Henrico County Transit Choices Report

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Contents

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1 Executive Summary

What is the purpose of this report?

This Choices Report is the first step in a rethinking of the Henrico County transit network as part of the GRTC Transit Development Plan.

The Choices Report helps guide the Henrico County part of the Transit Development Plan process, by *laying out relevant facts about transit and development in Henrico*, and by drawing the reader's attention to major choices that these facts force us to weigh.

Why focus on Henrico?

The Richmond metropolitan area is larger than Henrico County itself, and the Greater Richmond Transit Company (GRTC) also serves the City of Richmond and Chesterfield County, but as shown in Figure 1, most transit ridership is in the City of Richmond, with about 10% in Henrico County

In 2016 and 2017, the City of Richmond undertook a redesign of its transit network. The planned changes in the City's network affect routes that cross between the City and the County. These route changes will result in shifts in the Henrico County network and the larger changes in the GRTC network present an opportunity to reconsider the goals and priorities for transit service in Henrico County.

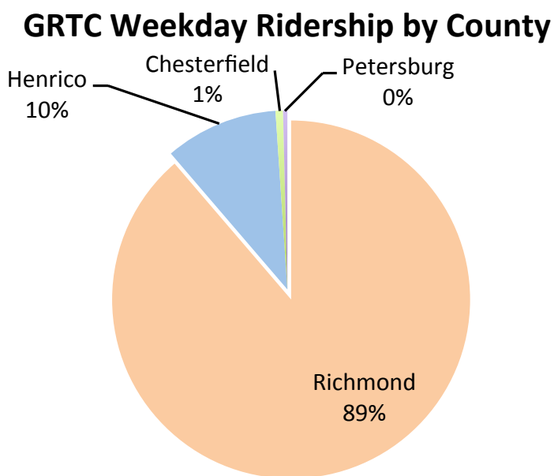


Figure 1: Most of the boardings on GRTC's transit network are within the City of Richmond.

Also, this Choices Report is about Henrico County because *the County's actions and decisions as a local government have enormous influence over transit's success*. The four geographic factors that most influence whether any transit service will attract high ridership are Density, Walkability, Proximity and Linearity.

In Henrico County as in most areas of the U.S., these factors are overwhelmingly controlled by the local governments that plan and regulate streets, land use, development and growth. While regional governments and states sometimes have influence, cities and counties are the most in control of these factors within their boundaries.

The usefulness of GRTC's transit network will depend enormously on how each of the cities and counties in its service area plan, develop and manage their urban development. This Choices Report will speak not only to GRTC about its transit options and opportunities but will also provide a ideas for the County's future infrastructure and development decisions.

Assessing the ridership market and coverage needs

The second Chapter of this report is an assessment of the market for transit in Henrico County. By "market" we are referring specifically to the demands for transit that result in *high ridership relative to cost*. This way of thinking about a transit market is similar to the way a private business thinks about its market for sales – how many potential customers there are, how useful they will find the product, and how well the product competes for their business.

High transit ridership satisfies a number of commonly-held values, like:

- If a city wants its transit system to compete successfully with cars to achieve environmental benefits (such as cleaner air and reduced carbon emissions) a Ridership goal is the path to that achievement.
- For transit to act as an economic stimulus, by providing job access to large numbers of workers, it must attract ridership. These interests are therefore also served by a Ridership goal.
- If leaders are concerned about government efficiency, they will want to maximize fare revenue relative to costs (and therefore reduce subsidy per rider), and they will also be drawn to a Ridership goal.

If the Henrico County and GRTC were only pursing a ridership goal, Chapter 2 would show them where to focus service.

In this report, we refer to transit services that are not operated with the goal of high ridership as having a "coverage" goal. Coverage goals reflect concerns about equity, and they also reflect social-service objectives, such as meeting the needs of people who are especially reliant on transit, whether due to age, disability, poverty or some other condition.

Transit coverage satisfies a number of commonly-held values, like:

- If a city wants all residents to have equal access to transit, no matter where they live, that is a coverage goal.
- If getting transit service to certain groups of people is important, but those people live in transit-unfriendly places (for example, if it is hard to walk to a bus stop), then a coverage goal will ensure that transit is provided in those places, even if few people can use it.
- If "return to source" is an important political principle (in which revenues are spent close to where they were raised, for example in Henrico County), that is a coverage purpose.
- If the severity of a person's need is a more important driver of transit service allocation than the number of people who will be served, that implies a coverage goal.

An assessment of coverage needs, that might warrant higher levels of service than can be justified based on ridership, is contained in Chapter 3.

Maximizing ridership is not the only goal

If the Henrico County transit system were designed *only* for maximum ridership or maximum farebox revenue, it would focus only on areas where there are many potential riders, and transit is useful for many trips. In other words, GRTC would be thinking like a private business and targeting a market where its product is competitive.

Yet maximizing ridership is not the only goal of public transit systems. While *private* transit companies may focus on profits, and therefore on exclusively high-ridership routes, *public* transit is almost always expected to meet other goals. In nearly every city, there is an expectation that transit service should be provided in some or all places regardless of the ridership it attracts.

Unlike governments, businesses are under no obligation to open storefronts in places where they would spend a lot of money to reach few potential customers, or where their products can't compete. For example, McDonald's is under no obligation to provide a drive-thru restaurant within 1/2 mile of every resident in Virginia. If it was, then thousands of houses in rural Virginia would have their own McDonald's at the end of a quiet dirt road. The company would quickly go bankrupt, as a result of operating all those restaurants across the state for tiny numbers of customers.

People understand that in a low-density, rural place they will have to drive many miles to reach a McDonald's, because McDonald's will be located only in places with enough potential customers. We wouldn't describe this situation as McDonald's being *unfair* to people in rural areas; McDonald's is just acting like a business. It has no coverage obligation, only a goal of maximizing profit.

Transit agencies are often accused of failing to maximize ridership, as if that were their only goal. But they are not private businesses, and as public agencies they are intentionally providing coverage services that they know will not generate much ridership. The elected officials who ultimately make public transit decisions hear their constituents say things like *"We pay taxes too"* and *"If you cut this bus line, we will be stranded"* and they decide that coverage, even in low-ridership places, is a worthy transit goal.

Figure 2: Is an empty bus failing? That depends entirely on why you are running it in the first place.

Ridership and coverage goals conflict

Ridership and coverage goals are both underpinned by laudable values, and most individuals would support both. Unfortunately, they come into direct conflict with one another. If a transit agency wants to do more of one, it must (within a fixed budget) do less of the other.

Here is an illustration of how ridership and coverage goals conflict with one another, due to geometry and geography.

In the fictional town shown in Figure 3, the little dots indicate dwellings and commercial buildings and other land uses. The lines indicate roads. Most of the activity in the town is concentrated around a few roads, as in most towns.

A transit agency pursuing only a ridership goal would run all of its buses on the streets where there are large numbers of people, where walking to transit stops is easy, and where the straight routes feel direct and fast to customers. This would result in a network like the one at bottom-left in Figure 3.

If the town were pursuing only a coverage goal, on the other hand, the transit agency would spread out services so that every street had a bus route, as in the network at bottom-right. As a result, all routes would be infrequent, even those on the main roads.

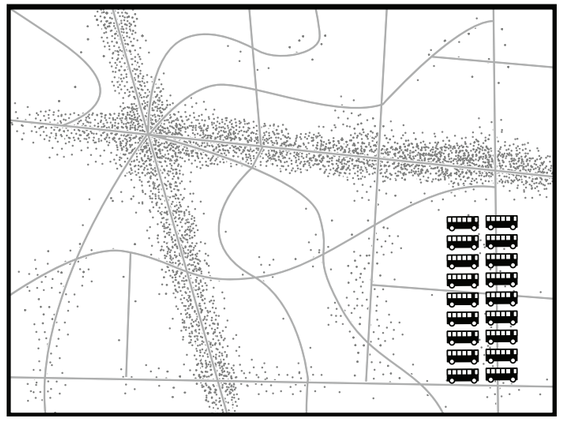
In these two scenarios, the town is using the same number of buses. These two networks cost the same amount to operate, but they deliver very different outcomes.

On a fixed budget, designing transit for both ridership and coverage is a zero-sum game. In the networks in Figure 3, each bus that the transit agency runs down a main road, to provide more frequent and competitive service in that market, is not running on the neighborhood streets, providing coverage. While an agency can pursue ridership and provide coverage within the same budget, *it cannot do both with the same dollar.* The more it does of one, the less it does of the other.

These illustrations also show a relationship between coverage and complexity. Networks offering high levels of coverage – a bus running down every street – are naturally more complex.

In this imaginary town, any person could keep the very simple "high ridership" network in their head, since it consists of just two routes, running in straight lines at high frequency. They would not even need to consult a schedule to catch a bus. The coverage network would be harder to memorize, requiring people to consult a map (to understand the routing) and a schedule (to catch these infrequent services).

Similarly, in real-life transit networks, overall complexity often tracks with the amount of service that is providing coverage.

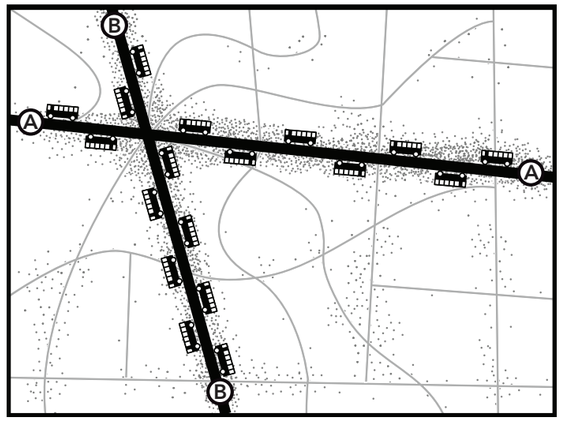


Imagine you are the transit planner for this fictional town. The dots scattered around the map are people and jobs; the streets shown are ones on which transit can be operated. The buses are the resources the town has to run transit.

Before you can plan transit routes, you must first decide what you want transit to do.

Ridership Goal

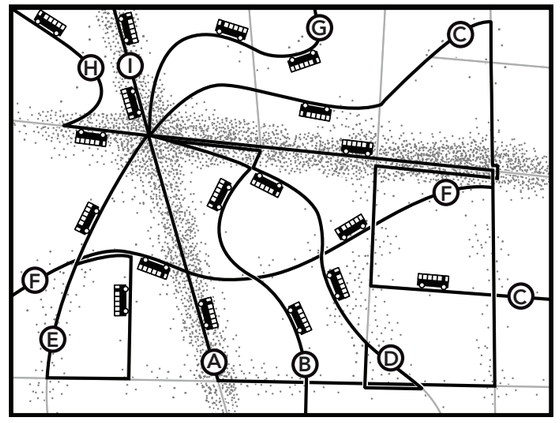
"Think like a business"



This transit network is designed to generate high ridership as efficiently as possible. The transit agency has thought like a business, investing its resources only into the best transit markets.

Coverage Goal

"Access for all"



This network is designed to provide some access to the transit system for all people. The transit agency has divided its resources among many routes throughout the town, none very frequent.

Figure 3: Ridership and coverage goals, both laudable, are in direct conflict within a fixed budget. The more we try to maximize one, the less we achieve of the other.

Frequency

In transit conversations there is always a great focus on *where* transit is provided, but sometimes not enough attention paid to *when* it is provided. The "when" of transit service can be described as "frequency" or "headway" (how many minutes between each bus) and "span" (how many hours per day, and days per week, it runs).

The map at right shows the existing GRTC transit network, with routes color-coded based on their midday frequencies.

Low frequencies and short spans are one of the main ways that transit fails to be useful, because it means service is simply not there when the customer needs to travel.

Even though Google Maps or an app on a phone can be consulted for directions, frequent transit service tends to attract high ridership because it has the simplicity of a road: it is there any time you need it. Frequent service allows you to maintain in your head a map of the transit system that is much like a road map.

Frequent service:

- Reduces waiting time (and thus overall travel time).
- Improves reliability for the customer, because if something happens to your bus, another one is always coming soon.
- Makes transit service more legible, by reducing the need to consult a schedule.
- Increases capacity (moving more people, with less crowding) on busy routes or at busy times.
- Makes transferring (between two frequent services) fast and reliable.

In order to think about whether any frequency is "frequent enough," imagine waiting one-half of the frequency, on average (since statistically, you will) and ask yourself whether you could tolerate waiting that long, regularly.

Many people assume that today, with real-time transit arrival information (like GRTC's Transit On The Go or Bus Tracker apps) and smartphones, nobody needs to wait for a bus anymore, and frequency therefore doesn't matter. If a bus only comes once an hour, that's fine, because your phone will tell you when it is a few minutes away and you can wait until then to walk to the stop.

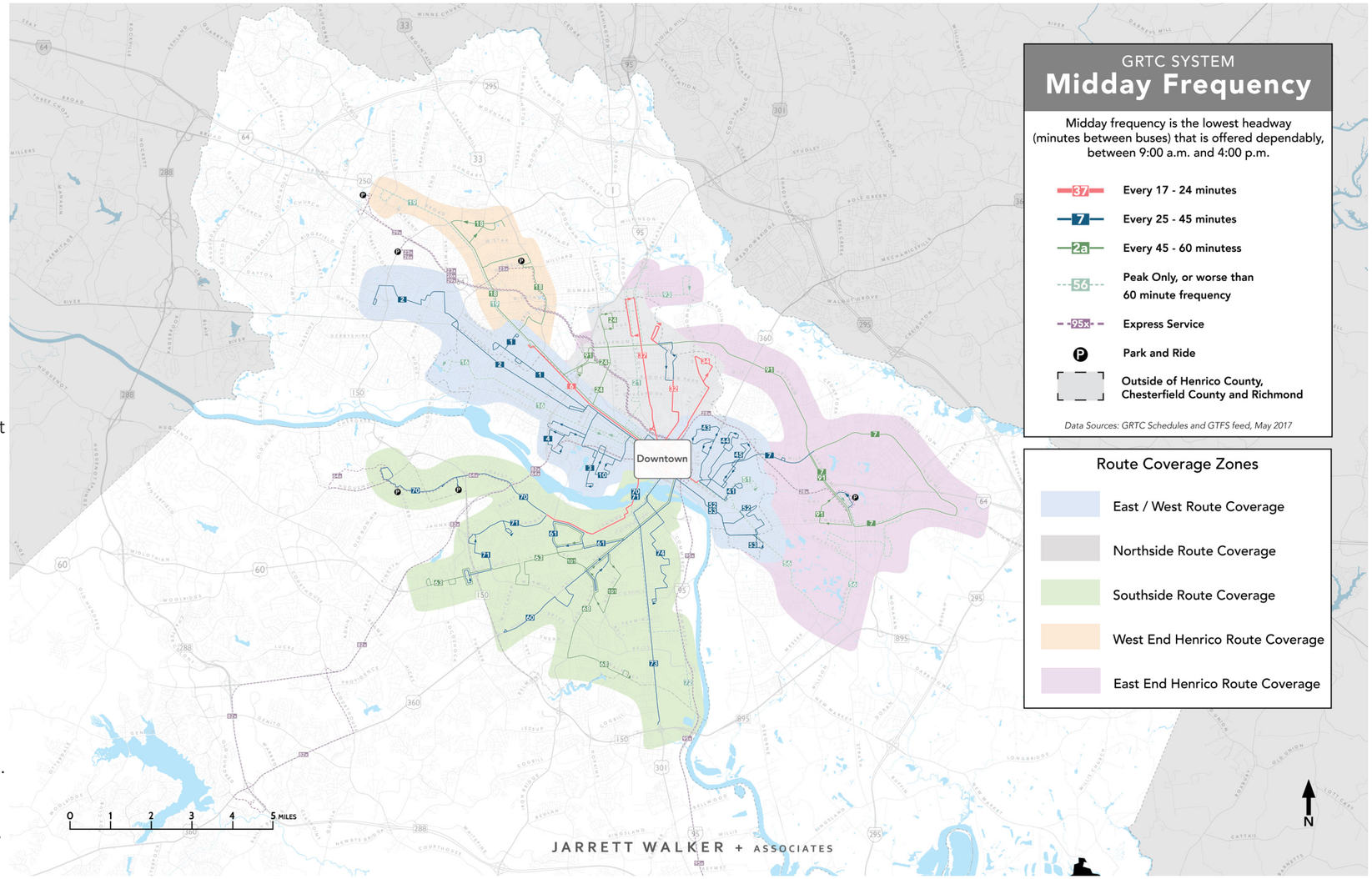


Figure 4: The GRTC transit network, with routes color-coded based on their weekday midday frequency. On orange routes, the next bus is coming within 24 minutes or less. Henrico County routes include Route 7, 18, 19, 56, 91, 93, 23x, 26x, 28x, and 29x. Henrico County also pays for the portions of Routes 1 and 2 that serve the county. None of the existing routes in Henrico County operate on weekends or after 8pm on weekdays.

Despite all these helpful technologies, frequency still matters enormously, because:

- Waiting doesn't just happen at the start of your ride, *it also happens at the end.* You may not need to leave the house much before your departure, but if your bus is infrequent and the schedule doesn't line up perfectly with your desired arrival time, you have to choose between being very early or too late. If you start work at 8:00 a.m. but the hourly bus passes your workplace at 8:10 a.m., you can be 50 minutes early or 10 minutes late. Or you can drive.

- Many of the places we go don't let us hang out until our bus's arrival is imminent. We can easily do this when leaving home, but it is more awkward when leaving a workplace that is closing, a movie, or someone else's house.

- Real-time arrival information doesn't make the bus more reliable, but frequency does. Your smartphone can tell you when your bus is arriving, but it cannot prevent your bus from having a problem and being severely delayed, or not showing up at all. Only frequency – which means that another bus is always coming soon – can offer this kind of reliability.

Service quantity vs. frequency

There is a difference between the number of buses serving a bus stop each hour and the route's frequency. If four buses serve a stop each hour, that could mean they come by at 12:00, 12:10, 12:50 and 12:55. A person could wait 5 minutes or 40 minutes. With such high variability in the time between trips, a rider must absolutely consult a schedule if they don't want to be waiting for a long time. Transferring to this route, from another route, is a high-stakes move, because if the their bus arrives at the transfer point just a little bit late, the rider's whole trip could take 40 minutes longer than expected.

In contrast, if those four buses an hour are evenly spaced, at 12:00, 12:15, 12:30 and 12:45, a rider knows that they will never have to wait more than 15 minutes. They can expect to wait, on average, 7.5 minutes, one-half of the frequency.

With frequency, it isn't just the short waits that are valuable, it's the *reliably, predictably* short waits. This is why the map on the previous page is based on the maximum reliable time between arriving buses, rather than the average time between arriving buses.

Both service quantity and frequency are expensive – a line on the map that represents a bus coming once an hour costs 1/4 as much to operate as if it were a bus coming every 15 minutes.

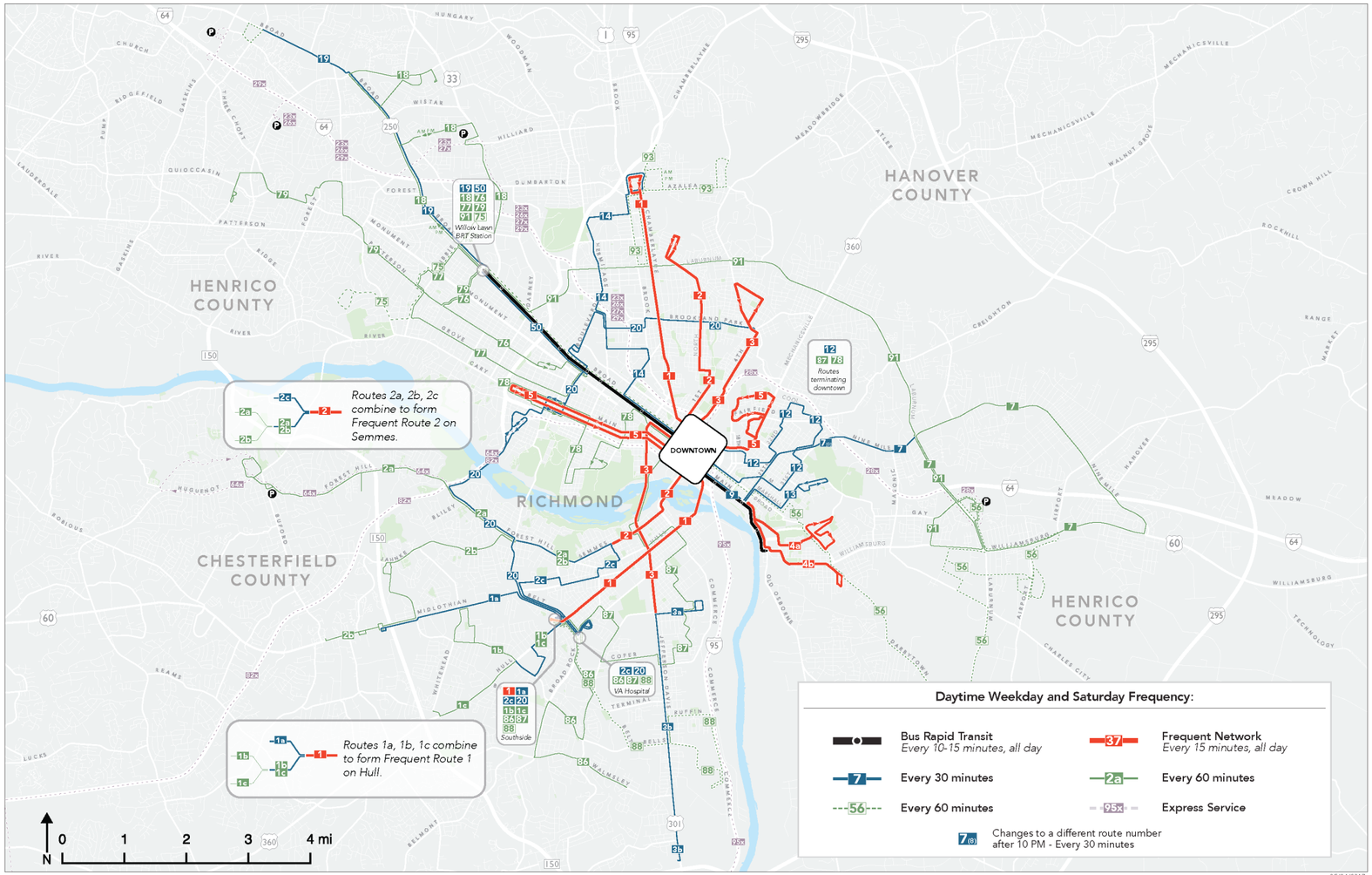


Figure 5: The new GRTC transit network to be implemented in late 2017 with the opening of the Pulse BRT. Routes are color-coded based on their weekday midday frequency. Henrico County routes include Route 7, 18, 19, 56, 79, 91, 93, 23x, 26x, 28x, and 29x. None of the Henrico County routes operate on weekends or after 8pm on weekdays.

The changes coming with the implementation of the Richmond Transit Network Plan will dramatically alter the transit network within the City of Richmond, shifting resources toward more ridership-focused service with higher frequencies. At the same time, all routes are being designed to fit a clockface schedule, which will address much of the quantity vs. frequency issues with the existing GRTC system.

