	0.3%	0.9%	0.7%	2.6%
5	0.1%	0.0%	0.1%	0.0%	0.2%
6	0.1%	0.0%	0.1%	0.0%	0.3%
7 or more	0.0%	0.0%	0.0%	0.0%	0.0%
No response	0.1%	0.0%	0.0%	0.0%	0.1%

Question 6: Household Members University or College Affiliation

	Richmond	Hanover	Henrico	Chesterfield	Total
Student	7.5%	14.1%	10.7%	13.0%	11.0%
Faculty	3.6%	3.5%	3.3%	2.8%	3.2%
Staff	3.2%	2.4%	3.3%	2.8%	3.0%
Other Affiliation	4.3%	2.4%	2.2%	2.0%	2.7%
No Affiliation	85.4%	80.4%	84.9%	82.7%	83.9%

Question 7: Universities or Colleges with which Households have an Affiliation

	Richmond	Hanover	Henrico	Chesterfield	Total
VCU - Monroe Park	34.1%	35.8%	34.1%	28.8%	32.5%
VCU - Medical Center	15.9%	3.8%	15.9%	15.4%	14.3%
University of Richmond	11.4%	5.7%	11.4%	5.8%	8.7%
Virginia Union University	11.4%	1.9%	2.3%	0.0%	3.5%
J. Sergeant Reynolds Community College	13.6%	32.1%	13.6%	11.5%	15.1%
John Tyler Community College	0.0%	5.7%	2.3%	9.6%	4.7%
Other	13.6%	15.1%	20.5%	28.8%	21.2%

Question 8: Number of Vehicles Available to Household

	Richmond	Hanover	Henrico	Chesterfield	Total
0	20.6%	1.2%	7.4%	1.2%	8.0%
1	31.6%	13.7%	25.7%	19.7%	24.0%
2	32.0%	39.6%	34.2%	40.9%	36.3%
3	10.7%	26.3%	23.2%	21.7%	20.0%
4	2.8%	9.8%	7.4%	10.6%	7.5%
5	0.8%	5.9%	1.1%	3.9%	2.4%
6	0.8%	1.6%	0.4%	1.6%	1.0%
7	0.0%	0.4%	0.4%	0.0%	0.2%
8	0.4%	1.2%	0.0%	0.4%	0.3%
No response	0.4%	0.4%	0.4%	0.0%	0.3%

Question 9: Member of Household that has a Disability making it Difficult to Drive

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	17.8%	7.5%	14.0%	12.2%	13.7%
No	81.4%	91.4%	85.7%	87.8%	85.9%
Not Sure/Refusal	0.8%	1.2%	0.4%	0.0%	0.4%

Question 10: Member of Household that has a Disability making it Impossible to Drive

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	7.1%	4.3%	8.1%	5.5%	6.7%
No	92.5%	94.9%	91.9%	94.5%	93.2%
Not Sure/Refusal	0.4%	0.8%	0.0%	0.0%	0.2%

Question 11: Provided Transportation to Someone who Could not Drive in past Month (Over age 16)

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	29.2%	27.5%	28.3%	28.0%	28.3%
No	70.0%	72.6%	71.7%	72.1%	71.5%

Not Sure/Refusal	0.8%	0.0%	0.0%	0.0%	0.2%

Question 12: Household Members Use of Transportation Services in Past Three Years

	Richmond	Hanover	Henrico	Chesterfield	Total
GRTC Local Bus	53.0%	4.7%	16.5%	7.9%	21.4%
GRTC Express Bus	9.1%	0.8%	5.9%	5.1%	5.9%
CARE Van Service	11.9%	1.2%	5.5%	3.5%	6.0%
C-VAN Transportation Service	3.6%	0.4%	2.2%	0.4%	1.8%
VCU Student Pass Program	5.1%	1.2%	3.7%	2.4%	3.4%
RideFinders Commuter Service	2.0%	0.0%	2.6%	2.4%	2.1%
Lunch Time Express	2.0%	0.4%	1.8%	2.4%	1.9%
Other	2.0%	0.8%	1.1%	0.8%	1.2%
None	43.5%	93.7%	78.7%	84.3%	73.4%

Question 13: How do you Travel to Work or School on a Typical Day

	Richmond	Hanover	Henrico	Chesterfield	Total
Driver of a car/vanpool	13.0%	13.3%	13.2%	14.2%	13.5%
Passenger of a car/vanpool	6.3%	2.0%	3.7%	3.1%	4.0%
Drive alone	42.7%	63.5%	56.6%	59.5%	54.8%
Bus	18.2%	0.8%	5.1%	2.8%	7.1%
Railroad	0.8%	0.0%	0.4%	0.4%	0.4%
Other	5.9%	2.0%	4.0%	0.0%	3.0%
Do not commute	31.6%	32.2%	30.1%	35.0%	32.2%

Question 14: Where is Your Work or School Located

	Richmond	Hanover	Henrico	Chesterfield	Total
Richmond	16.7%	2.7%	12.5%	10.8%	42.6%
Hanover	0.8%	3.7%	2.2%	2.0%	8.7%
Henrico	3.5%	3.3%	17.3%	4.5%	28.6%
Chesterfield	2.8%	0.8%	1.8%	14.2%	19.6%
Other	2.1%	1.4%	2.6%	3.8%	9.8%

Question 15: What time do you start work or school?

Start Time	Richmond	Hanover	Henrico	Chesterfield	Total
1:00:00 AM	0.0%	0.0%	0.2%	0.0%	0.2%
4:00:00 AM	0.3%	0.1%	0.2%	0.4%	0.9%
5:00:00 AM	0.3%	0.2%	0.9%	0.7%	2.1%
6:00:00 AM	1.8%	0.9%	2.0%	4.0%	8.7%
7:00:00 AM	5.8%	2.7%	8.5%	6.9%	23.8%
8:00:00 AM	9.5%	3.4%	12.1%	9.8%	34.7%
9:00:00 AM	2.2%	1.4%	4.3%	3.7%	11.6%
10:00:00 AM	1.1%	0.3%	0.9%	0.7%	3.0%
11:00:00 AM	0.0%	0.0%	0.5%	0.5%	1.1%

12:00:00 PM	0.3%	0.1%	0.7%	0.4%	1.5%
1:00:00 PM	0.0%	0.0%	0.4%	0.0%	0.4%
2:00:00 PM	0.3%	0.0%	0.2%	0.2%	0.6%
3:00:00 PM	0.1%	0.0%	0.7%	0.0%	0.9%
4:00:00 PM	0.3%	0.2%	0.0%	0.0%	0.4%
5:00:00 PM	0.3%	0.0%	0.2%	0.0%	0.5%
6:00:00 PM	0.1%	0.1%	0.4%	0.2%	0.7%
7:00:00 PM	0.0%	0.1%	0.0%	0.4%	0.5%
10:00:00 PM	0.3%	0.1%	0.0%	0.0%	0.3%
11:00:00 PM	0.1%	0.0%	0.2%	0.0%	0.3%
Varies	1.0%	0.6%	1.8%	1.4%	4.7%
No work or school	0.4%	0.2%	0.2%	0.4%	1.2%
Refused	0.0%	0.0%	0.5%	0.2%	0.7%
Do not know	0.4%	0.1%	0.0%	0.4%	0.8%
No response	0.0%	0.1%	0.4%	0.0%	0.4%

Question 16: What time do you leave work or school?