The changes have affected the Henrico County network. Because of changes in the west end network in the City, the current Patterson route will no longer continue directly out to Regency Square. Instead, a new Route 79 will take over the current service for that route in Henrico County. The new City routes 77 and 75 will provide service to St. Mary's Hospital that Henrico County previously provided with existing route 1. Similarly, Route 19 is being truncated at Willow Lawn Drive and will run all-day with 30 minute frequency.

Key Choices for Henrico

Ridership or coverage?
The most fundamental choice before the Henrico County concerns ridership: *How important is it that GRTC maximizes ridership within its fixed budget?*

A goal of maximizing ridership serves several common desires for urban transit, including:

- Reducing people's transportation costs and burdens,
- Reducing costs and subsidies per rider,
- Reducing car travel and pollution,
- Supporting denser urban development,
- Providing access to jobs for large numbers of workers,
- Allowing for economic growth despite congestion.

On the other hand, transit can serve several common desires that have nothing to do with high ridership:

- Ensuring that everyone has access to some transit,
- Providing lifeline access to critical services,
- Providing access for people with severe needs.

No transit agency focuses solely on either of these goals. Most agencies have routes that generate a lot of ridership very efficiently, and others that don't draw as much ridership but have important social purposes.

Some agencies act as though these goals were not in conflict, saying that they will "increase ridership while ensuring that all residents have access," or both "run efficiently" and "provide access for all." This can lead to a feeling among the public, elected officials and even transit staff themselves that no matter what they do, they are failing to achieve their goals. This is the natural result when major goals are in conflict. Conflicting goals cannot be maximized at the same time. They must be balanced instead.

It is often said about public and private organizations alike that if you want to know what really matters, look at their budgets. High-level policies are valuable, but when they are vague or in conflict, the real evidence of a community's values is in its budget.

We suggest that Henrico County think about this choice not as black-and-white, but as a dial that the community can turn to the correct position:

What percentage of the available budget for transit should be dedicated to generating as much ridership as possible, and what percentage should be spent providing transit where ridership may be low, but needs are high?

This is not a technical question, but one that relates to the values and needs of a community.

We estimate that, within Henrico County:

- About 20% of the existing transit network is designed as it would be if maximizing ridership were its only goal.
- The other 80% has predictably low-ridership, because of where or when it runs, or other factors that make it useful to predictably-small numbers of people. This suggests that it is being provided for other, non-ridership purposes.

A 20/80 balance between maximizing ridership and providing coverage may be the right balance for Henrico County in the future, or the community may wish for a shift in that balance.

The direction of that shift – either towards higher or lower ridership – and how fast Henrico should make such a shift are two questions that will be put to the public, stakeholders and elected officials in this Transit Development Plan.

Other cities that have thought about this have come to different answers. For example:

- In Reno, Nevada the transit agency Board's policy devotes 80% of resources to maximum ridership; this policy has been used to reallocate service to higher productivity locations, and to show that such moves are the result of consistent policy rather than animus toward a particular area.
- Closer to home, the Wake County (Raleigh, NC) Long Range Transportation Plan calls for shifting from a 50/50 split to investing nearly 70% of operating resources on a ridership goal.
- All other studies in which we have been involved have led to policies devoting between 50% and 80% of resources to ridership.

However, these observations should not cause any "peer pressure." Different places have different values and development patterns, and the ridership vs. coverage trade-off is a non-technical question about priorities that should reflect the value judgments of the people and representatives in Henrico.

Balancing weekday, evening and weekend service
Within Henrico County, GRTC Routes do not provide service after 8pm or on weekends. Yet most people still need to travel on weekends (especially people who work in the service industry). Also, GRTC operates many routes only during rush hours, and also offers higher frequencies during rush hours on all-day routes. In particular, many Henrico routes are peak only.

Rush-hour-only routes are sometimes designed to target the highest-demand time of the day. Yet, as we discuss in this report, GRTC's peak-only routes are less productive than most of its all-day routes.

All people, regardless of their income, value flexibility and spontaneity. If a transit service does not support a midday trip home to pick up a sick child, or a late night at the office finishing a report, more affluent people can easily respond by using a private car. Even very low-income people who need to travel at uncertain times will find another option (such as a ride from a family member, or a very inexpensive car) if the transit network does not offer them flexibility. Only a few people are willing to build their lives and their commutes around a peak-only route.

As of the 2010 Census, 29% of U.S. workers did not work a traditional weekday, daytime schedule. Add to this population the large proportion of people who work a second job, are studying, are retired, or are not working, and we can imagine the proportion of Henrico residents whose essential travel needs go far beyond the morning and evening weekday peaks.

Why is extra service at rush hours more expensive? It has higher costs than all-day service because it requires a larger fleet and more infrastructure for just a short period of service.

It might therefore be reasonable to expect *higher* productivity, and more crowded buses, during rush hours than during other (less expensive) times of day. Each rush hour passenger is costing GRTC more to serve than a passenger riding at midday, yet rush hour passengers are treated to lower levels of crowding and shorter waits.

> Which is more valuable: intense service during rush hours, or service that is available all-day and all-week for many different kinds of trips?

Thus, Henrico County may want to ask itself whether GRTC service in the county is a rush-hour-transit-service that runs some service at other times, or an all-day-transit-agency that supplements service during periods of high demand. (Periods that may or may not line up with the traditional morning and evening traffic peaks.)

A separate but related question is about weekend service. While professional jobs are most intense Monday through Friday, service jobs are most intense on weekends. Other types of work and activities happen 7-days-a-week: health care commutes, shopping and errands, trips to visit or worship, and all the other types of trips that people take as part of a full life.

Increasing evening, weekend and holiday service can serve ridership-related values (because all-week transit networks tends to attract higher ridership than limited-day networks) and coverage-related values (because low-income people, in particular, badly need to access jobs on weekends and holidays).

Should any service be shifted from weekdays to weekends? Should service be shifted from weekday daytimes to evenings? Within a fixed budget, lengthening the span of service each day or each week would require reducing weekday frequencies or reducing coverage (i.e. cutting some routes).

Is the current level of service enough?

The Richmond region currently invests less in service per capita than many of its peers, and receives proportionally low ridership per capita as a result. Ridership and productivity have also declined since 2012.

While it is certainly possible to increase transit ridership without raising more money, doing so requires cutting low-ridership coverage services.

If Henrico County does decide to shift resources from coverage services to higher-ridership services, there may still be an appetite in the county for higher levels of service overall. With the recent development of higher-density, mixed-use nodes in places like Rocketts Landing and Libbie Mill and plans for similar redevelopment at Innsbrook, a reassessment of the total amount of service provided is worthwhile.

2 Market Assessment

Many people are under the impression that transit ridership is entirely within the control of a transit agency, but this is rarely the case. Land use, development, zoning, urban design, density, highways and street patterns have enormous effects on transit's usefulness and therefore on its ridership. This section reviews a number of statistics and indicators highly relevant to quality and size of the transit market in different parts of the GRTC service area.

For this reason, transit providers like GRTC collaborate with municipal planners, counties, and other agencies to write plans and policies recognizing the relationships among these factors. These factors are outside of the direct control of GRTC, and yet they impact ridership and the costs GRTC must bear to attract that ridership. Henrico County is therefore an essential partner in developing high transit ridership on the GRTC network within the County. GRTC cannot do it alone.

Development Patterns Affect Transit Ridership

A good way to visualize the different ways development and land use impact ridership and costs is to ask: *"How far do we have to drive a bus to serve 100 people or jobs?"* The longer this distance is, the higher the cost to reach those people and jobs.

If a transit agency is pursuing high ridership, it will naturally focus service on places where it has to drive a bus only a short distance to serve large numbers of people. If high ridership is not the goal, then the agency is free to drive longer distances, at a higher cost, to reach smaller numbers of people.

Figure 6 offers a simple distillation of four ways that the built environment affects transit ridership potential:

- **Density**: How many people, jobs and activities are near each bus stop?
- **Walkability**: How many of the people near the bus stop can actually walk to the bus stop?
- **Linearity**: Can transit reach large numbers of people by traveling straight, direct paths?
- **Proximity**: Can transit reach large numbers of people without crossing long, low-demand gaps?

A transit provider can influence the level of ridership their services generate, within their fixed budget, by targeting corridors and places where the "Ridership Recipe" is in effect. However, they cannot directly control the urban form of the places they serve. Without dense, walkable places with connected streets, where demand is continuous along straight transit paths, even the best transit service is unlikely to achieve high ridership. The transit agency can try to provide useful service, but without support from the built environment, the potential for transit ridership will always be low.

In the following pages, we look at the Richmond transit market—measuring the potential for high ridership—with these factors in mind.

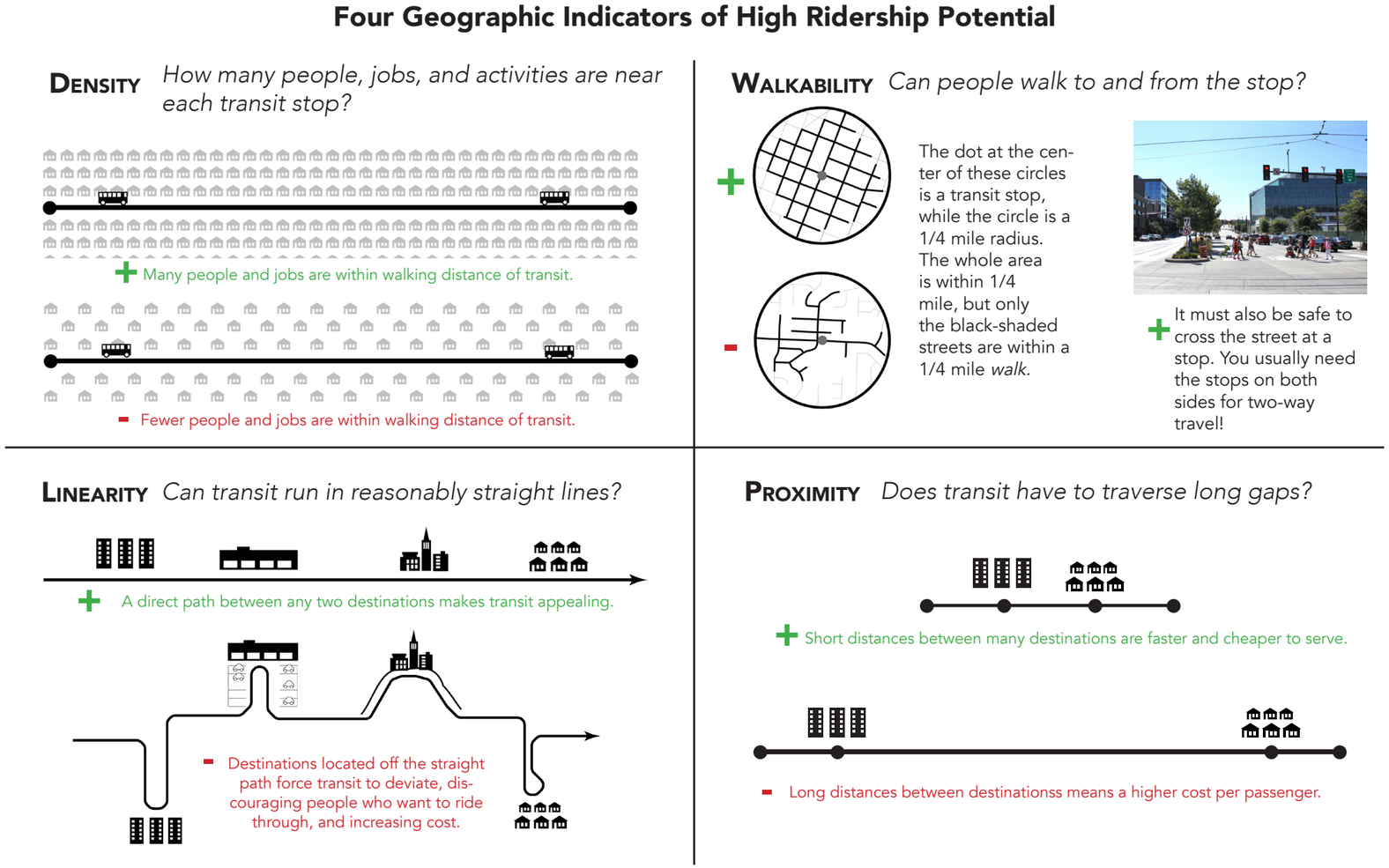


Figure 6: High transit ridership depends enormously on geographic and development factors. Density, Walkability, Linearity and Proximity are chief among them, and the City of Richmond controls or influences all four.

The maps on this page and the following page show the densities of residents and jobs in Henrico County and adjacent jurisdictions.

In planning, people sometimes react strongly to the word "density" based on their personal experiences and cultural assumptions. Yet density describes a geometric and geographic fact that matters enormously for transit – it is simply the number of people close to any given transit stop.

Market Assessment

Residents

While not all trips start or end at home, nearly everybody makes at least one trip starting or ending at home on most days. Further, places with many households are also destinations for other people, whether for visiting, worship, caring for family or home-based work.

The map at right shows the density of residents in Henrico County and adjacent jurisdictions.[1]

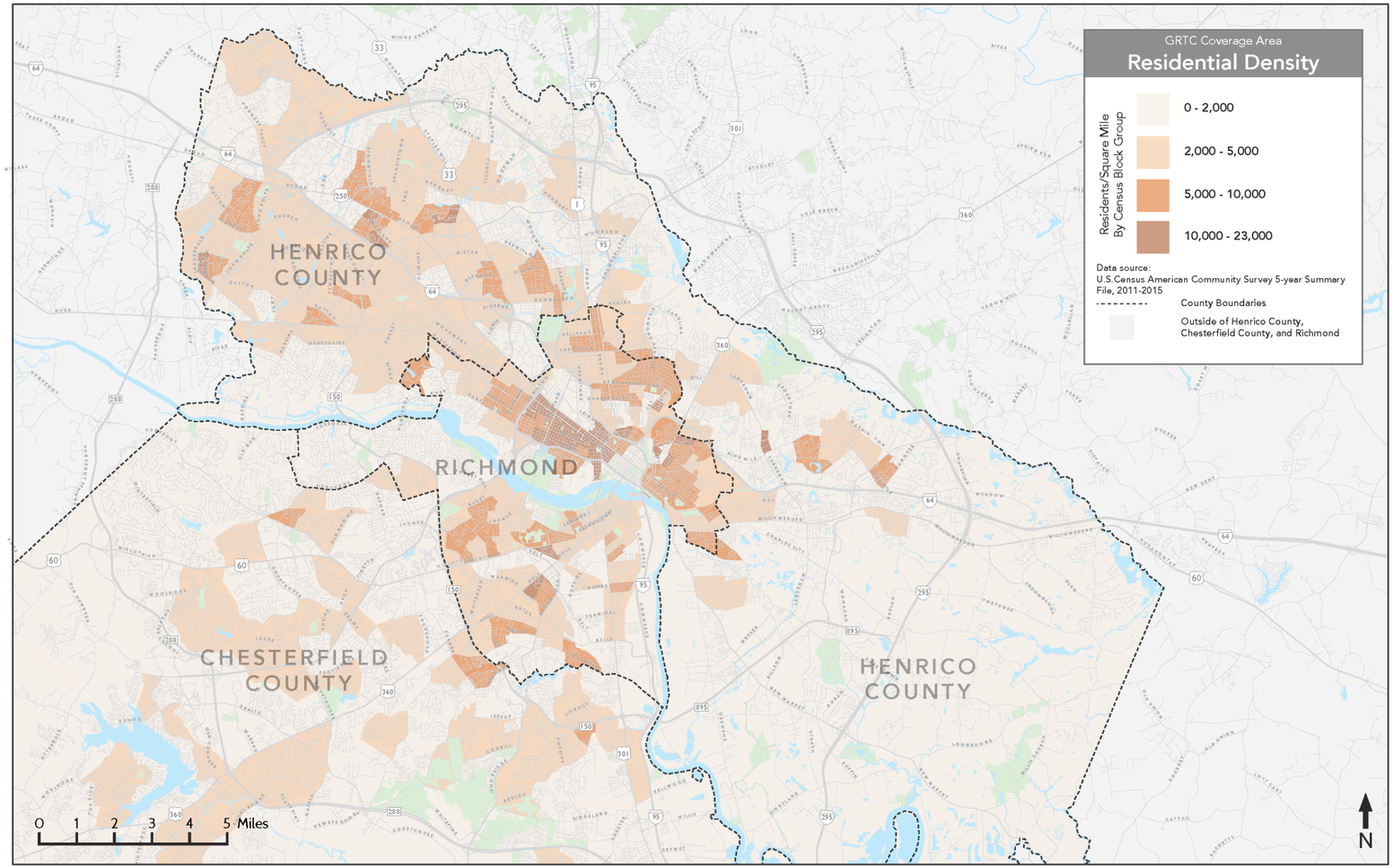


Figure 7: Residential density in Henrico County is highest in the western parts, particularly along Broad Street from Parham to Pemberton.

1. The zones in this map are quite large, some of them too wide for most people to walk across. Many of them can't be crossed at all for lack of through-streets. These are limitations of this type of map, in transit planning, because such distances and barriers can make or break transit access for people who live on one edge of a large zone.

In addition, the average density over such large areas can be misleading: a moderate-density zone could represent many low-rise apartments, or a single big apartment tower surrounded by empty lots. During this planning process, we will not rely solely on these maps, but will use aerial images and field work to look more closely at where in each zone people and jobs are concentrated.

Jobs

Job density is an even better predictor of transit ridership than residential density. It shows us not only where people go for work, but also where they go for services, shopping, community, health care, and more.

The map at right shows the density of jobs (and of other important destinations) in Henrico County and adjacent jurisdictions

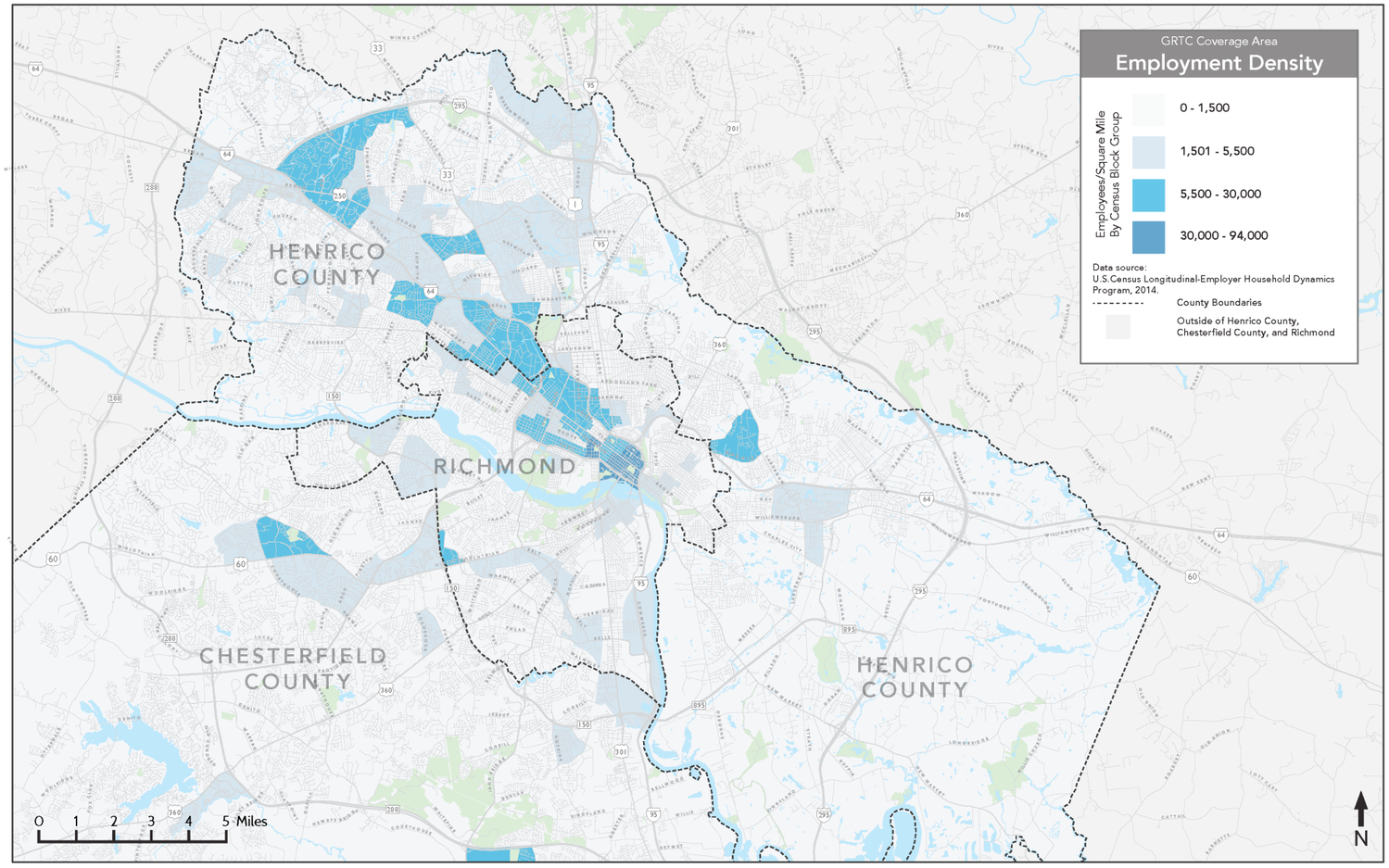


Figure 8: Job density in Henrico County is highest in the western parts of the County, particularly along Broad and Staples Mill near Willow Lawn and within the Innsbrook Business Park.

2. The employment data used for this map is the best available, but it does contain a flaw, which is "headquartering." An employer whose employees are out in the field may report those jobs as being located at headquarters. This is likely a problem for the many state agencies headquartered in downtown Richmond. It may also be a problem for the school district and large hospital systems (such as the VA), whose employees are shown as working at the headquarters instead of at the local schools, hospitals and offices.

In addition, the map on this page shows this employment data in areas called "Census block groups." Some of these block groups are very large, and we cannot know from this map alone where in that large area the jobs are actually located. Depending on the street connectivity within each block group, and its size, jobs on one side of a block group might be very far away from transit service on the other side. For this reason, this map is not the only source of information transit planners will use for the Richmond Transit Network Plan. Aerial imagery, field work and local knowledge will be essential.

Activity

In the map at right, residential and job densities are combined into Activity Density. This allows us to see how the total density of activities, the mix of uses, their proximity and their linearity could affect transit ridership across Henrico County. Shades of purple indicate of mixed jobs and housing.