Start Time	Richmond	Hanover	Henrico	Chesterfield	Total
12:00:00 AM	0.1%	0.0%	0.4%	0.2%	0.7%
1:00:00 AM	0.0%	0.0%	0.2%	0.0%	0.2%
2:00:00 AM	0.0%	0.0%	0.2%	0.0%	0.2%
5:00:00 AM	0.0%	0.1%	0.0%	0.0%	0.1%
7:00:00 AM	0.0%	0.0%	0.2%	0.0%	0.2%
8:00:00 AM	0.1%	0.1%	0.0%	0.0%	0.2%
9:00:00 AM	0.0%	0.0%	0.2%	0.0%	0.2%
10:00:00 AM	0.1%	0.0%	0.0%	0.0%	0.1%
11:00:00 AM	0.1%	0.0%	0.0%	0.4%	0.5%
12:00:00 PM	0.1%	0.1%	0.9%	0.4%	1.5%
1:00:00 PM	0.1%	0.1%	0.4%	0.2%	0.8%
2:00:00 PM	1.0%	0.6%	1.6%	1.4%	4.6%
3:00:00 PM	3.7%	1.3%	4.0%	4.8%	13.8%
4:00:00 PM	4.8%	1.6%	6.3%	5.8%	18.6%
5:00:00 PM	4.5%	3.3%	8.7%	7.8%	24.2%
6:00:00 PM	3.6%	1.1%	4.2%	3.4%	12.2%
7:00:00 PM	1.5%	0.5%	1.8%	0.5%	4.3%
8:00:00 PM	0.3%	0.2%	1.1%	0.4%	1.9%
9:00:00 PM	0.3%	0.1%	0.9%	0.4%	1.6%
10:00:00 PM	0.3%	0.1%	0.0%	0.4%	0.7%
11:00:00 PM	0.3%	0.0%	0.0%	0.0%	0.3%
Varies	2.1%	0.9%	3.2%	3.2%	9.4%
No work or school	0.4%	0.3%	0.2%	0.2%	1.1%
Refused	0.0%	0.0%	0.4%	0.4%	0.7%
Do not know	0.8%	0.1%	0.2%	0.4%	1.4%
No response	0.0%	0.1%	0.4%	0.2%	0.6%

Question 17: How long does it take you to get to work on a typical day?

Commute Length	Richmond	Hanover	Henrico	Chesterfield	Total
0 to 9 minutes	3.4%	1.5%	5.4%	3.5%	13.9%
10 to 19 minutes	8.5%	2.3%	11.2%	7.2%	29.3%
20 to 29 minutes	5.1%	3.2%	9.9%	7.4%	25.6%
30 to 39 minutes	2.8%	1.7%	4.3%	6.9%	15.7%
40 to 49 minutes	0.8%	0.9%	1.3%	2.7%	5.6%
50 to 59 minutes	0.1%	0.0%	0.0%	0.2%	0.3%
60 minutes or more	1.8%	0.3%	0.9%	0.9%	3.9%
Varies	0.4%	0.3%	1.3%	0.9%	2.9%
Not Sure	0.4%	0.1%	0.0%	0.0%	0.5%
Refused	0.0%	0.0%	0.2%	0.0%	0.2%
No Commute	0.7%	0.4%	0.2%	0.2%	1.4%
No Response	0.3%	0.0%	0.4%	0.2%	0.8%

Question 18: Is Your Workplace or School Location Served by GRTC Public Transit Service

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	14.1%	2.6%	12.3%	8.8%	37.9%
No	8.0%	6.1%	15.6%	16.0%	45.7%
Not Sure/Refusal	2.4%	1.8%	7.0%	5.2%	16.4%

Question 19: GRTC Use Frequency to Get to Workplace or School

Days per Week	Richmond	Hanover	Henrico	Chesterfield	Total
0	20.0%	10.4%	32.6%	30.6%	93.5%
1	0.5%	0.0%	0.1%	0.1%	0.7%
2	0.6%	0.0%	0.3%	0.0%	0.8%
3	0.4%	0.0%	0.1%	0.1%	0.6%
4	0.0%	0.0%	0.1%	0.1%	0.2%
5	2.7%	0.0%	0.8%	0.1%	3.6%
6	0.1%	0.0%	0.1%	0.1%	0.3%
7	0.0%	0.0%	0.1%	0.0%	0.1%

Question 20: Would You Consider Using the Bus to Commute

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	9.9%	4.0%	12.3%	11.2%	37.5%
No	8.9%	7.3%	22.6%	19.9%	58.7%
Not sure	0.9%	0.5%	1.2%	1.2%	3.8%

Question 21: What would be a reasonable one-way fare to and from work or school for local service?