This map of Activity Density gives us the full picture of how many people and jobs might be around any given transit stop. In terms of ridership potential, we can observe that:

- The most continuously dense part of Henrico County runs in a band along and near Broad Street from Willow Lawn to Short Pump. In terms of the Ridership Recipe, this section of the county offers **density, linearity** and **proximity**.
  - On Staples Mill density is moderate all the way to Parham Road while on Broad it continues out to Short Pump. Broad Street is mostly commercial and retail, while Staples Mill has more industrial employment as well. Both of these corridors offer **density**, **proximity** and **linearity**.
- To a lesser degree, the East End also offers continuous, **proximate density**, along Nine Mile Road through Highland Springs.
- The northern parts of Henrico, along Brook Road, has relatively low overall density, and what dense neighborhoods do exist are less **proximate** from one another.
- Similarly, the pockets of higher density in western Henrico along Patterson and Quioccison are separated from each other by lower density development, creating gaps in the **proximity** of destinations.

Though it isn't one of the four major factors in the Ridership Recipe, the mix of land uses along a transit route also affects ridership on that route. Transit routes serving purely residential neighborhoods tend to be used in only one direction – away from the residential neighborhood, towards the center of jobs and services. In residential areas that are far away from any jobs and services, transit routes tend to be used only for long commutes to and from work, and not at other times of day.

The "directionality" of ridership on a transit route limits how much ridership it can attract relative to its cost, because:

- If ridership is only high during the morning and evening rush hours, that means the transit provider must pay to run mostly-empty buses during the rest of the day (or must pay drivers extra for split shifts).

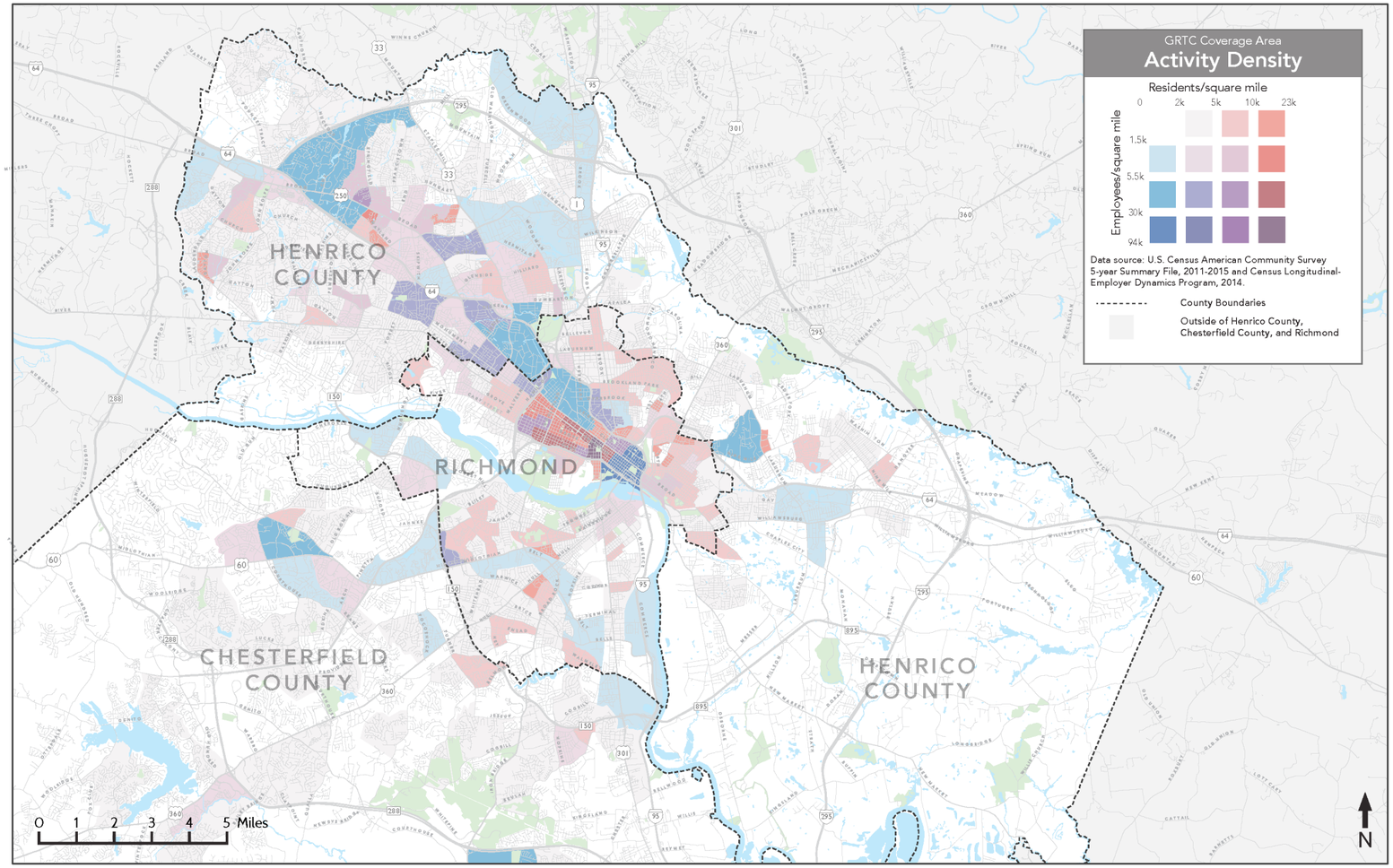


Figure 9: In this map, residential and job densities are combined to show Activity Density. Intense red areas have high residential density. Intense blue areas have high job densities. Shades of purple indicate mixes of jobs and housing.

- If ridership is only high in one direction during each peak, then the provider must pay to run mostly-empty buses back in the other direction.

Thus all-day and two-way demand, along an entire route, yields higher ridership relative to cost. All-day and two-way demand tends to arise on corridors that have continuous mixtures of housing, retail, services and jobs.

A mix of uses along a transit line also makes the service far more useful to riders. The time they must spend traveling to the next useful place is potentially much shorter. They are also more able meet multiple needs on their transit commute – hopping off halfway home to get groceries, or meet a friend, and then hopping back on again.

Zero-Car Households

People with limited access to personal vehicles must find other ways of traveling, whether they carpool, cycle, walk, used a shared car or take transit. Which of these they choose has everything to do with availability and usefulness.

If transit is of limited use for the trips a person needs to make, they are less likely to use it, even if they don't have a car in their household. This person is not necessarily "transit-dependent" just because they don't own a car. However, they do have a greater inclination toward transit use because they don't have a car in their driveway, always ready to go.

The map at right shows where households with no vehicle are numerous. Neighborhoods where car-free households are numerous are great prospects for high-ridership transit.

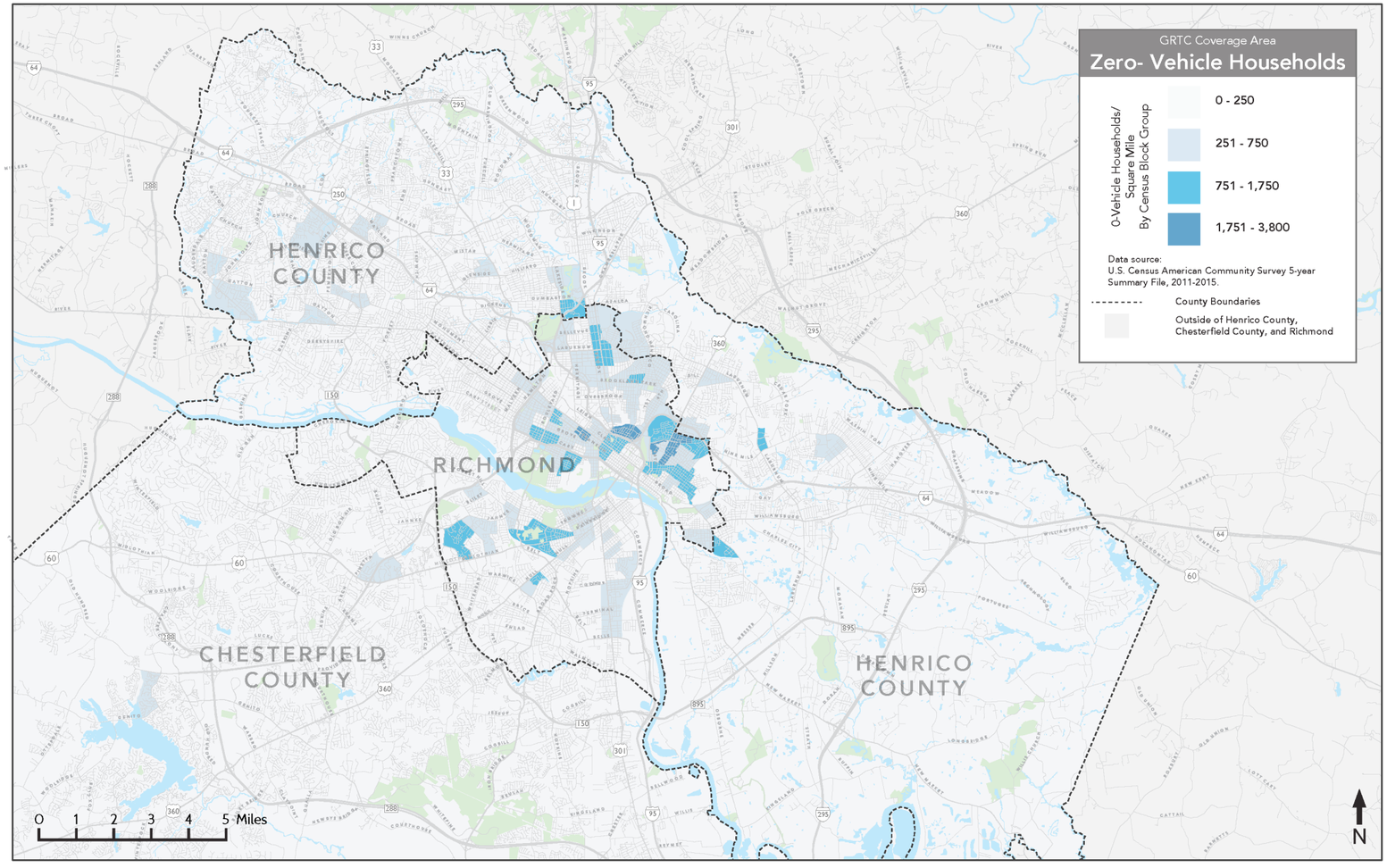


Figure 10: This map shows the number of households that reported having no personal car. While most of the darkly-shaded areas on this map also reported high rates of transit commuting, a few do not. This may relate to the usefulness of walking and cycling; the overall levels of employment; or the usefulness of transit service currently offered there.

3 Need Assessment

The previous Chapter assessed transit markets across Henrico County, and its neighboring jurisdictions, for their potential to generate high transit ridership.

However, in nearly every community transit serves purposes other than ridership. One of transit's most important non-ridership goals is to meet severe needs for lifeline transportation. Transit may also be expected to distribute access equitably, whether that equity is measured based on geographic area, political representation, financial contribution, historical injustices or legal entitlements.

In this Chapter, we assess some of the factors that are relevant to transit's non-ridership purposes. The division of these factors into "Market" and "Need" is not perfectly tidy: Poverty is included under "Need," even though people with low incomes are more likely to ride, and thus offer high ridership potential. Walkability is included under "Market," even though there are places where the walking environment is so terrible that transit service is needed as a lifeline, even for extremely short trips.

In transit planning, words like "need" are often paired with the term "transit dependence." The industry sometimes divides people into "transit dependent" and "choice riders." The implication (intended or not) is that "dependent" riders will use the bus no matter how bad it is, but "choice" riders must be wooed with premium service. Yet every person, at every income, has some kind of choice about how to travel. At worst, if the transit is truly useless to them, they may choose not to travel at all.

In some families, for example, someone without a car of their own can depend on family members for a ride. Family members can carpool, driving a long way together twice each day. People with disabilities often resort to taking taxis to essential appointments. Elderly people may choose to travel as little as possible, and use transit or get a ride when they absolutely must. Young and fit people may choose to walk or cycle rather than wait for the bus. Thus, many residents of the Henrico County ultimately have a choice about whether to use transit.

Low-Income Residents

The map at right shows the density of people living in poverty in Henrico and surrounding jurisdictions.

An map of poverty in Henrico arguably belongs in the preceding Chapter about ridership potential. Individuals with lower incomes tend to ride transit at higher rates than other people. Yet they also have a need for transit access that exists whether or not they ride in large numbers from any given place.

Transit is often tasked with providing affordable transportation for low-income residents, and this is a type of coverage goal. Federal laws also protect those with low incomes from disparate transportation impacts, which can lead agencies to provide transit service in places where poverty is high even if this does not maximize ridership.

Understanding where there are large numbers of low income residents (and where else they travel) is thus important in terms of both ridership goals and coverage goals.

Some people think that transit, especially all-day transit, is only useful to people who cannot afford a car. This is a simplistic view of a complex matter. Persons with lower incomes do not automatically choose transit because it's the cheapest option. The service available to them must be useful and reliable for the kinds of trips they need to make, otherwise they will find other options, such as walking, cycling, taking a taxi or asking friends and family for rides.

What is certainly true is that people with fewer resources have an incentive to spend less on transportation. The more carefully a person must manage their money, the more attractive transit's value proposition may be. In low-income and moderate-income families, not having to purchase, insure and maintain a second car could free up enough money for school, college or some other productive investment.

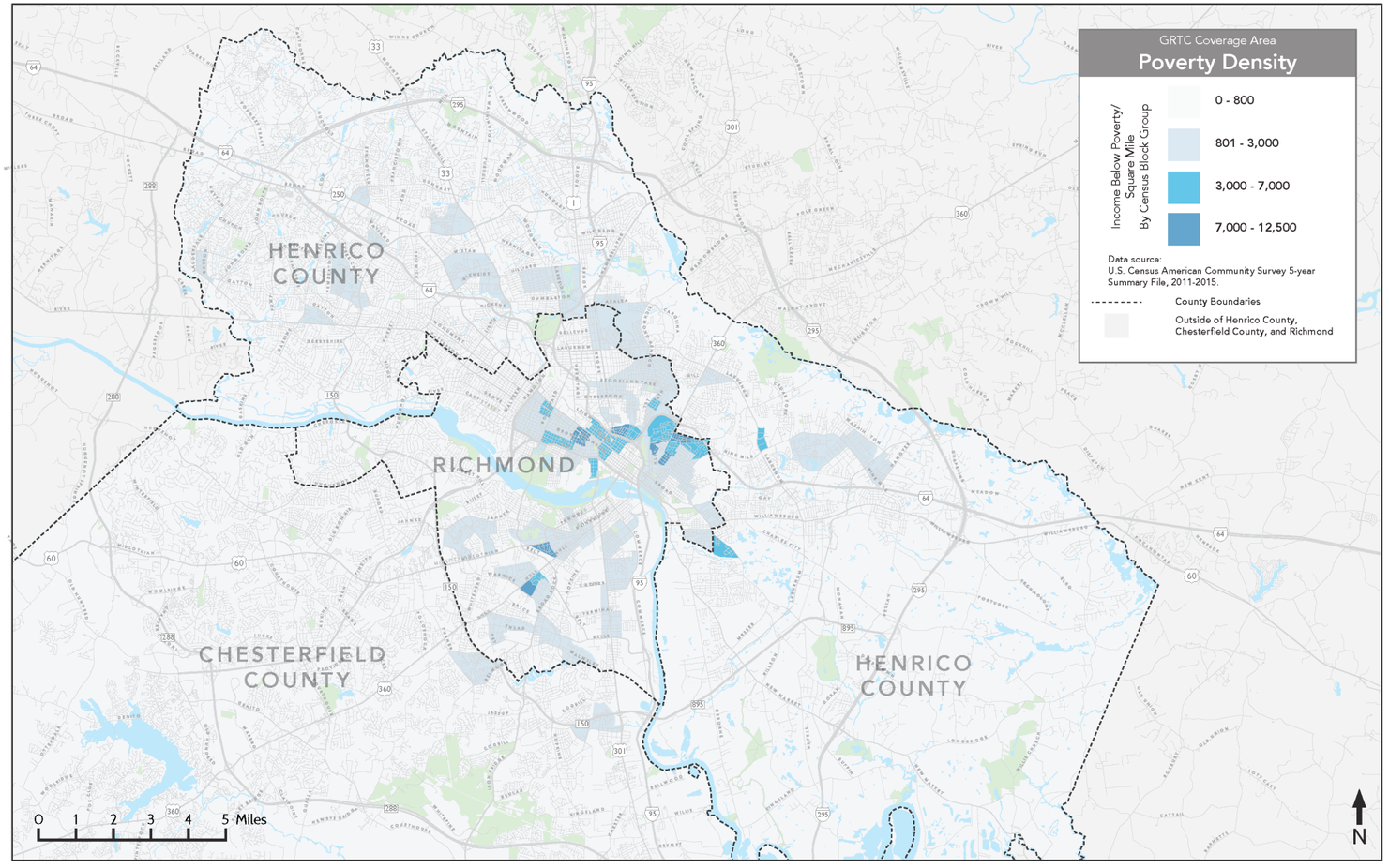


Figure 11: This map shows the density of people living below the federal poverty line in the Henrico and surrounding areas.

Race and Ethnicity

The map at right shows where white, black, Hispanic and people of other races and ethnicities live in Henrico County and the surrounding area. Each dot represents 18 residents. Where many dots are very close together, the overall density of residents is higher. Where dots of a single color predominate, people of a particular race or ethnicity make up most of that area's residents.

While information about people's income tells us something about their potential interest in or need for transit, information about ethnicity or race do not alone tell us how likely someone is to use transit. However, avoiding placing disproportionate burdens on people of color, through transportation decisions, is essential to the transit planning process. Transit agency policies that protect non-white people from negative impacts are one type of coverage goal. Such policies might state, for example, that service to high-density and high-minority neighborhoods should be prioritized even if such service would not maximize ridership.

In addition to local policies, federal civil rights law protects people from discrimination in the provision of transit service on the basis of their race or ethnicity. It is important to understand where large numbers of non-white people live, so that service changes can be evaluated in light of impacts to protected people.

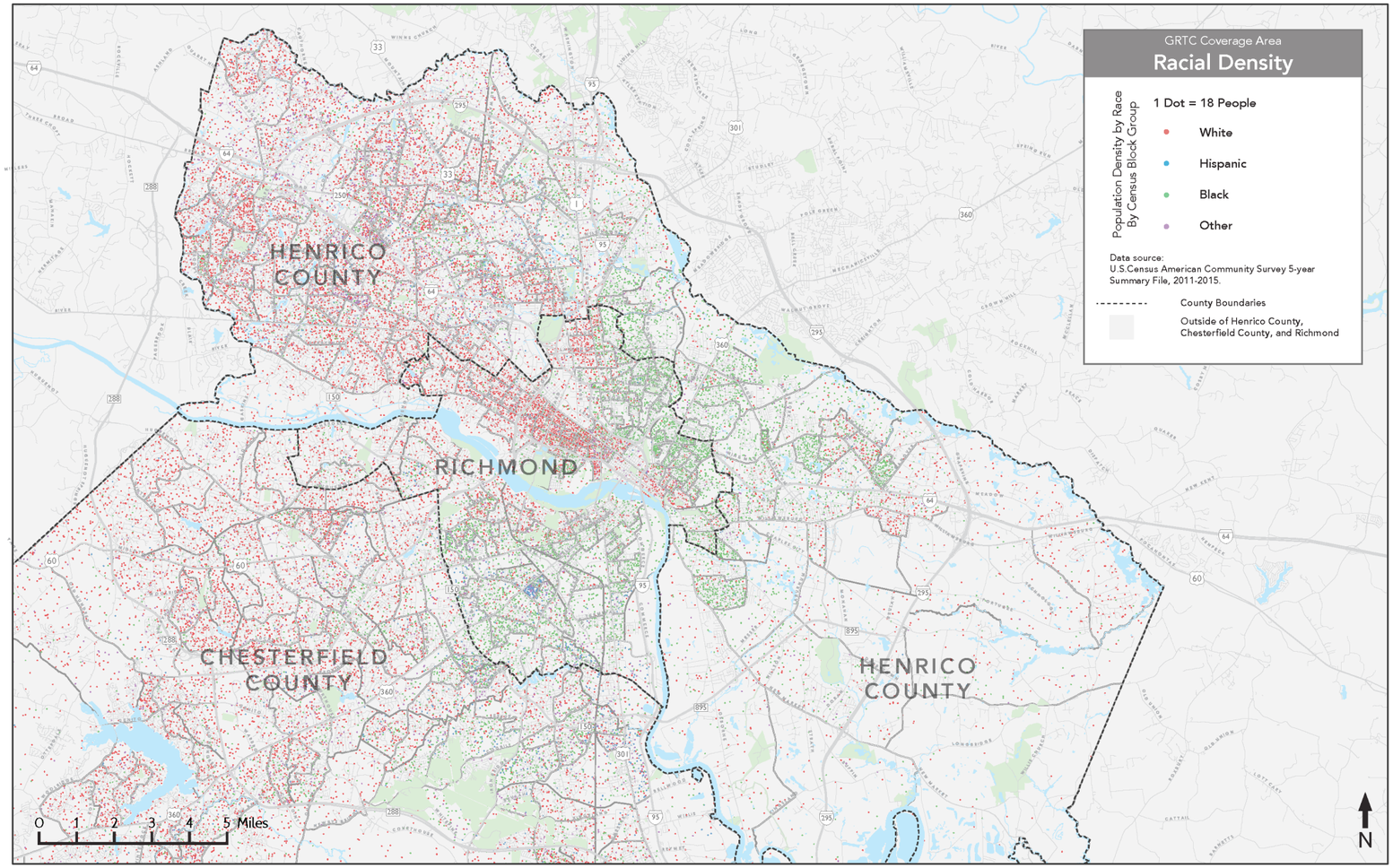


Figure 12: Each dot in this map represents 18 residents. Dots are color-coded based on residents' races or ethnicity: red dots represent non-Hispanic whites; green dots represent blacks; blue dots represent Hispanics. All other races and ethnicities are represented by grey dots. Overall, residents in Henrico County are 55% white, 29% black, 7% Asian and 5% Hispanic.

4 Transit Service Analysis

The map at right shows GRTC's fixed route transit network.

Routes are color-coded based on their midday frequency. Routes that do not operate midday, or have many hours between trips in the midday, are shown in light green with dotted lines. Routes that make non-stop express trips from outlying areas into Richmond also make few or no trips in the midday, and they are shown in violet.

While this map simplifies routes into frequency categories, in reality, most GRTC's routes have very variable frequencies throughout the day.

These frequency designations correlate with the presence or absence of weekend service. Peak-only and express routes do not operate on weekends. Routes that do operate on weekends generally have lower frequency, and shorter span, than in their weekday schedules.

Frequency

In transit conversations there is always a great focus on *where* transit is provided, but unfortunately little concern about *when* it is provided. The "when" of transit service consists of:

- Frequency: how many minutes between each bus, which defines a passenger's average and maximum waiting time, and
- Span: how many hours a day, and days a week, it runs, which defines whether the service exists at the times when a passenger needs it.

Low frequencies and short spans are one of the main ways that transit fails to be useful, because it means service is simply not there when the customer needs to travel. Low frequencies also mean that connections from one route to another require a long wait.

Even though Google Maps or a phone app can provide directions, most people still retain a mental image of their city that helps them understand their travel options in any situation. Frequent transit service is effective at attracting ridership because it has the simplicity of a road: you can use it anytime you need to. Frequent service allows someone to maintain a map of the transit system in their head that is like a road map.