Cost	Richmond	Hanover	Henrico	Chesterfield	Total
Free	0.1%	0.0%	0.1%	0.0%	0.3%
$0.01 to $0.25	0.1%	0.2%	0.1%	0.2%	0.6%
$0.26 to $0.50	1.1%	0.2%	1.3%	0.9%	3.4%
$0.51 to $0.75	0.3%	0.1%	1.1%	0.7%	2.2%
$0.76 to $1.00	3.6%	1.1%	5.5%	3.7%	13.9%
$1.01 to $1.25	3.4%	0.2%	2.4%	0.6%	6.6%
$1.26 to $1.50	2.3%	0.3%	2.0%	2.2%	6.8%
$1.51 to $1.75	0.2%	0.0%	0.1%	0.4%	0.7%
$1.76 to $2.00	1.2%	1.3%	3.1%	3.3%	9.0%
More than $2.00	1.1%	1.8%	2.8%	2.8%	8.4%
Not sure	3.4%	1.9%	5.7%	5.5%	16.4%
No response	8.2%	3.5%	8.4%	11.5%	31.7%

Question 22: What would be a reasonable one-way fare to and from work or school for express service?

Cost	Richmond	Hanover	Henrico	Chesterfield	Total
Free	0.1%	0.0%	0.1%	0.0%	0.3%
$1.00 or less	1.9%	0.7%	4.1%	2.7%	9.5%
$1.01 to $1.25	1.3%	0.0%	1.8%	0.7%	3.9%
$1.26 to $1.50	3.3%	0.5%	3.0%	2.5%	9.3%
$1.51 to $1.75	0.7%	0.1%	0.0%	0.5%	1.3%
$1.76 to $2.00	3.1%	1.2%	3.9%	2.6%	10.8%
$2.01 to $2.25	0.0%	0.0%	0.1%	0.1%	0.2%
$2.26 to $2.50	0.5%	0.4%	1.3%	1.0%	3.1%
$2.51 to $2.75	0.1%	0.0%	0.1%	0.1%	0.3%
$2.76 to $3.00	0.5%	0.5%	1.4%	1.6%	4.0%
More than $3.00	0.7%	1.7%	2.6%	3.2%	8.2%
Not sure	4.5%	1.9%	5.7%	5.3%	17.4%
No response	8.3%	3.5%	8.6%	11.6%	32.0%

Question 23: Would You Consider Using the Bus for Trips to Other Locations

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	15.3%	4.7%	17.0%	15.0%	52.0%
No	7.9%	5.0%	16.6%	14.9%	44.3%
Not sure	1.1%	0.7%	0.6%	1.4%	3.7%

Question 24: How far is it from your home to the nearest bus stop?

Distance	Richmond	Hanover	Henrico	Chesterfield	Total
0.00 to 0.25 miles	18.3%	0.2%	5.3%	1.4%	25.1%
0.26 to 0.5 miles	1.1%	0.0%	2.1%	0.4%	3.7%

0.51 to 0.75 miles	0.1%	0.0%	0.4%	0.0%	0.5%
0.76 to 1.00 miles	1.1%	0.2%	2.5%	0.9%	4.7%
1.01 to 2.00 miles	0.6%	0.1%	4.7%	2.9%	8.3%
2.01 to 3.00 miles	0.2%	0.3%	1.6%	2.6%	4.7%
3.01 to 4.00 miles	0.0%	0.1%	1.3%	1.1%	2.4%
4.01 to 5.00 miles	0.0%	0.5%	1.8%	2.7%	5.0%
More than 5.00 miles	0.2%	3.5%	2.6%	4.9%	11.2%
No bus stop nearby	0.0%	0.5%	0.5%	0.6%	1.6%
No precise distance given	1.1%	0.9%	2.9%	2.0%	6.9%
Not sure	1.5%	4.1%	8.5%	11.8%	25.9%

Question 25: Do You Have a Park-and-Ride Lot within Two Miles of Your Home

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	4.0%	1.3%	9.7%	4.2%	19.1%
No	16.9%	8.1%	20.6%	22.0%	67.6%
Not sure	3.4%	1.0%	3.9%	5.0%	13.3%

Question 26: I have, or would have, difficulty using the bus for the following reasons:

Difficulty Using the Bus	Richmond	Hanover	Henrico	Chesterfield	Total
None of the above items apply to me	9.7%	1.2%	6.5%	6.5%	23.9%
There is no safe place to wait for the bus near my job/school	2.4%	1.7%	4.0%	4.8%	12.9%
There is no safe place to wait for the bus near my home	3.4%	2.6%	7.7%	7.2%	21.0%
There is no safe place to walk to/from the bus stop near my job/school	2.8%	1.9%	5.2%	5.6%	15.5%
There is no safe place to walk to/from the bus stop	4.3%	3.2%	9.1%	10.4%	27.0%
It's too far from my job/school to bus stop	4.3%	3.5%	9.9%	8.5%	26.2%
It's too far from my home to the bus stop	2.7%	6.6%	14.7%	15.5%	39.5%
The bus doesn't go where I want to go	8.0%	3.7%	12.6%	10.1%	34.4%
The bus doesn't run often enough	6.4%	1.7%	7.2%	6.5%	21.8%
The hours of service doesn't meet my schedule	4.6%	1.6%	8.3%	5.6%	20.1%
There is no service where I live	2.0%	8.3%	16.6%	19.8%	46.7%
I don't know how to use the bus	2.4%	1.2%	5.4%	3.9%	12.9%

Question 27: I would like to have bus service available near my home

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	18.8%	4.8%	18.0%	13.8%	55.3%
No	4.6%	5.1%	14.2%	15.2%	39.1%
Not sure	0.9%	0.4%	2.0%	2.2%	5.5%

Question 28: I think the city/county in which I live should provide financial support for public transit service

	Richmond	Hanover	Henrico	Chesterfield	Total
Yes	18.1%	6.4%	26.6%	21.8%	72.8%
No	3.5%	3.0%	6.3%	6.3%	19.0%
Not sure	2.6%	1.0%	1.4%	3.2%	8.2%

Question 29: Respondent Age

	Richmond	Hanover	Henrico	Chesterfield	Total
Refused	0.4%	0.2%	0.5%	0.1%	1.2%
75 or older	3.4%	0.9%	3.1%	2.8%	10.2%
65 to 74	3.2%	1.7%	5.4%	5.4%	15.7%
55 to 64	4.1%	1.5%	6.7%	6.6%	19.0%
45 to 54	4.9%	2.9%	7.1%	7.9%	22.7%
35 to 44	4.0%	2.0%	5.8%	5.2%	16.9%
25 to 34	2.7%	0.9%	3.7%	2.1%	9.3%
18 to 24	1.4%	0.4%	2.0%	1.1%	4.9%

Question 30: Duration of Residence in the Greater Richmond Area

	Richmond	Hanover	Henrico	Chesterfield	Total
Less than 1 year	0.8%	0.3%	0.9%	1.2%	3.2%
1 to 4 years	1.8%	0.8%	3.0%	3.1%	8.7%
5 to 9 years	2.7%	0.9%	3.8%	4.4%	11.9%
10 years or longer	18.7%	8.3%	26.6%	22.6%	76.2%

Question 31: Racial or Ethnic Identity

Race/Ethnicity	Richmond	Hanover	Henrico	Chesterfield	Total
American Indian	0.5%	0.1%	0.6%	0.6%	1.8%
Asian	0.1%	0.1%	1.0%	0.2%	1.4%
Black	12.6%	0.9%	8.6%	5.0%	27.1%
Hispanic	0.4%	0.1%	0.8%	0.5%	1.7%
White	10.5%	8.7%	22.0%	24.1%	65.3%
Other	0.4%	0.2%	0.4%	0.5%	1.4%
Refused	0.4%	0.3%	1.0%	0.9%	2.6%

Question 32: Household Income

	Richmond	Hanover	Henrico	Chesterfield	Total
Less than $18,000	3.2%	0.2%	2.9%	1.8%	8.1%
$18,000 to $24,999	2.2%	0.5%	2.0%	1.1%	5.9%
$25,000 to $34,999	2.5%	0.7%	2.6%	1.5%	7.3%
$35,000 to $49,999	2.6%	1.1%	3.4%	3.6%	10.7%
$50,000 to $74,999	4.0%	2.2%	4.5%	5.7%	16.4%
$75,000 to $99,999	1.1%	1.3%	3.4%	5.0%	10.8%
$100,000 to $149,999	1.2%	1.2%	2.9%	3.4%	8.8%
$150,000 or more	0.8%	0.6%	2.4%	2.0%	5.7%
Refused	6.5%	2.6%	10.1%	7.1%	26.3%