Frequent service:

- Reduces waiting time (and thus overall travel time).
- Improves reliability for the customer, because if something happens to your bus, another one is always coming soon.
- Makes transit service more legible, by reducing the need to consult a schedule.

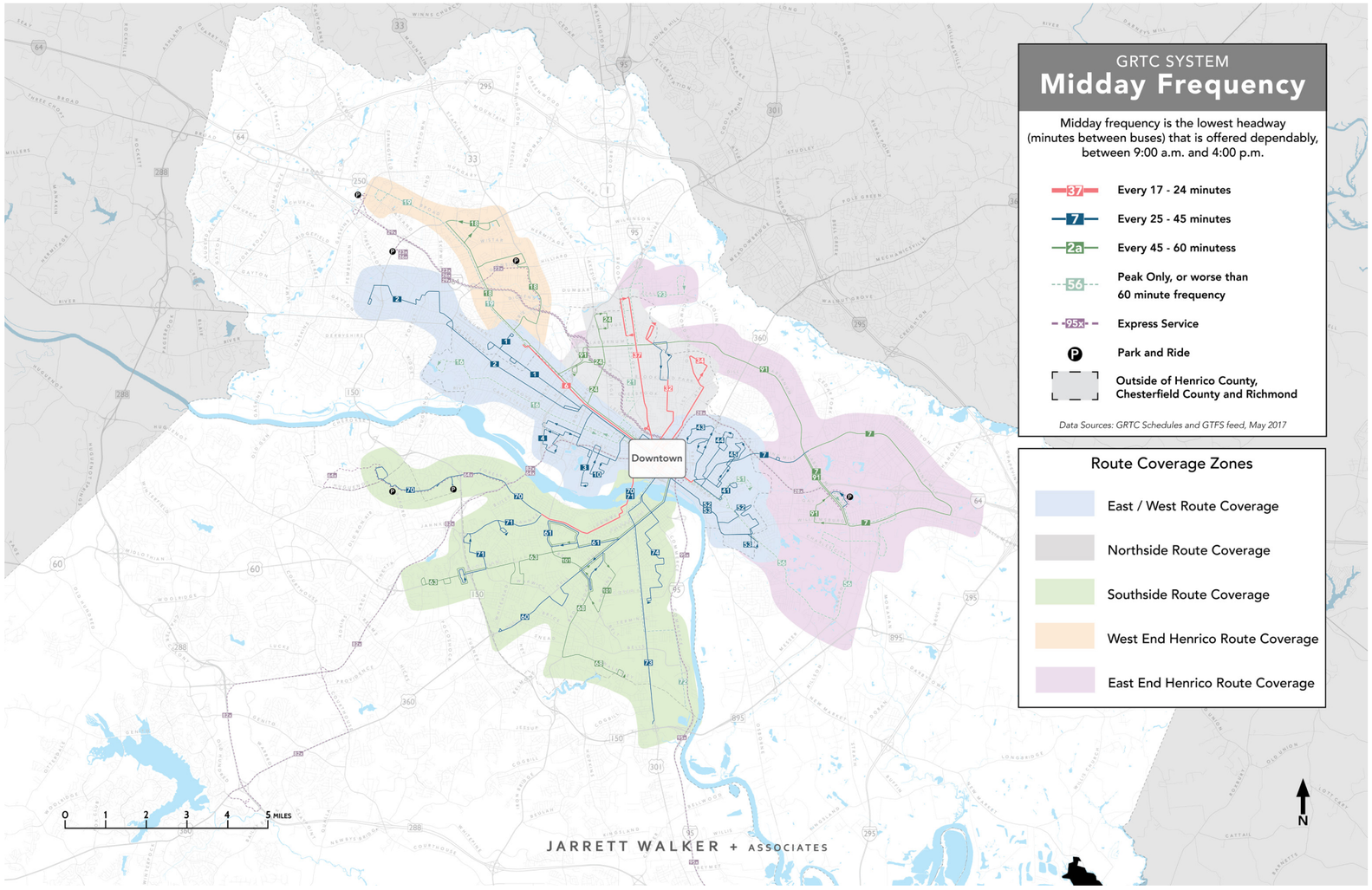


Figure 13: In the GRTC transit network, we have defined "frequent service" as service that comes every 24 minutes or less. In many cities of Richmond's size, the threshold for frequent service is lower, at 15-20 minutes. GRTC operates four routes that come every 24 minutes or less, during the weekday midday: the 6, 32, 34 and 37. Routes 70 and 71, combine to offer frequent service on their shared segment.

- Increases capacity (moving more people, with less crowding) on busy routes or at busy times.

But frequency is expensive—a line on the map that represents just one bus an hour costs the agency 1/4 as much as a line that represents a bus coming every 15 minutes.

In order to think about whether any frequency is "frequent enough," imagine waiting one-half of the frequency, on average (since, statistically, you will) and ask yourself whether you could tolerate waiting that long, regularly, in exchange for the benefits of riding transit.

Many people assume that today, with real-time transit arrival information

(like GRTC's Transit On The Go and Bus Tracker apps) and smartphones, nobody needs to wait for a bus anymore, and frequency therefore doesn't matter. If a bus only comes once an hour, that's fine, because your phone will tell you when it is a few minutes away and you should start walking.

Despite all these new technologies, frequency still matters enormously, because:

- Waiting doesn't just happen at the start of your ride, *it also happens at the end.* You may not need to leave the house much before your departure, but if your bus is infrequent and the schedule doesn't happen to line up perfectly with your desired arrival time, you have to choose between being very early or too late. If you start work at 8:00 a.m. but the bus passes your workplace at 8:10 a.m., you can be 50 minutes early or 10 minutes late. Or you can drive.
- Many of the places we go don't let us hang out until our bus's arrival is imminent. We can easily do this when leaving home, but it is more awkward when leaving a movie, an office that is closing, a workplace at the end of your shift, or someone else's house.
- Real-time arrival information doesn't make the bus more reliable, but frequency does. Your smartphone can tell you when your bus is arriving, but it cannot prevent your bus from having a problem and being severely delayed, or not showing up at all. Only frequency – which means that another bus is always coming soon – can offer this kind of reliability.

Furthermore, even with the availability of new technologies, two other burdens of low frequency fall more heavily on those who tend to have fewer resources:

- People who work in service or retail need to be early or on time for work every time, and they must leave their workplace after their shift; they can't decide to work late until it is time to catch their hourly bus.
- White-collar professionals may have the money and the social permission to hang around and wait for an infrequent bus, whether in their office, a Starbucks, at a bar or on the street. However, non-white people and persons with lower incomes may feel more vulnerable sitting in public places for a long time, and are less likely to have disposable income to pass the time in a private establishment.

It is thus easy to assume that everyone can plan their day and their lives around an infrequent bus schedule, or that the consequences of a missed bus are bearable. But this assumption depends on the idea that all people navigate public and private spaces with the same level of comfort and privilege. It is important to remember that other people have a very different experience of low-frequency transit service.

Radial Networks and Transfers

The GRTC transit network is highly radial. A radial network design ensures that anyone looking to travel downtown can make their trip without the need to transfer between routes. Because there is ample employment and commercial activity in downtown Richmond, it is important for people to be able to reach the center of the city easily, so the radial structure works well.

The geographic structure of a network essentially dictates the transfer pattern. The major transfer points in any city are the joints or nodes in the transit network. The transferring that happens on GRTC's network is primarily downtown, because that is where radial routes naturally converge.

There are a few routes in the GRTC network that connect outside of downtown, such as Route 91 on Laburnum that provides an orbital (or crosstown) connection from eastern Henrico to western Henrico through the city. But Route 91 is very infrequent, so any transfer to or from other routes would involve a long wait.

An un-timed connection between two buses that come every 60 minutes could require a 30 minute wait, on average, and in the worst case a 59-minute wait! If one of the buses comes every 90 or 120 minutes the waits are even longer.

A transfer between low frequency routes can be appealing, however, if the routes are timed to allow transfers at regular times. In a timed-connection, multiple buses are scheduled to arrive at a designated transfer point (which can be a formal Transit Center, or an intersection, or a shared bus stop) at the same time. The buses sit together for a few minutes so that people can connect between any two of them. Then the buses leave together and continue along their routes.

Of course, the worst outcome of all is an unreliable connection of infrequent services. If buses run every 60 minutes and their connection is pulsed, but one is chronically late, then those passengers are regularly waiting almost 60 minutes for their connection. These are the situations in which transit riders are seen sprinting after a bus that is pulling away.

Scheduling repeated timed-connections among infrequent routes requires recurring frequencies. For example, a pair of routes can connect repeatedly throughout the day if both have 60-minute frequencies. Or, if Route A comes every 60 minutes and Route B every 30 minutes, they can connect on every-other trip of Route B. As long as their frequencies repeat reliably, and divide into one another (as 30 does into 60), then the timed-connection can be scheduled to happen many times each day.

Timed-connections are much less practical when every route has a fairly unique frequency, as in the current GRTC schedules. Routes that come every 17, 19, 22, 27, 31, 37 and 41 minutes could only meet one another once in the day, and then they will never be back at the same time again. The current frequency of service on existing GRTC routes, therefore, makes timed connections nearly impossible. The new schedules in the new GRTC network that is being implemented later this year will address this problem for many routes in the system, particularly routes in the City. In addition, Henrico Routes 7, 19 and 79 will be scheduled with clockface frequencies that could allow timed transfers to other routes downtown or at Willow Lawn.

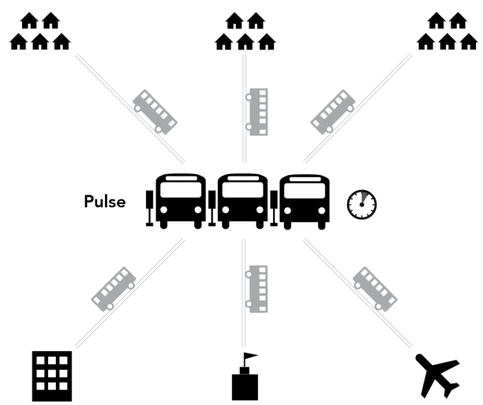


Figure 14: In a timed-connection, multiple low-frequency routes are scheduled to come together regularly, dwell for a few minutes so that passengers may transfer among them, and then depart again.

"Pulse" BRT

In 2017, GRTC and the City of Richmond and Henrico County will open a new bus-rapid transit (BRT) line called "The Pulse."

The Pulse will offer fast and frequent service from Willow Lawn through Downtown on Broad Street, and then along 14th and Main Streets through Shockoe Bottom to Rocketts Landing. Construction began in April 2016, and service is expected to begin in late 2017.

BRT offers faster speeds and higher frequencies than local buses. The Pulse will come every 10 minutes in the peak periods and 15 minutes in the midday and evenings. Four features make the largest contributions to the Pulse's faster travel speeds:

- Wider spacing between stops. Stations are spaced 1,000-2,000 feet apart downtown, and 1/2-mile to 1 mile apart in other areas.
- The payment of fares off-board, which will reduce the time vehicles need to spend at stops,
- Level boarding that makes it easier and faster for people to board using mobility devices, and with luggage, bicycles or strollers,
- Traffic signal priority, which increases the likelihood that a Pulse bus gets a green light.

For 2.5 miles of Broad Street, between Adams and Thompson Streets, The Pulse will be in its own exclusive right-of-way, against a center median. However, the Pulse is a "closed BRT" system, so Broad Street local buses would not be able to take advantage of the Pulse's dedicated right-of-way or enhanced stops, and must run adjacent to it, in mixed-traffic.

The development of the "Pulse" BRT presents some opportunities for the Henrico County transit network. With the changes planned at Willow Lawn with the BRT and the Richmond Transit Network Plan, the western terminus of the BRT can become a key hub for connections between local routes and the BRT. Similar opportunities are available at the Rocketts Landing terminus, where new connections to routes for the east end of Henrico are possible.

Peaking

During the peak commute period, transit demand patterns change to a degree, and it's normal for service to change in response. Some agencies, GRTC included, also offer certain routes *only* during the weekday peaks.

The map at right shows the frequencies of routes during the a.m. and p.m. peaks. Some routes that were shown in the map on page 24 are more frequent during the peaks, others are less frequent.

Peaking has some high costs that are often invisible to the public:

- The agency must maintain a large fleet of buses for the peaks, a fleet that sits idle at all other times. For each extra bus that is run during peak times, the agency had to purchase the bus, find land to store it on, pay people to maintain it.
- Peak hour services have a slightly higher average labor cost than service at other hours. This is because GRTC must pay a higher hourly rate to drivers who work swing shifts targeted at providing peak hour service.

The graph on the left below shows how much service GRTC is putting out in each hour of the weekday and the number of boardings in each hour. The graph on the right below shows the same trips and boardings for only Henrico County routes. In general, service and boardings are much more heavily peaked for Henrico County routes and the drop off in mid day service is much steeper.

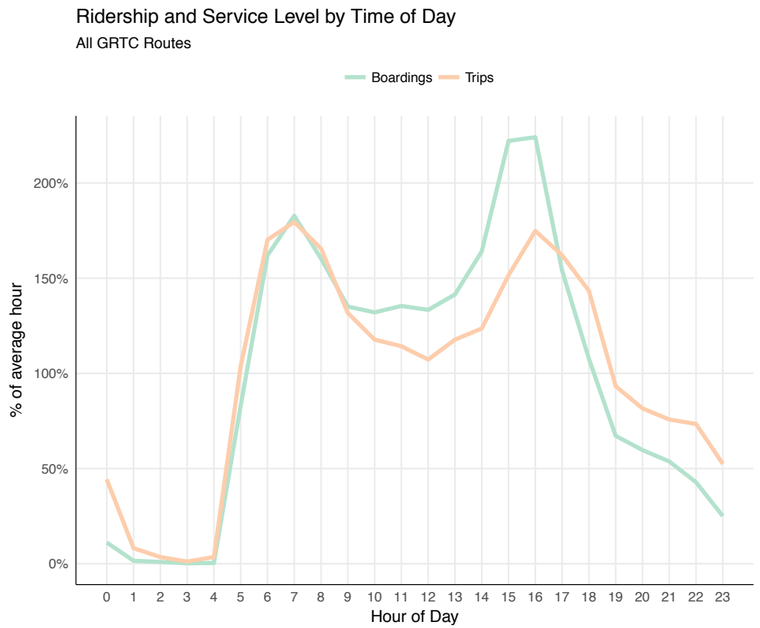


Figure 15: The number of riders and trips made by a bus on all GRTC routes is shown above, for each hour of the weekday. Service peaks in the hours after 7:00 a.m. and 4 p.m.

In addition, Commuter Express routes do not currently connect well with local routes downtown. Some Express routes do go outbound, to suburban destinations, and could be used in combination with the GRTC local network to allow people to make a reverse commute trip to access suburban jobs. One of the main purposes of transit centers, in many cities, is to host timed-connections among infrequent Express routes and local routes. Any such connections, in Richmond, would still happen at a limited number of Broad Street stops.

A key consideration as Henrico thinks about redesigning its network is the interaction between express and local routes in downtown and whether there can be opportunities to provide reverse commute service. The benefits of such service would be positive for Henrico and the City. Henrico routes would get more riders on effectively empty buses that need to return to suburban park-and-ride lots anyway and city residents would get additional options for taking transit to destinations in the county.

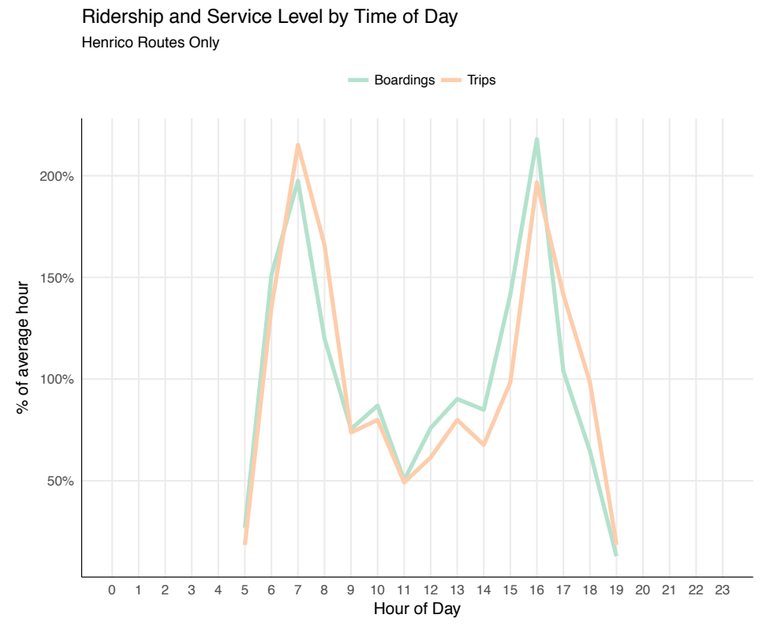


Figure 16: The number of riders and trips made by a bus on all Henrico County GRTC routes is shown above, for each hour of the weekday. Service peaks are steeper and there is a much larger fall off in the mid day for Henrico County routes.

Recent Trends

Overall quantity of transit provided
The chart at right shows the change in the number of service hours that GRTC delivers compared to some peer regions, since 2004. The trend for GRTC is shown in a thick black line, and the average trend for all eight peer regions is shown in dashed red.

Over the past decade, the amount of fixed route transit service GRTC provides has stagnated, while service in most of these peer cities has increased. While service quantity grew in the Richmond region from 2005 to 2009, it has fallen since then, and is today about 7% less than a decade ago.

Note that this chart shows the number of hours of transit service offered, not the dollar cost. It also does not include the other transit services that GRTC and peer agencies operate, such as dial-a-ride, vanpool and paratransit.

While one conclusion from this chart could be that the Richmond region is failing to deliver as much transit as other regions, an equally important observation is that the level of service is also quite variable, as a result of the lack of a consistent funding source from year to year. GRTC must contend with all other demands on the budgets of the local jurisdictions for an uncertain resource level in each budget cycle.

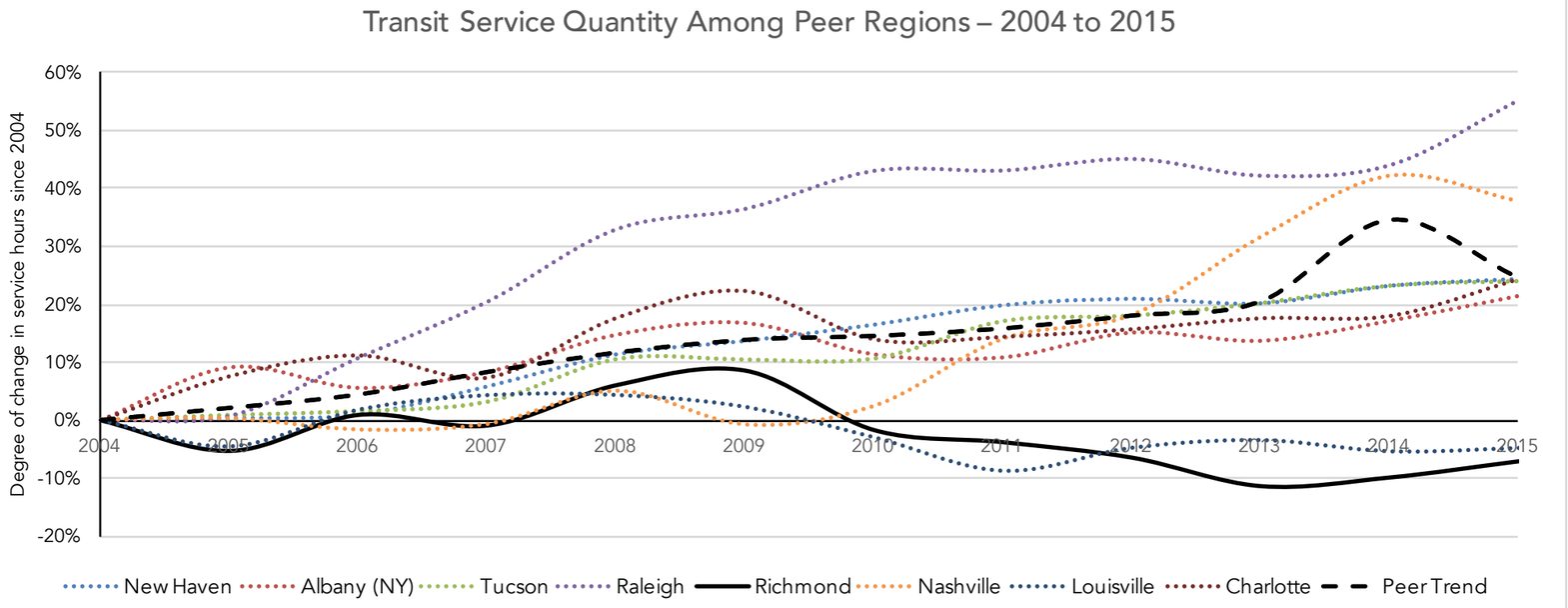


Figure 17: This graph shows changes in the quantity of fixed-route transit service provided, in Richmond and seven peer regions. (It does not include other transit services such as dial-a-ride, vanpool or paratransit.) While the average quantity of service provided in these peer cities has grown by 22% in the past decade, it has dropped in the Richmond area by 7%.

Quantity of service per mile of route

The chart at right, bottom, shows the same decline in service quantity as on the previous page, along with the change in GRTC route miles.

Route miles can be thought of as "lines on the map." The more routes are drawn on the map (regardless of how frequently each route runs or how many days per week) the more route miles an agency is offering.

If the amount of service GRTC provides were holding steady, but it were divided among more route miles, frequency and span would naturally go down.

Yet the amount of service GRTC provides has *itself* declined over the past decade, while the number of miles of routes it operates has grown, so the level of service represented by each line on the map has fallen sharply.

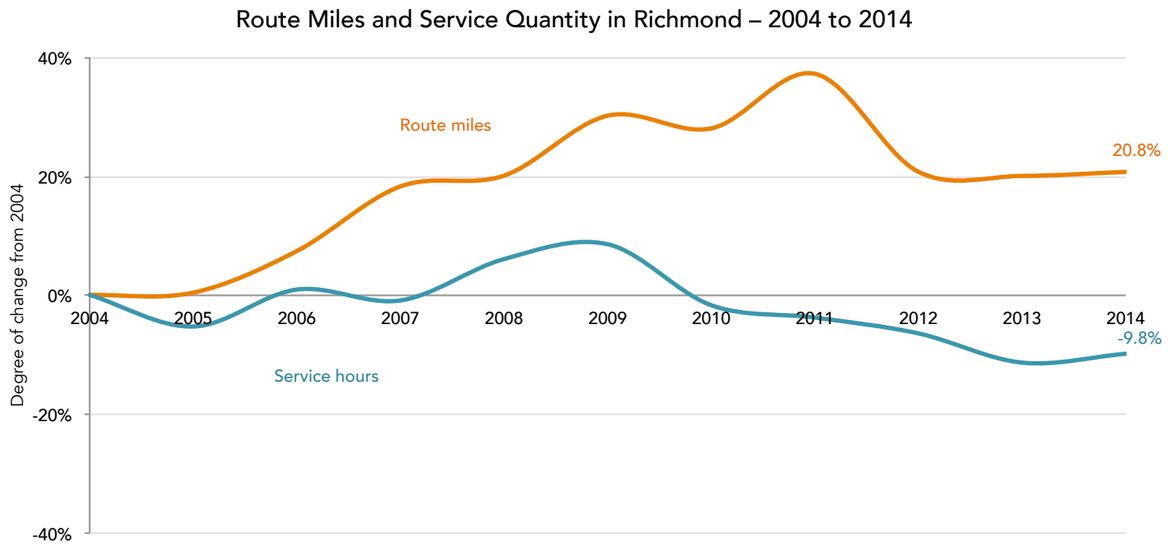
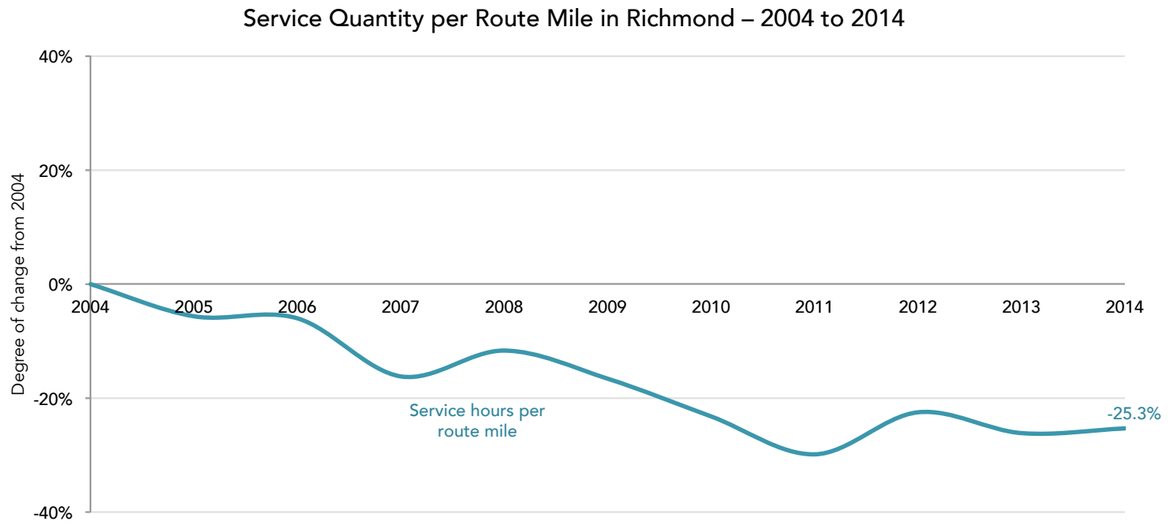


Figure 18: The graph at top shows that while the quantity of service in Richmond has been slowly declining, the number of miles of routes among which GRTC divides service has grown. The graph at bottom shows the inevitable, arithmetic result: each mile of route on GRTC's map actually represents less service. This can only mean worse frequencies, or shorter spans of service within each day or week.



5 Performance

In the previous chapter, we discussed the distribution of GRTC's resources across its service area, throughout the day, and the historical trajectory of its service level and operating expenditures. In this section, "Performance", we examine the return on that investment in terms of the level of ridership and extent of coverage of population and employment this network produces.

Additionally, we examine key indicators for GRTC to a select group of peer agencies, in order to gain a better sense of how GRTC's service offering and outcomes compare to other agencies of a similar size, or serving similar regions. Peer comparisons can be a useful way to explore how outcomes in other places vary as a result of different choices or conditions.

Ridership

Average daily boardings per stop

One measure of transit performance is the amount of ridership it generates. The easiest way to picture ridership is by mapping boardings at each bus stop. Figure 19 shows the average number of daily boardings at each stop in the existing GRTC network, on weekdays. Where multiple routes serve the same stop, their boardings are summed for that stop.

89% of the daily boardings on the network are at stops within Richmond, while 11% are in Henrico County. Less than 1% are in Chesterfield County and Petersburg.

The largest dots in or near Henrico County are:

- At the Willow Lawn shopping center, at the northwest end of the frequent Route 6. This area shows up in the Activity Density map as dark purple – dense with both jobs and housing.
- At the Brookhill Azalea shopping center, where the frequent Route 37 ends.
- At the Gaskins park-and-ride lot where the highest ridership commuter express route starts.

Shopping centers often have high transit ridership, because they are important destinations for the many people who shop there, as well as job centers for retail employees. Ending a transit route at such strong "anchors" makes sense because the buses are full all the way to the end of the line.[3]

3. Suburban-style shopping centers also offer signalized driveways and large parking lots in which to turn around a bus, and are good places for transit operators to take their breaks.

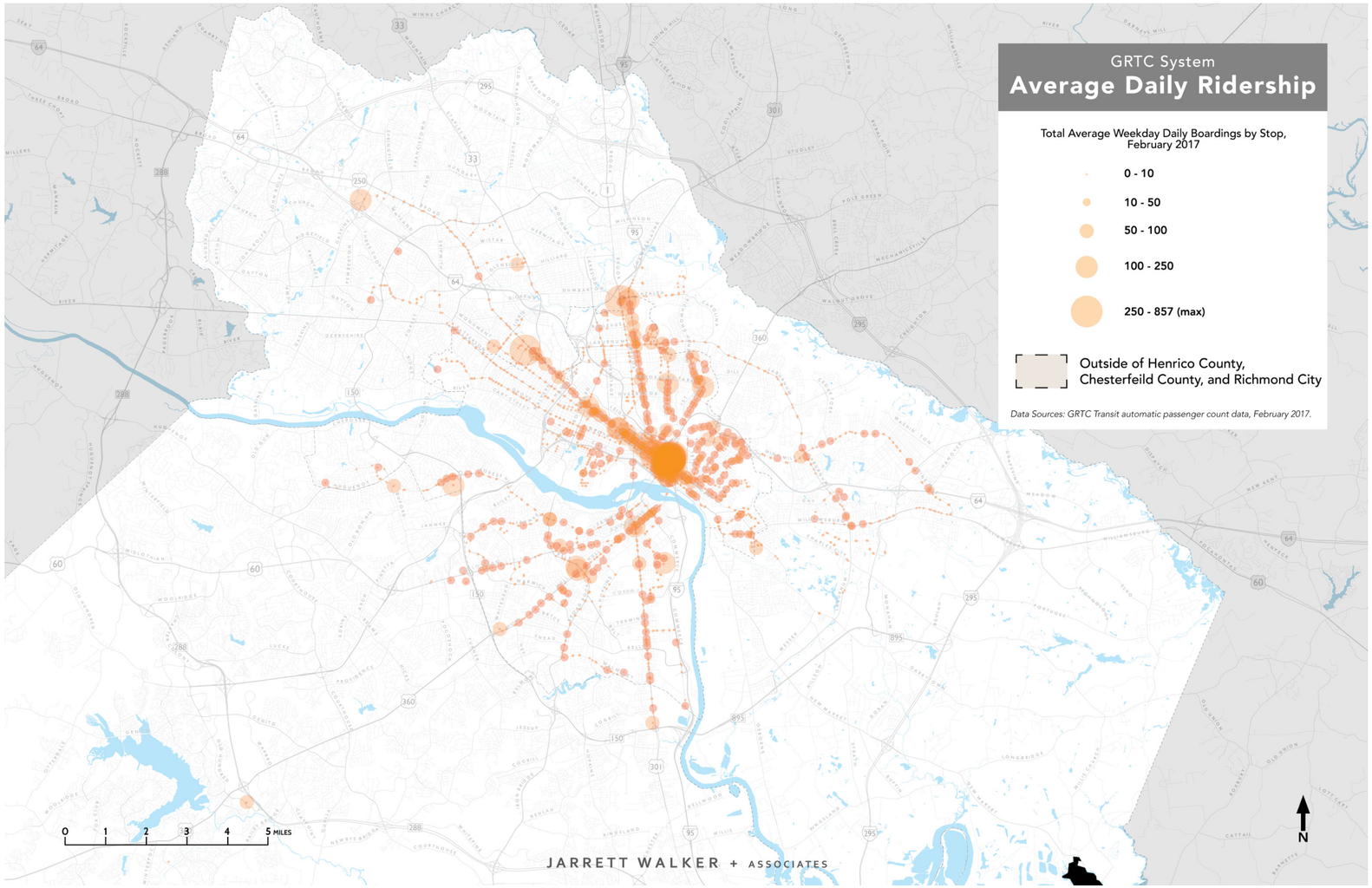


Figure 19: This map shows the average daily boardings at every transit stop in the GRTC network. (Boardings on different routes at a single stop are combined.) The three largest dots in (or adjacent to) Henrico County are at Willow Lawn, Brookhill Azalea and the Gaskins Road Park and Ride Lot.

More frequent services are visible on this map as strings of bigger dots: on Broad, Chamberlayne, North and 4th in the city. But also Route 7 in the county, where there are strings of higher ridership dots on Nine Mile Road.

Network-wide Productivity

Some transit agencies and cities have adopted a goal of "maximizing ridership." Implicit in this statement, however, is a constraint: there is a limit to how much funding is available to increase ridership. The transit agency cannot spend infinite amounts of money pursuing each additional rider in pursuit of "maximum" ridership. The more specific way to state this goal, then, is "maximize ridership within a fixed budget." Even if the budget grows, it is and always will be limited.

People who value the environmental, business or development benefits of transit will talk about ridership as the key to meeting their goals. However, because their transit agency is operating under a fixed budget, the measure they should be tracking is not sheer ridership but ridership per unit of cost. They should not be satisfied with a large dot on the boardings map on page 30, until they know what it cost the transit agency to attract those boardings.

If a transit agency is getting a large number of riders, but it costs them a lot of service to attract each rider, this suggests that even *more* ridership could be attained if some of that service were reallocated to places with higher ridership potential. Only by measuring ridership relative to cost – productivity – can we evaluate how well a route is maximizing its potential ridership.

In this report, productivity is measured as boardings per service hour:

Productivity = Ridership / Cost = Boardings / Service hour

Productivity is strictly a measure of achievement towards a ridership goal. Services that are designed for coverage goals will likely have low productivity. This does not mean that these services are failing or that the transit agency should cut them. It just means that their funding is not being spent to maximize ridership.

The bar chart below shows the productivity of transit service in Richmond compared to some peer regions. Richmond's productivity is relatively low within this group of cities. In other words, considering the amount of service GRTC is providing, ridership is relatively low.

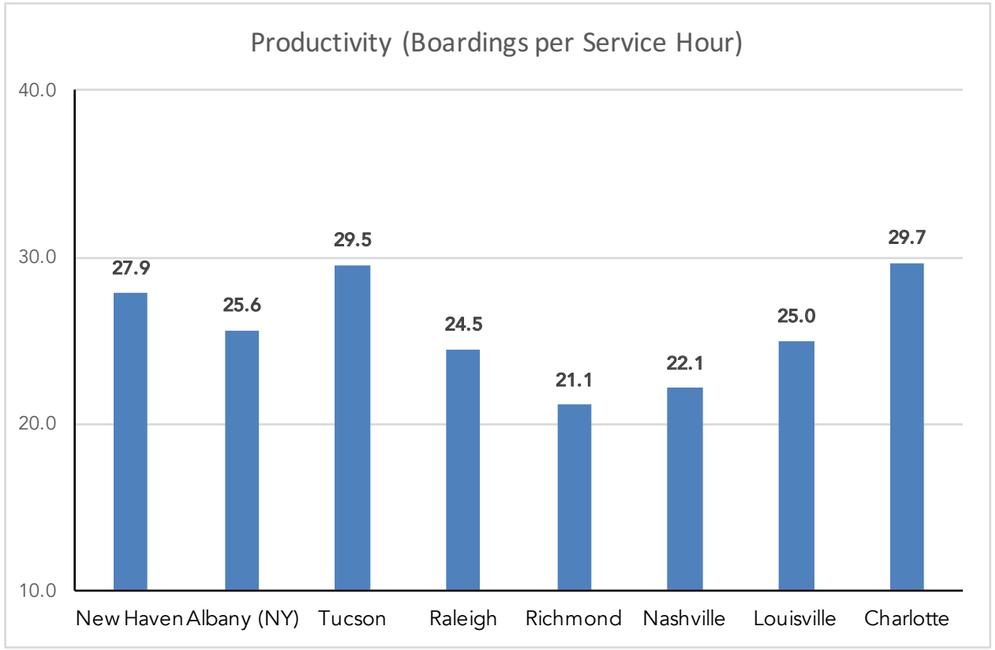


Figure 20: Each hour of transit service provided in the Richmond area attracts less ridership than does service in these peer regions.

Route-by-Route Productivity

In this report, "productivity" means the number of boardings per hour of service. It is a ratio of benefits to cost. The numerator is ridership. The denominator is service hours, which represent cost.

The major costs of providing transit relate to hours of service (rather than miles). The service hours provided on any particular route, and to any particular stop, will depend on a few factors:

- The length of the route.
- The operating speed of the bus (a slower operating speed means that covering the same distance takes more time).
- The frequency of service along the route or to the stop (higher frequency is supplied by more buses and operators out driving the route concurrently).
- The span of service along the route each day and each week.

Changing any of these factors for a transit route will affect the denominator of the productivity ratio. For example, doubling the frequency of service on a route will double the number of service hours being supplied and will roughly double the operating cost. We might therefore expect that productivity of the route would be cut in half, unless the numerator of the productivity ratio – boardings – were to also double.

In the table at right, GRTC routes are sorted according to their weekday productivity. Express routes are included in this table, but they have hidden costs that are not captured by this measure: for each one-way trip into Richmond with passengers, GRTC must pay to run them back (empty) the other way. These empty hours cost the agency money, but are not included in the service hours that make up the denominator of the productivity ratio. Routes that run mostly "one-way" (at least, as far as the public knows) have exaggerated productivities.

Route	Route Name	Approximate Mid Day Frequency	Daily Boardings	Daily service hours	Productivity (boardings per service
43	Fairmount/Whitcomb	30	1,248	34.6	36.0
37	Chamberlayne	20	2,594	74.9	34.6
29	Gaskins Express	Peak	409	12.0	34.1
82	Comonwealth 20 Express	45	135	4.1	32.6
6	Broad	20	3,183	100.2	31.8
45	Jefferson	30	899	32.4	27.8
32	Ginter Park	30	2,112	76.8	27.5
60	Hull Street	30	1,681	61.8	27.2
44	Fairfield	30	918	33.8	27.2
34	Highland Park	20	1,414	52.5	27.0
7	Seven Pines	60	1,344	54.5	24.7
63	Chippenham Square - Midlothian	60	874	36.1	24.2
70	Forest Hill - Stoney Point	60	848	36.9	23.0
73	Ampthill	30	1,111	48.3	23.0
71	Forest Hill - Spring Rock Green	60	791	35.9	22.0
68	Broad Rock - Walmsley	60	758	34.9	21.7
64	Stony Point Express	45	280	13.1	21.4
52	Montrose Heights	30	539	25.5	21.1
53	Darbytown	30	493	24.4	20.2
18	Henrico Government Center	60	240	12.4	19.4
51	Briel - Church Hill	45	186	9.7	19.1
3	Robinson - South Meadow	30	656	35.5	18.5
74	Oak Grove	60	870	47.1	18.5
4	Robinson - South Belmont	30	651	35.4	18.4
10	Riverview	30	617	33.9	18.2
41	Chruch Hill - Oakwood	60	347	19.2	18.1
91	Laburnum Connector	60	427	23.9	17.8
72	Ruffin Road	45	263	14.8	17.7
27	Glenside Express	Peak	121	6.9	17.5
1	Monument	30	570	33.2	17.2
19	Pemberton	Peak	241	14.4	16.8
61	Crutchfield - Midothian	60	588	35.7	16.5
56	South Laburnum	Peak	46	2.8	16.4
26	Parham Express	Peak	105	6.4	16.3
2	Patterson	60	788	50.8	15.5
95	Petersburg Express	45	97	6.5	14.9
24	Crestwood - Westbrook	45	474	35.5	13.4
101	Southside Plaza	60	141	11.2	12.6
16	Grove	45	310	27.1	11.4
28	White Oak Village Express	Peak	16	1.5	10.7
21	Brook	21	69	7.7	9.0
23	Parham/Glenside Express	Peak	10	1.3	7.7
93	Azalea Connector	Peak	65	8.9	7.3

Figure 21: This table shows GRTC routes' midday frequencies, daily boardings, daily service hours and productivity, for weekdays. The routes are sorted from most to least productive. Routes with midday frequencies of more than 250 minutes are shown has having no reliable midday frequency, even though there may be one or two trips midday on a few of those routes.

Frequency and Productivity

More frequent services tend to have higher productivity (ridership per service hour). This is observable in national data, but also in GRTC's own data.

The chart in Figure 22 shows GRTC's routes plotted based on their midday frequency (on the horizontal axis) and their productivity (on the vertical axis). We can see a clear correlation between all-day frequency and productivity: the better the frequency, the higher a route's productivity is likely to be.

This alone does not tell us whether frequency causes productivity, or vice versa. Do transit agencies offer more frequency on their most productive lines, so that they can give the best service to the most people? Or do people respond to frequent services by riding them in greater numbers, thereby increasing their productivity? Both are normally true – over time, transit agencies put more service on high-ridership lines, and people respond by riding *even more*, and the agency responds by putting more service there, and so on, in a positive cycle.

What is so striking about the pattern shown in Figure 22 is how very productive some GRTC routes are *even though their higher frequencies make them so much more expensive.* A route that comes every 20 minutes costs twice as many service hours as one that comes every 40 minutes....but in Richmond, it is probably attracting *more* that twice as much ridership, and is therefore more productive. With a few exceptions, GRTC's investments in frequency are getting a greater-than-proportionate response in ridership.

Peak-only routes are treated separately, since they have no midday frequency. Their productivity tops out at about 34 boardings per hour for Route 29 Gaskins Express,.

Express and peak routes are shown on the right side of the chart, since they have no mid-day frequency. Many of the express routes only accept boardings one-way, but GRTC must pay for them to run two-way. Thus their productivities are misleadingly high, compared to all of the local routes.

One-way express routes

When a transit agency offers one-way peak service from an outlying suburb into a city, passengers are only aware of the driver driving the bus in. Yet every one-way trip is, by the end of the day, a round-trip, and the agency must pay for the hours spent driving in (with passengers) and driving out (empty).

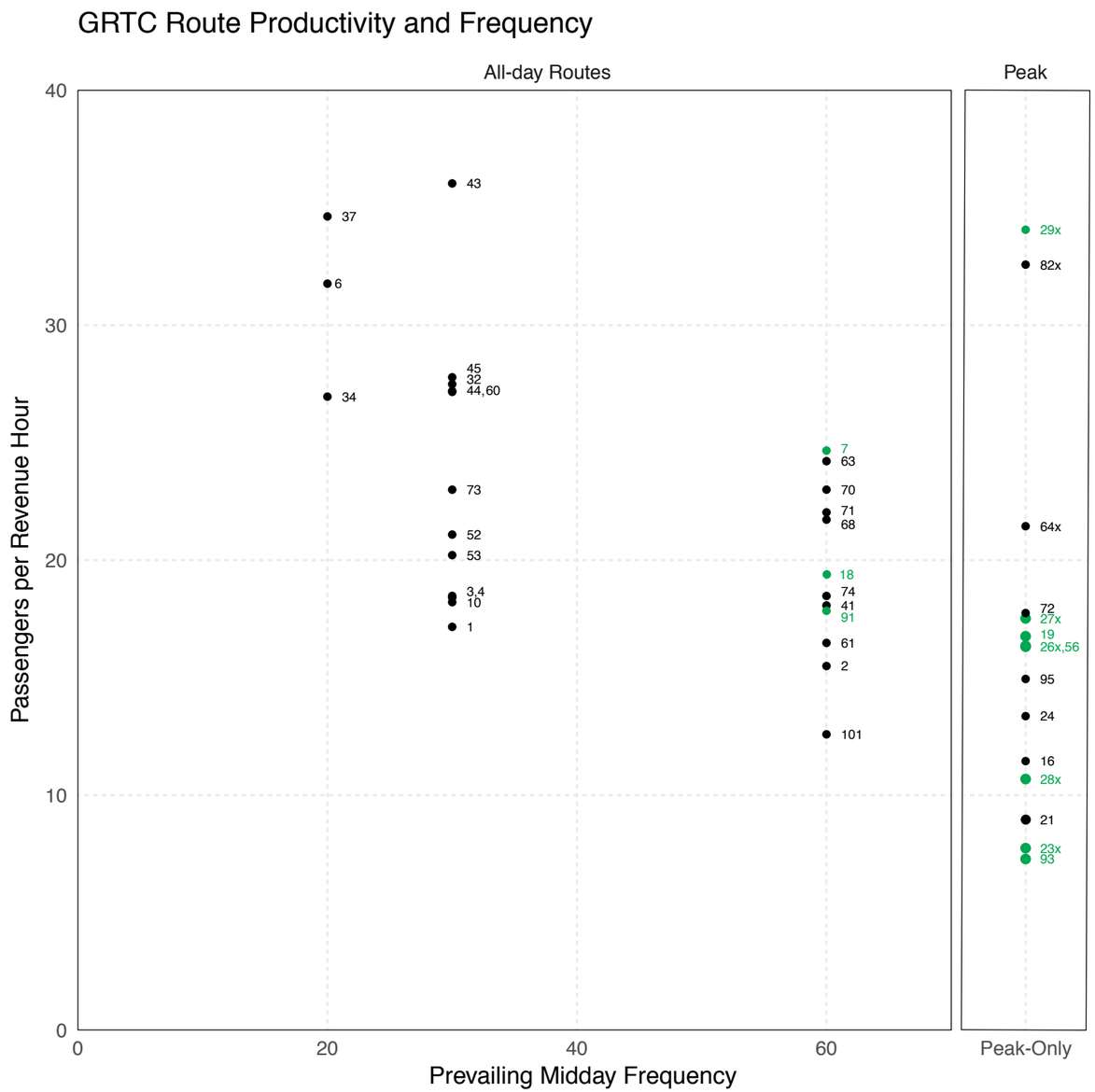


Figure 22: GRTC's routes plotted according to their midday frequency (on the horizontal axis) and their productivity (on the vertical axis). Henrico County routes are highlighted in green. More frequent routes tend to be more productive. Peak-only routes have moderate to low productivity, with two major exceptions, Routes 29x and 82x.

Most of GRTC's Express routes are not purely one-way. For example, Route 29x from Gaskins makes 9 inbound trips and 4 outbound trips each morning. Five times each morning, an empty bus drives back out to Gaskins. The service hours for the 29x do not reflect these empty-bus hours, so its productivity does not represent its true ridership relative to cost.

Route 82x from Commonwealth 20 appears to be very productive. However, all of its service is one-way: in the morning, all trips on the 82x are inbound, and vice versa in the evening. The hours spent driving the 82x buses back to Commonwealth 20 are probably nearly equal to its service hours, so the actual productivity of the 82x is probably one-half as high as it appears, i.e. about 21 boardings per hour.

Routes 23x and 28x are also likely performing at about one-half their apparent productivity, which is already very low. Most peak only and express routes in the GRTC system have productivites below the average for hourly routes in the system.

Peak Productivity

GRTC operates peak-only routes and increases frequencies during the peaks on many other routes.

Peak-only routes are sometimes designed to target the highest-demand time of the day. Yet, as we see in the charts on the previous pages, GRTC's peak-only routes are not as productive as most of the all-day routes.

All people, regardless of their income, value flexibility and spontaneity. If a transit service does not support a midday trip home to pick up a sick child, or a late night at the office finishing a report, more affluent people can easily respond by using a private car. Even very low-income people who need to travel at uncertain times will find another option (such as a ride from a family member, or a very inexpensive car) if the transit network does not offer them flexibility. Only a few people are willing to build their lives and their commutes around a peak-only route.

As of the 2010 Census, 29% of U.S. workers did not work a traditional weekday, daytime schedule. Add to this population the large proportion of people who work a second job, are studying, are retired, or are not working, and we can imagine the proportion of Richmond residents whose essential travel needs go far beyond the morning and evening weekday peaks.

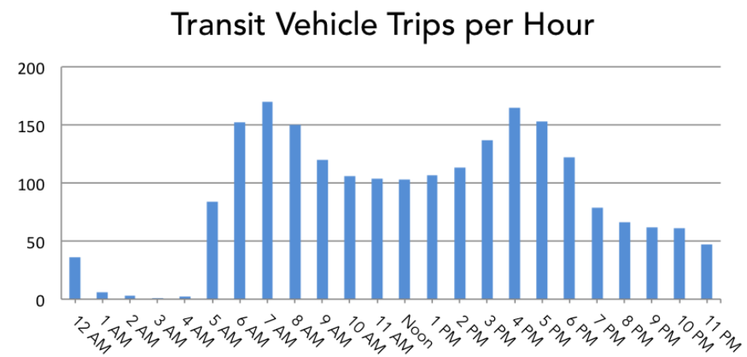
Transit agencies increase frequencies of all-day routes during the peaks for a number of reasons:

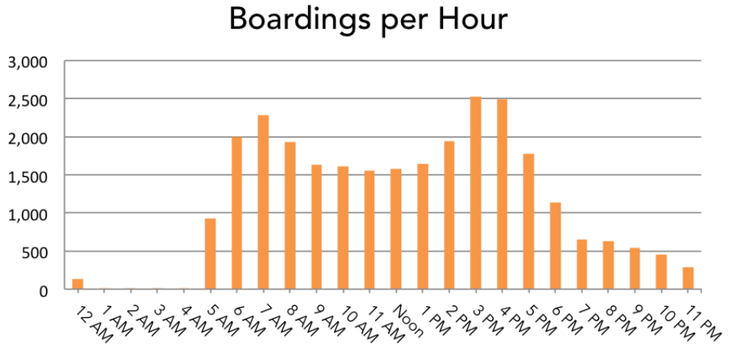
- To reduce crowding, if the peaks are the highest-demand periods of the day.
- To attract more affluent riders, who have more choices in how they travel and therefore less tolerance of waiting, and who are more likely to work professional jobs and commute on the peaks.
- To reduce auto congestion on the peaks, when roads are most strained.

The charts in Figure 23, at right, show the relationship among peak service increases, boardings throughout the day, and the resulting productivity throughout the day. Productivity seems to be highest in the midday and afternoon, rather than on the a.m. and p.m. peaks. Morning and evening buses, which are provided at great expense, are less crowded than midday and afternoon buses.

Given the high costs of running peak-only services and higher frequencies during the peak, it would be reasonable to expect *higher* productivity, and more crowded buses, on the peaks than at other (less expensive) times of day. Each peak passenger is costing GRTC more to serve than a passenger riding at midday, yet peak passengers are treated to lower levels of crowding and shorter waits. This is why GRTC's standard for passengers loads is higher during the peaks (120% of seats) than during midday and evening (100% of seats).

Thus a key question for Henrico County is whether transit service is primarily a peak service that runs some service at other times, or an all-day-transit-service that supplements certain services during periods of very high demand.





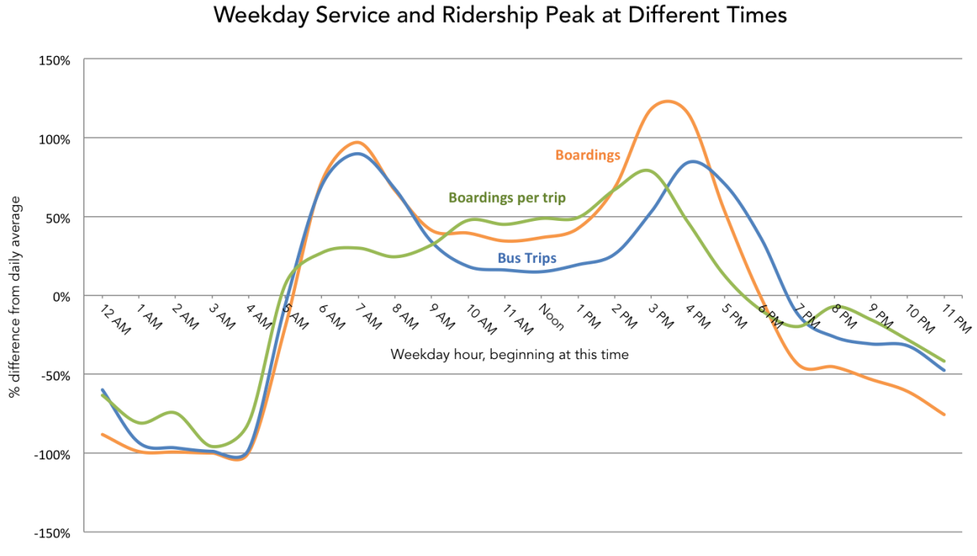


Figure 23: At top, the number of trips made by buses on all routes is summed for every hour of the weekday. We can clearly see the a.m. and p.m. peaks in GRTC service. At middle, the boardings on all routes are summed for every hour of the weekday. Boardings also peak twice a day, though the a.m. boardings peak is a little lower, proportionately, than the a.m. service peak, and the p.m. boardings peak happens about one hour earlier than the p.m. service peak. These mismatches become clear in the graph at bottom, which shows how these two factors – boardings and bus trips – change throughout the day, relative to their daily averages. Boardings per trip is also shown, indicating how full the buses are, and how productive the routes are, throughout the day. Buses are less full during the a.m. peak than they are midday, and most full after 3 p.m., when boardings are high but GRTC's p.m. peak service increase hasn't yet begun.

Density of Transit Commuters

Productivity is a measure of transit's effectiveness in attaining ridership within a fixed budget. Another measure is the number of residents in Henrico who choose to ride transit.

In the map at right, areas are shaded based on the percent of residents who report commuting by transit. We should keep in mind that the work commute is only one type of trip, though it is the one that is measured by the Census and other sources. This data source can't tell us anything about the other trips people are making using transit to go shopping, visit friends or access services.

On the other hand, for most people, the work trip is the most important, time-sensitive trip they make each day, and the one that must be the most reliable.

This map shows transit commuting based on workers' residential addresses, we can observe some interesting differences:

- By far the largest area where transit commuters live in Henrico appears to be the area along and north of Laburnum Avenue between the City/County line and Richmond-Henrico Turnpike.
- On the West End, there are a few areas where small percentages of people commute by transit, most likely using park-and-ride lots to access commuter express routes.
- In the East End, there is a sizeable area around Highland Springs where 6-15% of commuters use transit. This area is served by Route 7, which has more service than most routes in the county.

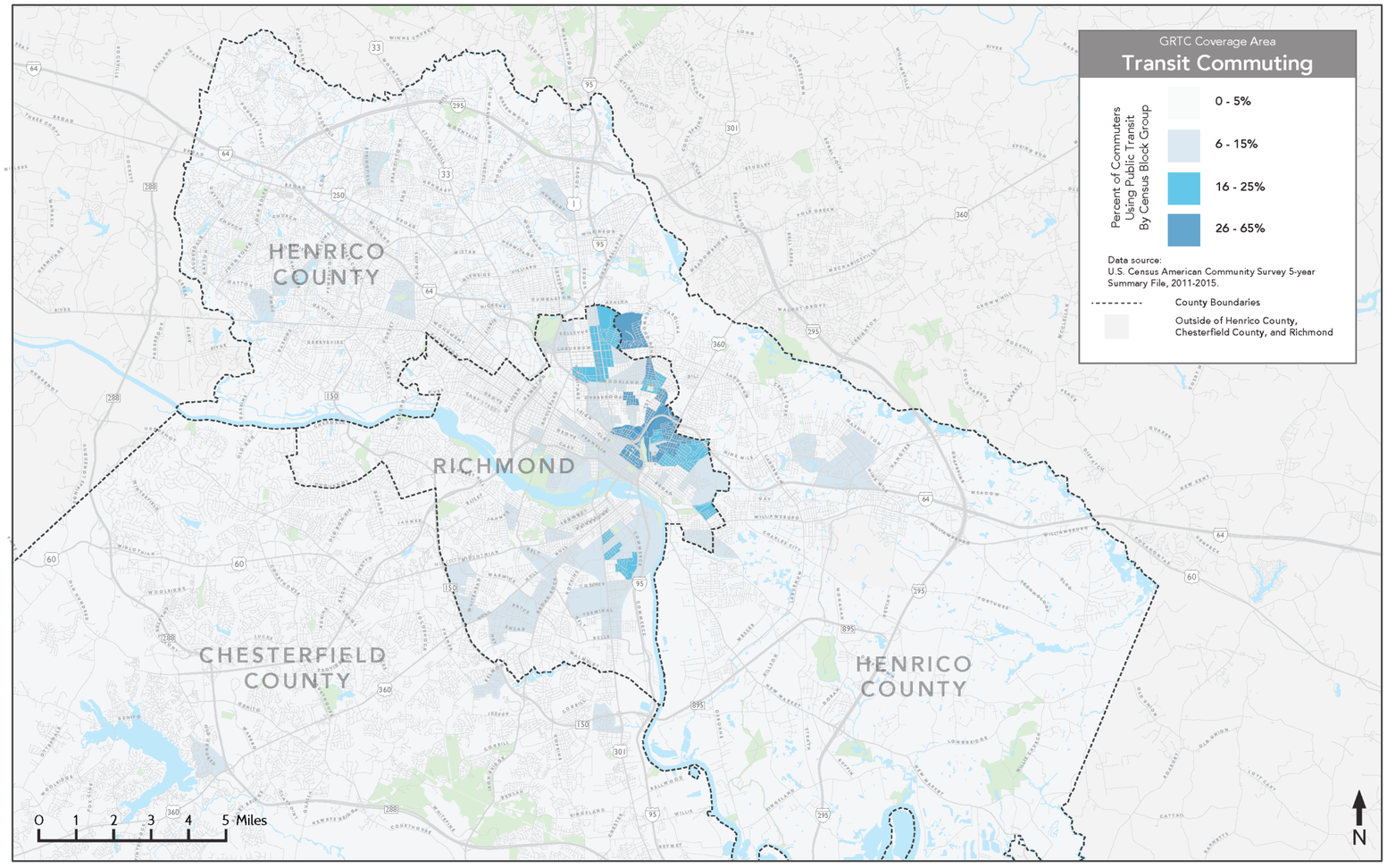


Figure 24: This map shows where large numbers of Richmond residents report commuting to work by transit. The areas that are densest with transit-commuting workers are mostly around frequent transit lines, except in the East End.

Outliers and Interesting Exceptions

A few routes offer intriguing, sometimes surprising productivity and patterns of boardings. They are "outliers" from the trend, and in this section we explore why.

Route 7–Seven Pines

The pattern of boardings on Route 7 is shown below. Route 7 has the highest productivity of any route with less than 30 minute frequency and is the highest productivity route in Henrico except for Route 29x (which as an express route actually has higher costs than the productivity calculation suggests).

Route 7 connects the east end of Henrico with downtown Richmond and along the way connects

- Dense housing where large numbers of low-income people live, without cars in their households,
- Governmental buildings, particularly the East End Henrico Government Center, which attract both employees and visitors,
- Multiple shopping centers, including White Oak Village on its southern branch,
- And a high school, a middle school, and two elementary schools in Henrico.

Given all this, it is unsurprising that boardings on Route 7 are so high. It has linearity and density. It lacks somewhat in walkability in places (due to the lack of sidewalks or safe crossings). Also, some of the higher density nodes are far apart. Overall, though, it presents a strong opportunity for ridership potential.

However, Route 7 has fairly low-frequency considering both its ridership and the density of the neighborhood it is serving. It comes 3-4 times per hour, throughout the weekday, with waits between buses averaging 20-30 minutes on the trunk of the route and double that wait on the branches.

In addition, the limited span of the route (it only runs weekdays, 6am-8pm) limits potential ridership. Many potential riders would probably like to access the many shopping destinations along Nine Mile Road and Laburnum Avenue, but have no option to do so on Saturday or Sunday.

The relatively high productivity of Route 7 (given its frequency) and the positive transit potential of the corridor it serves suggests that if it ran every 15 minutes on its trunk and every 30 on its branches, and operated seven days a week, that ridership would likely respond positively.

One challenge with increasing frequency on this route is that a significant portion of the trunk route is within the City of Richmond. Thus, there may be reticence by the County to pay for increased service that provides sizeable transit benefits to the City. In this instance, therefore, it would be beneficial if Henrico County and the City collaborated to determine an appropriate distribution of costs for the service if frequency and span are increased.

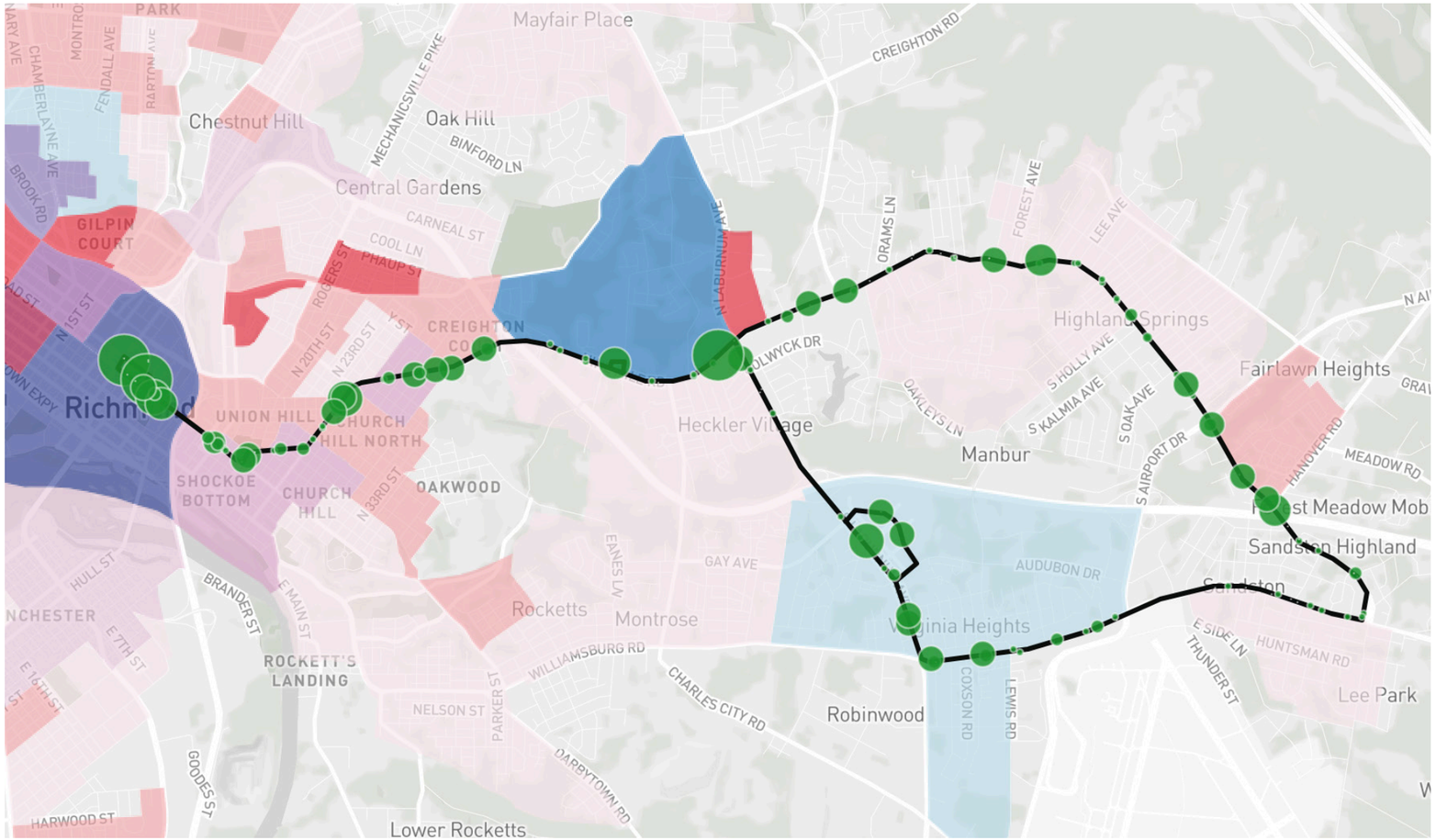


Figure 25: Route 7 connects Highland Springs and Sandston to downtown, via Laburnum Avenue and Nine Mile Road. It is highly productive, given its relatively low frequency and is the highest productivity route in Henrico (among non-express routes).

Route 93 - Azalea Connector

Route 93 connects multiple destinations and dense housing, across a very short distance, using multiple one-way loops. Boardings on the route are shown in Figure 26. The residential areas served by Route 93 include some of the larger apartment complexes in Henrico County. A route that connects them to schools, shopping centers and other service should, at first glance, have high ridership potential.

Route 93 is infrequent, coming about every 45 minutes in the from 6am to 9am and from 2pm to 6pm. There is a significant gap in service in the midday from 9am to 2pm. Yet even when compared to other low-frequency routes, it is unproductive. Why would it attract so few boardings, relative to its service level?

One possibility is the short span. While it covers the standard peak commute hours, many people are unwilling to use a transit service that will leave them stranded in the middle of the day or later at night, if they end up working late.

The one-way loops within this route probably undermine its usefulness to the many people nearby it.

Imagine that someone in the Treehouse Apartments wants to ride transit to the Brookhill/Azalea shopping center in the morning.

- They live on the big one-way loop, so Route 93 only goes northbound past their apartment.
- First they ride it north to Wilkinson, before circling south again to come back to Azalea.
- They head west on Azalea, but in the AM, the bus turns north on Woodrow to reach the Richfield Place Apartments.
- Finally, they reach the shopping center after a nearly 30 minute ride.
- This travel time doesn't yet account for the route's frequency which, at 45 minutes, means that they will waste on average 22 minutes waiting, either at the start or end of their trip.

Those who are able might be more likely to take this trip on foot. The walking time is only 31 minutes, which would save approximately 20 minutes off the average travel time.

We suspect that three characteristics of Route 93 depress its ridership below what it otherwise would be: its short length, its short span and its large one-way loops.

Because it is so short and because of its one-way loops, this route is barely faster than walking for many trips. For the majority of people who are capable of walking, then, it would not earn their ridership, except that it may give them safer passage along or across Azalea Avenue.

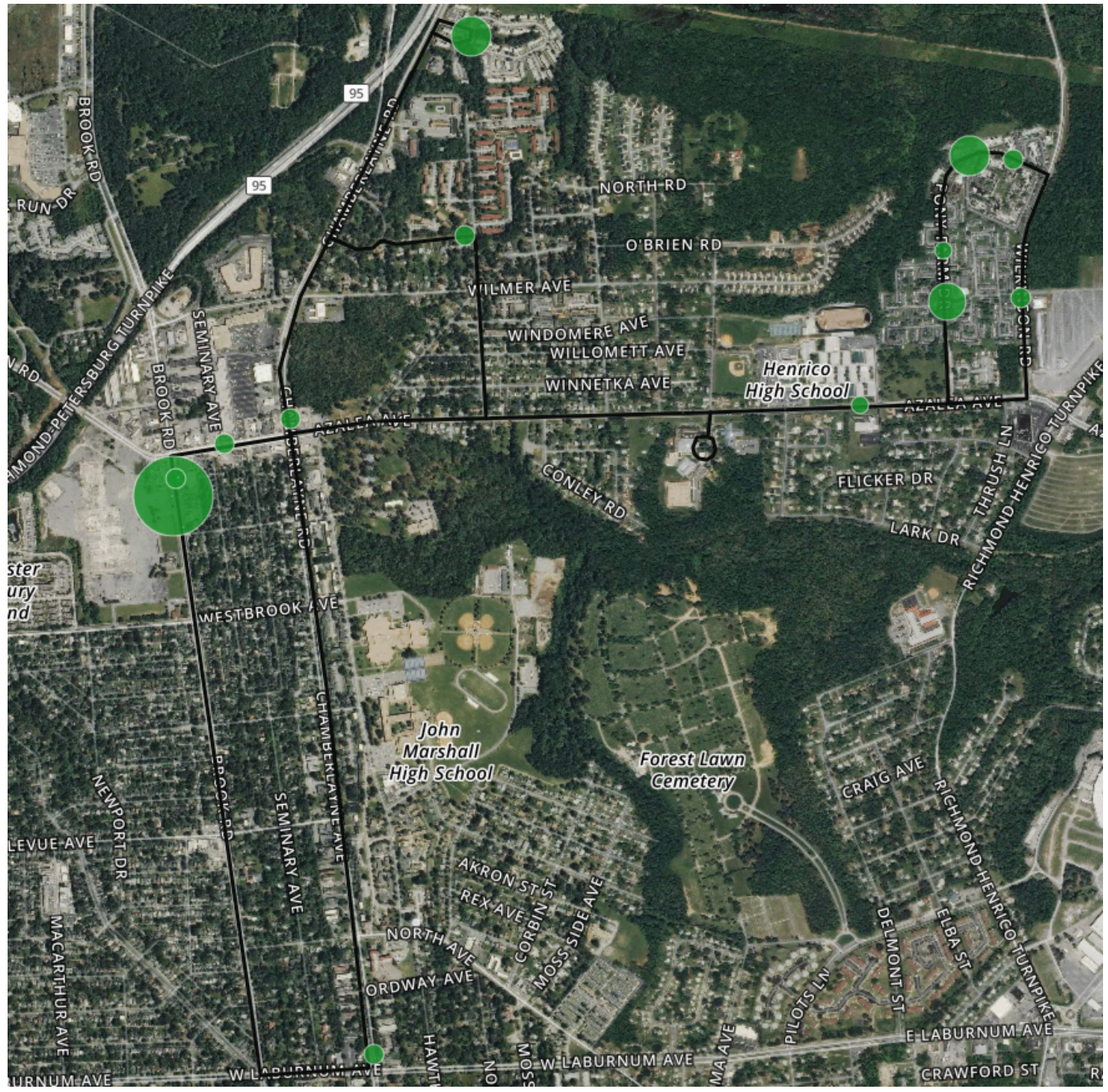


Figure 26: Route 93 along Azalea Avenue, attracts few boardings relative to its frequency, and to the high number of people and destinations it services.

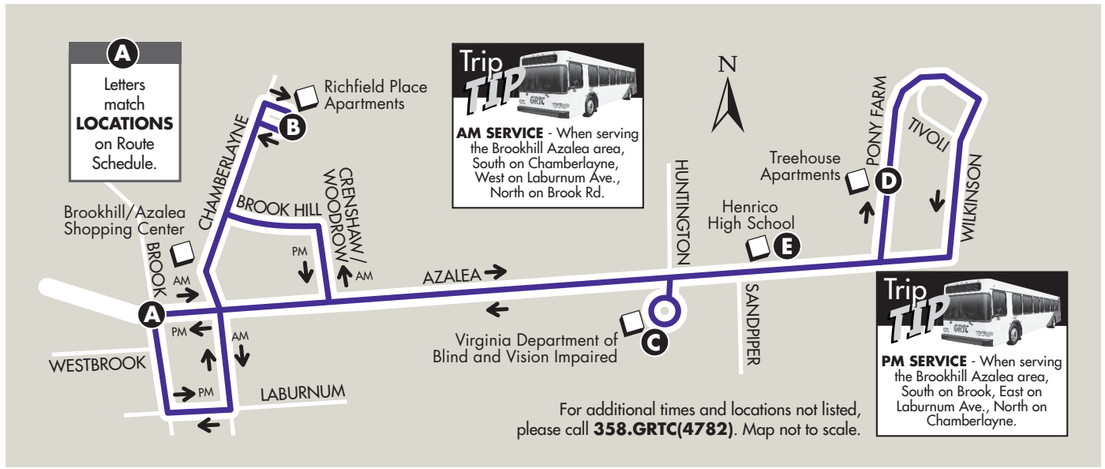


Figure 27: Route 93 makes multiple one-way loops. For each round trip, someone must ride the long way around a loop, going far out of direction.

One-way loops compound the route's short length by making anyone's travel time even longer, relative to the distance they want to travel. This would naturally make walking, driving, or getting a ride from someone else appealing alternatives to riding Route 93.

One-way loops

One-way loops are sometimes put at the ends of long routes, because they are easy ways to turn-around a bus. At the end of a long route, buses tend to be empty, so very few people end up riding around the loop.

But sometimes one-way loops are used to provide coverage: access to service that doesn't result in much ridership. One-way loops sacrifice directness and travel time in order to cover a larger geographic area.

How does a passenger experience this sacrifice? It may be that on their way out, they can get on the bus and it goes in the direction they are traveling, so the trip feels fairly direct. But on their way home, they must ride around the loop the long way, out of direction, to get back to where they started.

Like hourly service, a one-way loop cannot attract a passenger whose time is scarce and valuable (and that person may be rich or poor) because it guarantees that in one direction or another, the trip will be long and circuitous.

GRTC's network includes a few large one-way loops, all of which present this problem. Only people with very limited choices, or ample free time, accept a big one-way loop.

Some one-way loops are narrow enough that people will walk to one stop for their outbound trip, and from a different stop for their inbound trip, and thereby avoid riding around in a circle. In particular, Route 18 operates as a large one-way loop trying to provide basic coverage to a large area between Willow Lawn and the Henrico County Government Center.

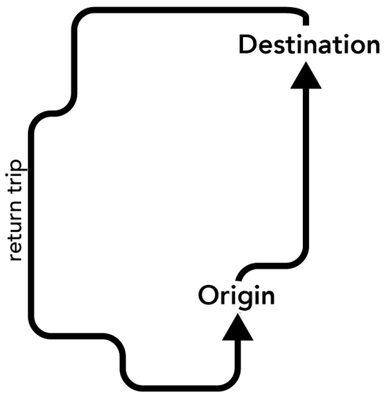
Route 18 - Henrico Government Center

Imagine that someone in the apartment complexes off Basie Road (marked Apartments on the map in Figure 28) and they want to get to Parham Doctors Hospital (marked with Hospital on the map) in the morning.

- They live on the big one-way loop, so Route 18 only goes eastbound toward Willow Lawn in the AM past their apartment.
- So they ride to Willow Lawn, stay on the same bus, and continue riding out Broad, through the Henrico Government Complex.
- At this point they have ridden the bus for 35 minutes, but are only 1.3 miles from their point of origin.
- Finally the bus arrives at Parham Doctors Hospital after riding for about 40 minutes, to reach a destination that is 1.8 miles away on foot. It would take an average person 37 minutes to walk this distance.
- This travel time doesn't yet account for the route's frequency which, at about 55 minutes, means that they will waste on average 27 minutes waiting, either at the start or end of their trip.

Those who are able might be more likely to take this trip on foot. The walking time is only 37 minutes, which would save approximately 30 minutes off the average travel time.

More generally, large one-way loops increase the complexity of a transit network, which in turn can baffle, frustrate and turn away potential new riders. While every complex element of a transit network does have some benefit, to someone or some group of people, complexity must be traded-off against simplicity and ease-of-understanding.



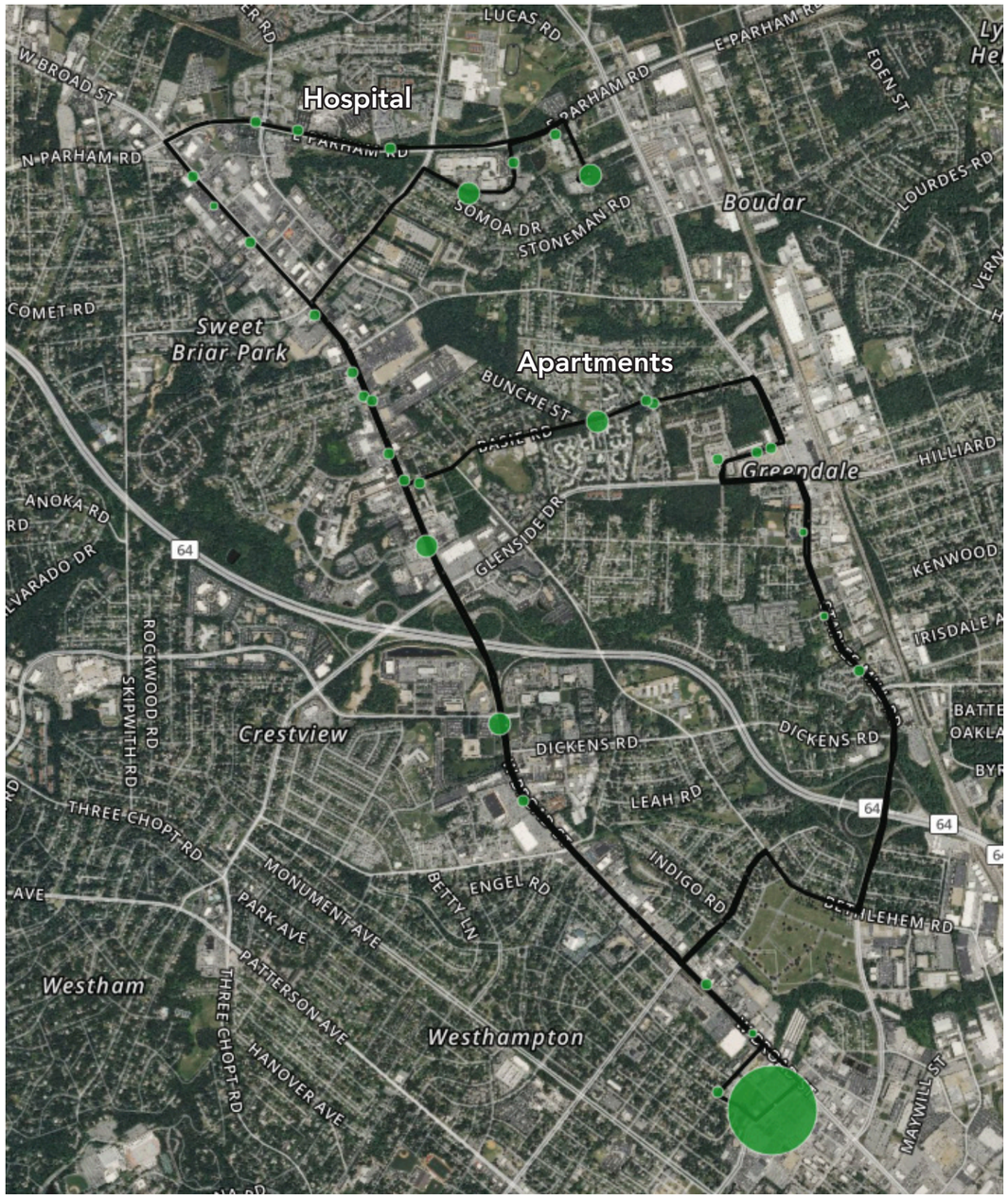


Figure 28: Route 18 - Henrico County Government Center operates as a very large one-way loop, that changes direction between the AM and PM peaks.

Routes 2 in the West End

Route 2 - Patterson, serves some of the highest activity density areas in western Henrico, particularly Henrico Doctors Hospital and Regency Square Mall. Yet the boarding patterns show generally low ridership along this route. And Route 2 has relatively low productivity overall. Like most routes in Henrico, the short span and relatively low frequency of service likely depress ridership. But another factor likely hurts ridership in this area: poor linearity.

Route 2 has a number of circuitous deviations in its trip from Patterson and Three Chopt to Regency Square. Long circuitous routes struggle to compete with driving, but for long trips they are still always faster than walking. In this case, some of the deviates are sensible. Route 2 deviates via Skipwith and Forest to serve Henrico Doctors Hospital, a major destination for workers and visitors.

But Route 2 further deviates to zig-zag through the office complex south of Cheswick Park. Why would it make this deviation, when proceeding directly via Forest and Three Chopt would be faster and more direct? One likely reason is that there are no cross walks around the office complex to allow someone to reach a bus on the other side of the street and sidewalks are not continuous on both sides of the street. Therefore, the lack of walkability forces GRTC to take a time consuming and circuitous path.

Similar issues likely affect the decision to route via Fargo and Starling from Three Chopt to Regency. With a lack of sidewalks on Starling, people living in the apartments at Starling and Fargo would have a hard time reaching bus service that operated via Quioccasin Road (the more direct route to Regency).

All of these examples point to the long-term consequences of the lack of walkability in a suburban environment served by transit. To provide service that people can actually access requires more circuitous routing that takes longer and is therefore less useful to people. The lack of walkability forces GRTC to design routes that lack linearity. Strategic investments in sidewalks and crosswalks might allow for more direct routing in some areas and the time savings could be used to increase the frequency of service or extend the coverage of service to areas farther out.

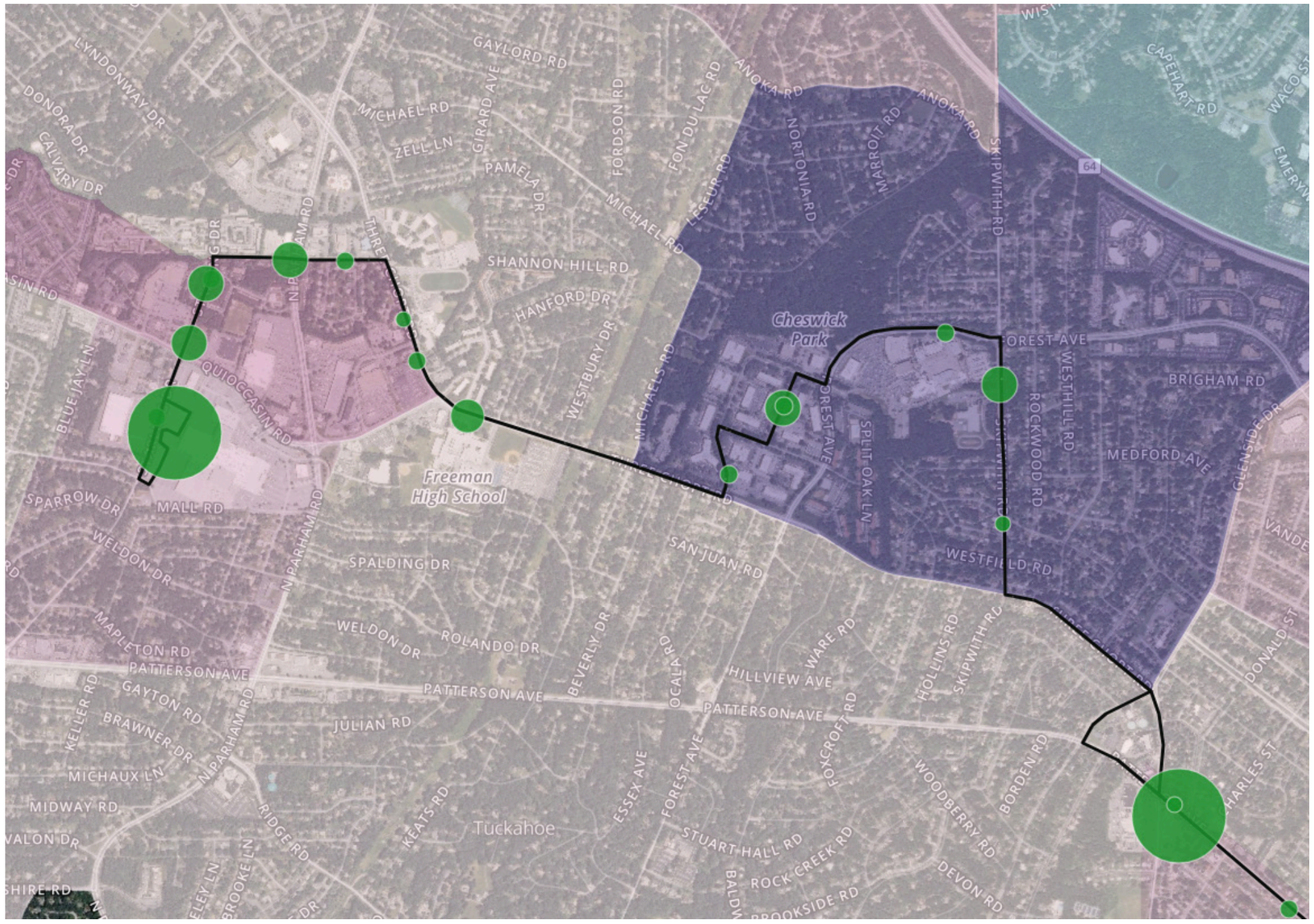


Figure 29: Route 2 winds its way through the near west end of Henrico County through some of the higher density areas of the county and hitting major destinations like Henrico Doctors Hospital and Regency Square Mall.

Investment and Relevance

The pair of charts in Figure 30 show how much each region is investing in transit service relative to its population (at left) and how relevant transit is to the life of the region (at right).

Relative to its population, the Richmond region invests less in transit service than all of these peers, save for Raleigh. The Richmond region also achieves fewer rides, relative to its population, than every other peer save for Raleigh.

The shapes of these two charts are so similar that they suggest *"You get what you pay for"* – all other things being equal, the level of service provided relative to the size of the population has a big impact on transit ridership in a region.

The graph in Figure 31 shows this information for Richmond alone, over the past ten years. Both Investment and Relevance have declined.

Why are both investment and relevance declining in Richmond? Are the same trends in force in other similar regions?

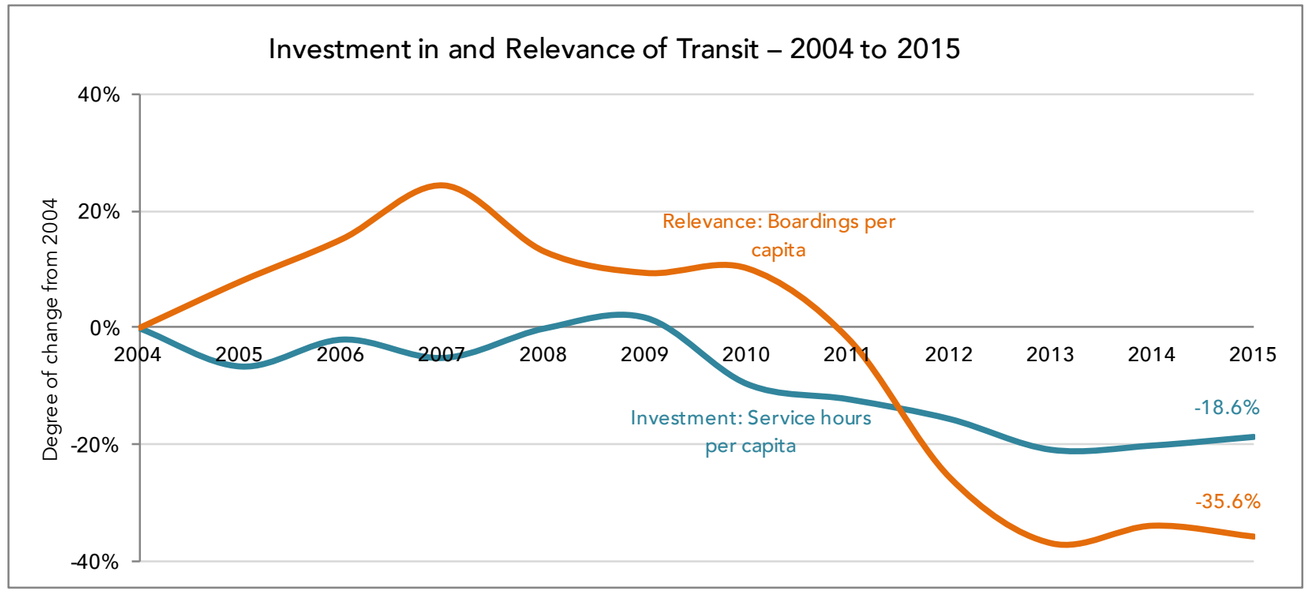
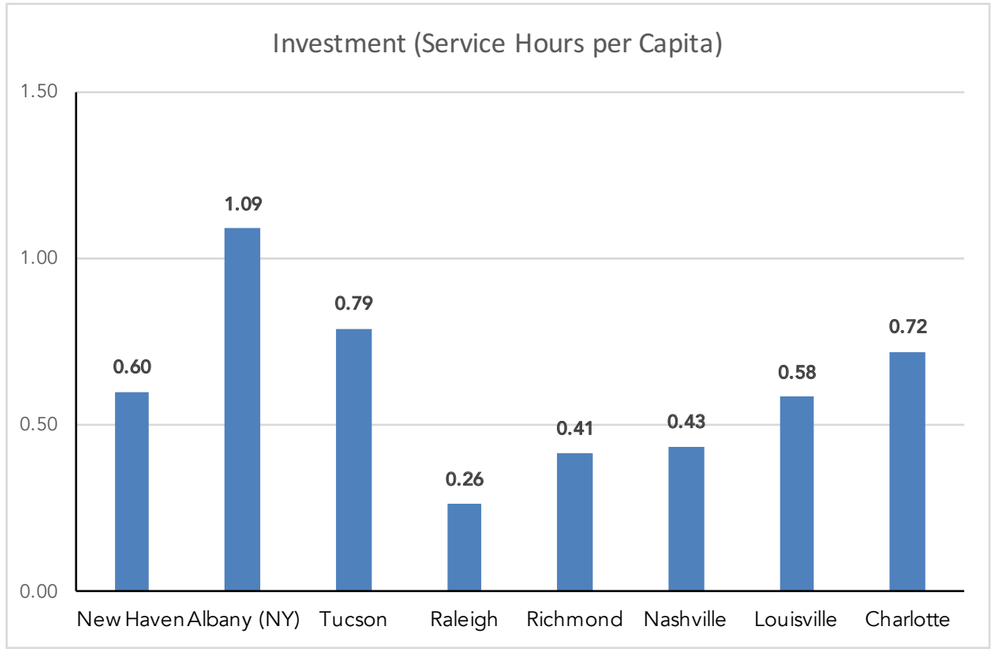


Figure 31: This graph tracks changes in Investment (service per capita) and Relevance (ridership per capita) in Richmond over the past decade. Both have declined, though Relevance has declined more.



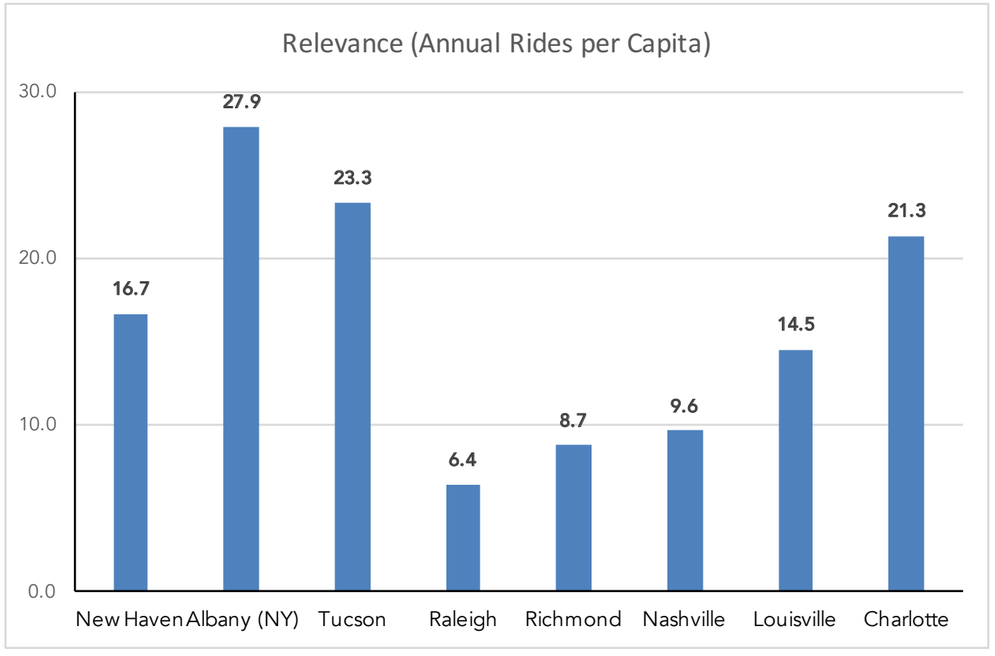


Figure 30: The charts at right reveal a similar pattern in both Investment (service per capita) and Relevance (ridership per capita), while controlling for the size of each region. This suggests that, in urban transit systems, *"You get what you pay for."*

Investment by Peer Localities

Comparing peers at the agency level is only so useful for understanding how relevant transit is within Henrico County. Henrico County has approximately 41,000 annual service hours for a population of about 325,000 people. That yields about 0.13 service hours per person.

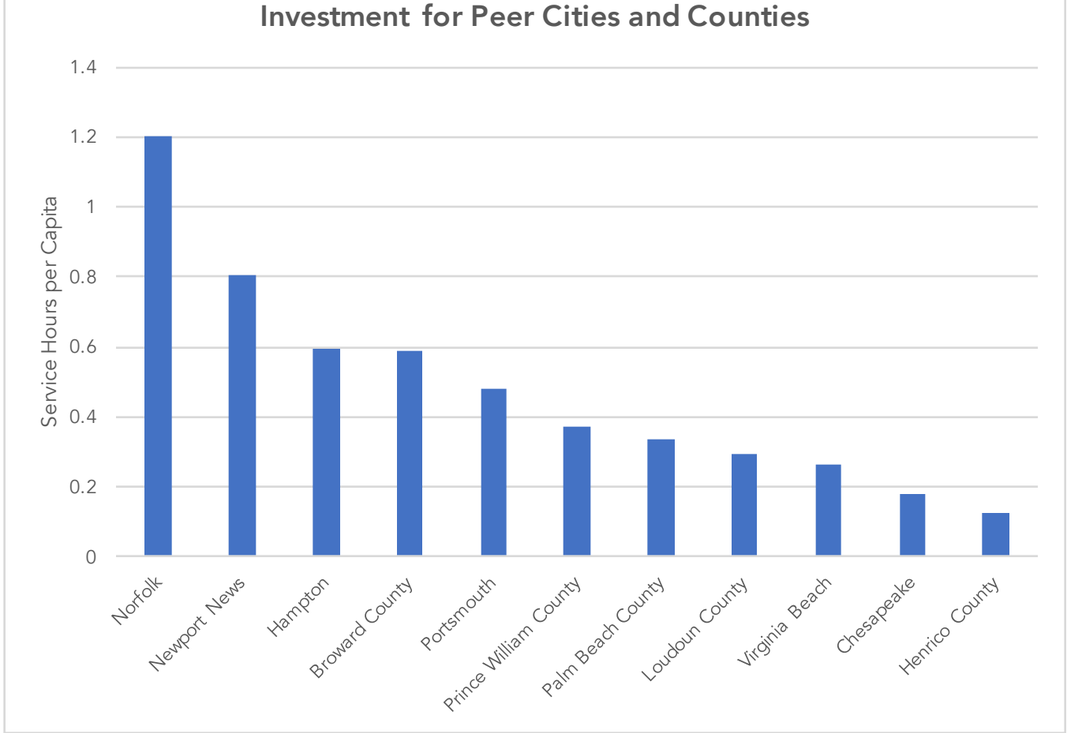
Looking at peers in the Hampton Roads region is instructive as each jurisdiction must pay the subsidy for service within its community on an annual basis, much the way service is funded in the Richmond region. In the Hampton Road region, all the suburban localities provide more service per capita than Henrico County. For example, Virginia Beach provides about twice as much per capita.

Two Florida peers (Broward and Palm Beach counties) are useful as both are mostly suburban in character with some downtown like centers (like Fort Lauderdale and West Palm Beach). In both cases, the Florida peers provide significantly more service per capita.

Two northern Virginia peers, Loudoun and Prince William counties, also provide more than twice the service per capita as Henrico.

Figure 32: The table and bar graph show the level of Investment (service per capita) provided by individual cities or counties that are comparable to Henrico in their density and suburban development pattern.

Peer City/County Characteristics			
City/County	**Urban Area Population -2015**	**Revenue Hours -2015**	**Invesment -2015**
Norfolk	246,393	295,688	1.20
Newport News	182,385	146,402	0.80
Hampton	136,454	80,898	0.59
Broward County	1,909,632	1,124,809	0.59
Portsmouth	96,201	45,975	0.48
Prince William County	451,721	169,519	0.38
Palm Beach County	1,422,789	481,081	0.34
Loudoun County	375,629	109,555	0.29
Virginia Beach	452,745	121,044	0.27
Chesapeake	235,429	42,017	0.18
Henrico County	***325,155***	***41,340***	***0.13***



Ridership Trends in Peer Regions

Richmond is unique among its peer regions for its declining transit ridership, when measured per capita and in total.

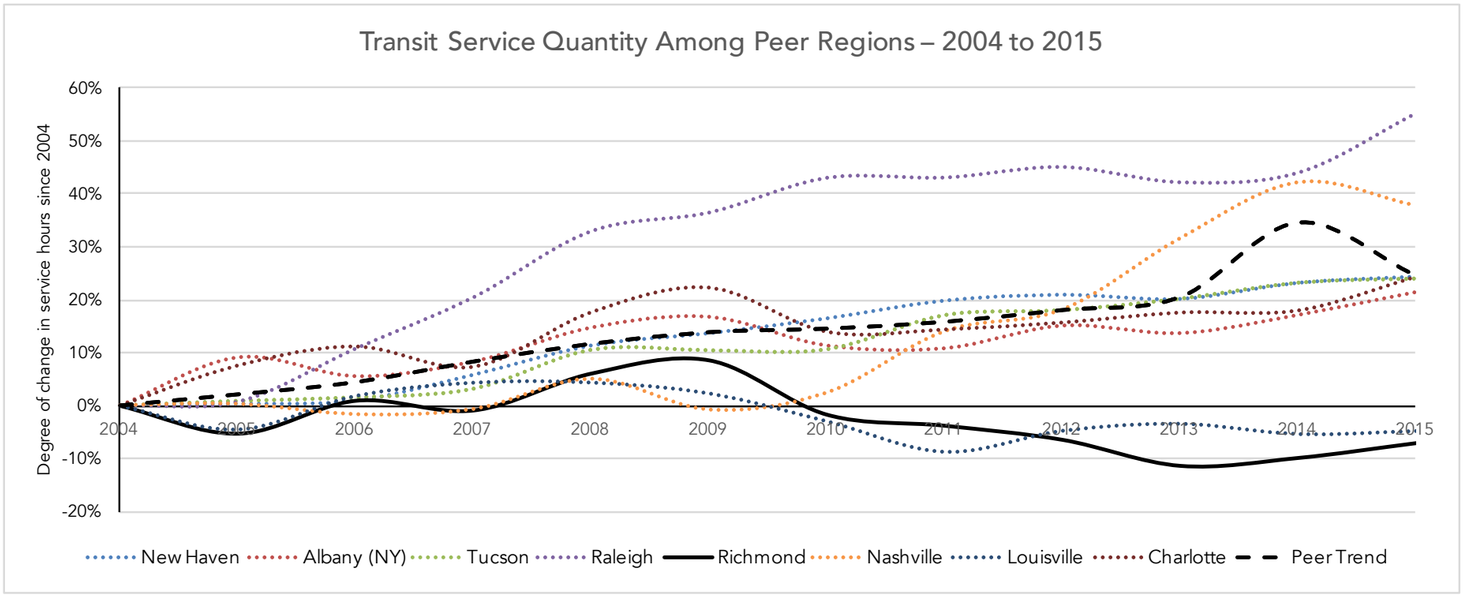
The graph at right, on top, shows the amount of service provided in the Richmond region (and is repeated from an earlier page). The graph at bottom shows the amount of transit ridership in the Richmond region, compared to peer cities.

Among these regions, Richmond and Louisville are the only two that are providing less service, and getting less ridership, than in 2004. Louisville's decreases have been slight, whereas Richmond's service levels have declined by 7% and ridership by 26%.

The severe drop in ridership, compared to the modest drop in service quantity, suggests that other factors are in play. Many things can effect transit ridership: employment levels, urban development trends, large changes in the costs of driving (especially from parking, tolls or gas).

In 2012, VCU solicited bids for it shuttle system in a way that inadvertently prevented GRTC from bidding on it. GRTC stopped running VCU shuttles in 2012. The large drop in both service hours and ridership visible in the two graphs at right, between 2012 and 2013, is probably due to the removal of the VCU shuttles from GRTC's system. However, a larger decline in both service and ridership preceded the loss of the VCU routes by three years, so the loss of the VCU routes alone does not explain most of the decline.

Are macroeconomic factors – such as declining employment – causing Richmond to invest less in transit, and to get drastically less ridership, than in the past? One thing we know is that many of Richmond's peers have continually grown their total fixed-route transit service, and seen ridership grown in turn, while GRTC's service level and ridership have moved in tandem in the opposite direction.



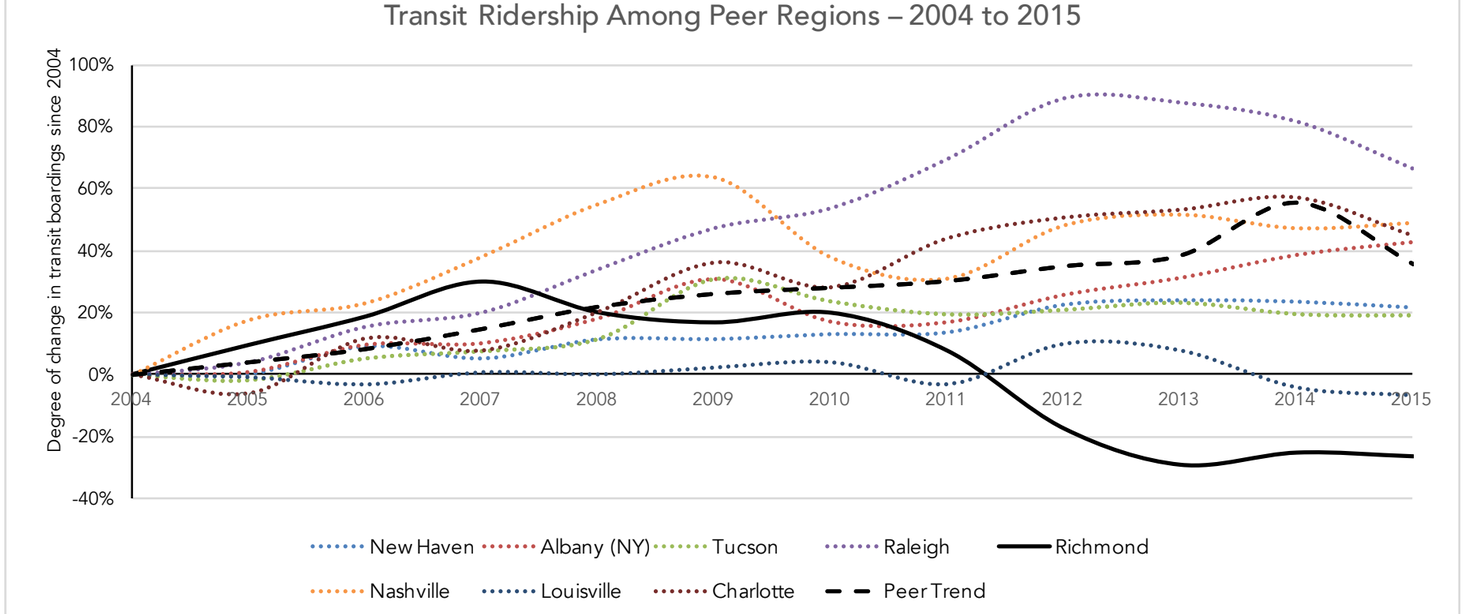


Figure 33: The graph at top (repeated from an earlier page) shows changes in the quantity of fixed-route transit service provided, in Richmond and peer regions. The graph at bottom shows changes in fixed-route transit ridership. Richmond, shown in black, has experienced a decline, while all other peers except for Raleigh have increased total ridership.

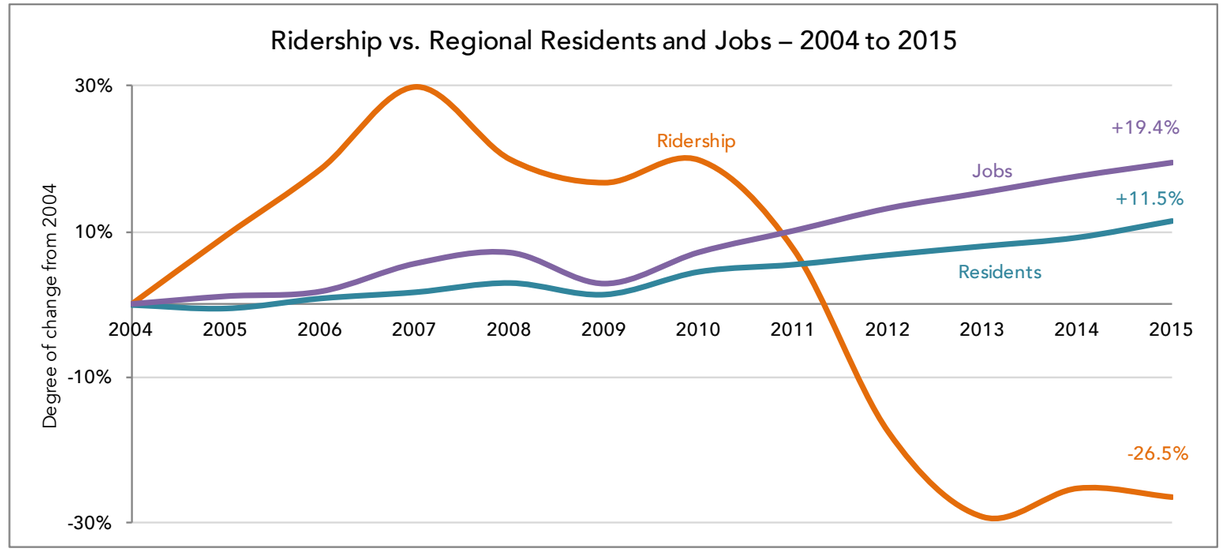
In the graph at right, top, there is a dip in ridership (in 2008 and 2009) that coincides with a major recession, and a dip in Richmond area employment.

However, since then the economy in Richmond has grown, and the region has added both jobs and residents. Yet ridership crashed between 2010 and 2013.

No single factor seems to explain this drop in ridership. It is surely a result of a combination of factors, such as:

- GRTC's shift towards more routes with lower frequencies, or shorter spans, and therefore with lower transit ridership. (The downward trend in service hours per route mile is shown in the graph at bottom.)
- Development of job centers and residential neighborhoods far from the transit network, so that those new workers and residents do not find transit useful.
- CARE and CARE Plus are likely competing with fixed route transit. Some of the people who are eligible for these programs might otherwise be riding GRTC's fixed routes.
  - GRTC's website describes CARE and CARE Plus as meant for "individuals with disabilities who may not be reasonably able to use GRTC fixed route bus service." However, GRTC offers CARE customers free rides on fixed routes, and about one-half of surveyed CARE riders said they also used fixed-route service in 2014. This means that GRTC is providing paratransit beyond what is required by law, to people whose disabilities do not prevent them from using fixed routes. This is likely reducing fixed route ridership and increasing paratransit ridership.
- There may be changes in the design and scheduling of GRTC transit routes that, since 2007, have made many services less useful.
- As noted on the previous page, the drop in service hours and ridership between 2012 and 2013 is probably due to VCU's decision to hire another operator for its shuttle routes.

Some of these factors are under the control of GRTC, some are under the control of the City of Richmond and some are under the control of Henrico County. The development of job centers and residential neighborhoods in transit accessible and transit friendly areas is one factor under control of the county. The amount of service within the county is largely under the control of the county. And the general design of routes is still largely under county control, though GRTC does play a major role.



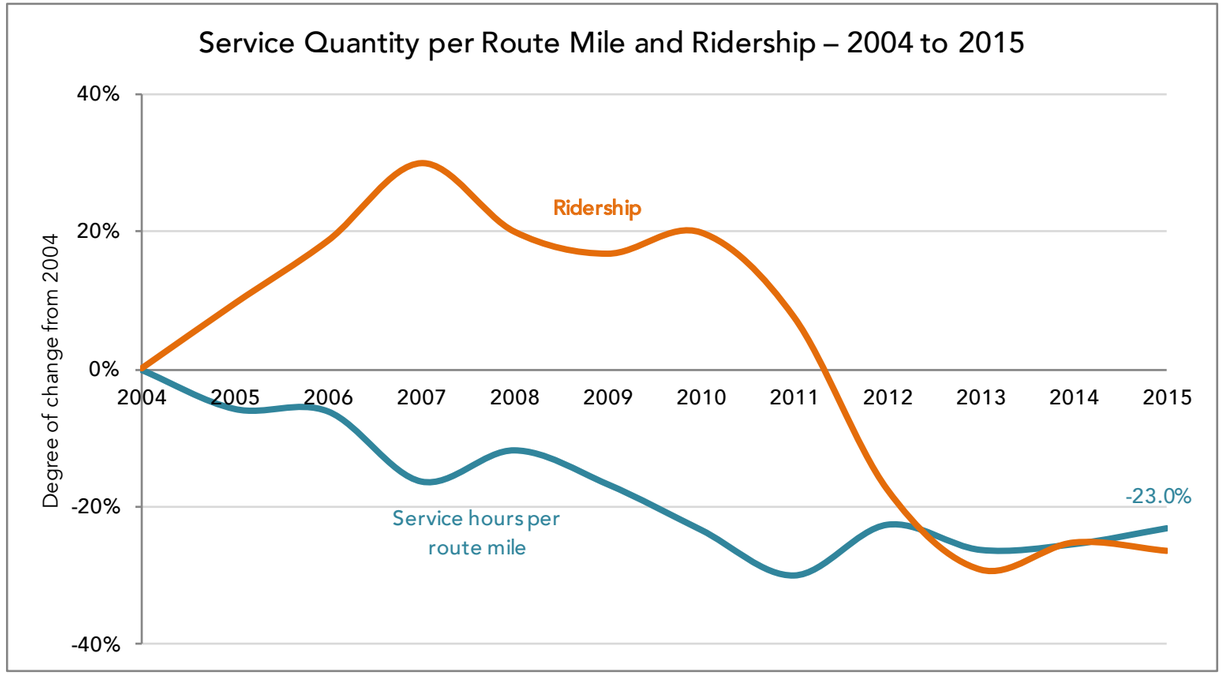


Figure 34: The graph at top shows the decline in fixed route transit ridership alongside growth in the number of jobs and residents in the Richmond region. At bottom, the decline in ridership is compared to the decline in service quantity per route mile.

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6 Key Choices

Ridership or Coverage?

The most fundamental choice before the Henrico County concerns ridership: *How important is it that GRTC maximizes ridership within its fixed budget?*

A goal of maximizing ridership serves several common desires for urban transit, including:

- Reducing people's transportation costs and burdens,
- Reducing costs and subsidies per rider,
- Reducing car travel and pollution,
- Supporting denser urban development,
- Providing access to jobs for large numbers of workers,
- Allowing for economic growth despite congestion.

On the other hand, transit can serve several common desires that have nothing to do with high ridership:

- Ensuring that everyone has access to some transit,
- Providing lifeline access to critical services,
- Providing access for people with severe needs.

No transit agency focuses solely on either of these goals. Most agencies have routes that generate a lot of ridership very efficiently, and others that don't draw as much ridership but have important social purposes.

Some agencies act as though these goals were not in conflict, saying that they will "increase ridership while ensuring that all residents have access," or both "run efficiently" and "provide access for all." This can lead to a feeling among the public, elected officials and even transit staff themselves that no matter what they do, they are failing to achieve their goals. This is the natural result when major goals are in conflict. Conflicting goals cannot be maximized at the same time. They must be balanced instead.

It is often said about public and private organizations alike that if you want to know what really matters, look at their budgets. High-level policies are valuable, but when they are vague or in conflict, the real evidence of a community's values is in its budget.

We suggest that Henrico County think about this choice not as black-and-white, but as a dial that the community can turn to the correct position:

What percentage of the available budget for transit should be dedicated to generating as much ridership as possible, and what percentage should be spent providing transit where ridership may be low, but needs are high?

This is not a technical question, but one that relates to the values and needs of a community.

We estimate that, within Henrico County:

- About 20% of the existing transit network is designed as it would be if maximizing ridership were its only goal.
- The other 80% has predictably low-ridership, because of where or when it runs, or other factors that make it useful to predictably-small numbers of people. This suggests that it is being provided for other, non-ridership purposes.

A 20/80 balance between maximizing ridership and providing coverage may be the right balance for Henrico County in the future, or the community may wish for a shift in that balance.

The direction of that shift – either towards higher or lower ridership – and how fast Henrico should make such a shift are two questions that will be put to the public, stakeholders and elected officials in this Transit Development Plan.

Other cities that have thought about this have come to different answers. For example:

- In Reno, Nevada the transit agency Board's policy devotes 80% of resources to maximum ridership; this policy has been used to reallocate service to higher productivity locations, and to show that such moves are the result of consistent policy rather than animus toward a particular area.
- Closer to home, the Wake County (Raleigh, NC) Long Range Transportation Plan calls for shifting from a 50/50 split to investing nearly 70% of operating resources on a ridership goal.
- All other studies in which we have been involved have led to policies devoting between 50% and 80% of fixed route resources to ridership.

However, these observations should not cause any "peer pressure." Different places have different values and development patterns, and the ridership vs. coverage trade-off is a non-technical question about priorities that should reflect the value judgments of the people and representatives in Henrico.

Balancing Weekday, Evening and Weekend Service

Within Henrico County, GRTC Routes do not provide service after 8pm or on weekends. Yet most people still need to travel on weekends (especially people who work in the service industry). Also, GRTC operates many routes only during rush hours, and also offers higher frequencies during rush hours on all-day routes. In particular, many Henrico routes are peak only.

Rush-hour-only routes are sometimes designed to target the highest-demand time of the day. Yet, as we discuss in this report, GRTC's peak-only routes are less productive than most of its all-day routes.

All people, regardless of their income, value flexibility and spontaneity. If a transit service does not support a midday trip home to pick up a sick child, or a late night at the office finishing a report, more affluent people can easily respond by using a private car. Even very low-income people who need to travel at uncertain times will find another option (such as a ride from a family member, or a very inexpensive car) if the transit network does not offer them flexibility. Only a few people are willing to build their lives and their commutes around a peak-only route.

As of the 2010 Census, 29% of U.S. workers did not work a traditional weekday, daytime schedule. Add to this population the large proportion of people who work a second job, are studying, are retired, or are not working, and we can imagine the proportion of Richmond residents whose essential travel needs go far beyond the morning and evening weekday peaks.

Why is extra service at rush hours more expensive? It has higher costs than all-day service because it requires a larger fleet and more infrastructure for just a short period of service.

It might therefore be reasonable to expect *higher* productivity, and more crowded buses, during rush hours than during other (less expensive) times of day. Each rush hour passenger is costing GRTC more to serve than a passenger riding at midday, yet rush hour passengers are treated to lower levels of crowding and shorter waits.

Thus, Henrico County may want to ask itself whether GRTC service in the county is a rush-hour-transit-service that runs some service at other times, or an all-day-transit-agency that supplements service during periods of high demand. (Periods that may or may not line up with the traditional morning and evening traffic peaks.)

A separate but related question is about weekend service. While

professional jobs are most intense Monday through Friday, service jobs are most intense on weekends. Other types of work and activities happen 7-days-a-week: health care commutes, shopping and errands, trips to visit or worship, and all the other types of trips that people take as part of a full life.

Increasing evening, weekend and holiday service can serve ridership-related values (because all-week transit networks tends to attract higher ridership than limited-day networks) and coverage-related values (because low-income people, in particular, badly need to access jobs on weekends and holidays).

Should any service be shifted from weekdays to weekends? Should service be shifted from weekday daytimes to evenings? Within a fixed budget, lengthening the span of service each day or each week would require reducing weekday frequencies or reducing coverage (i.e. cutting some routes).

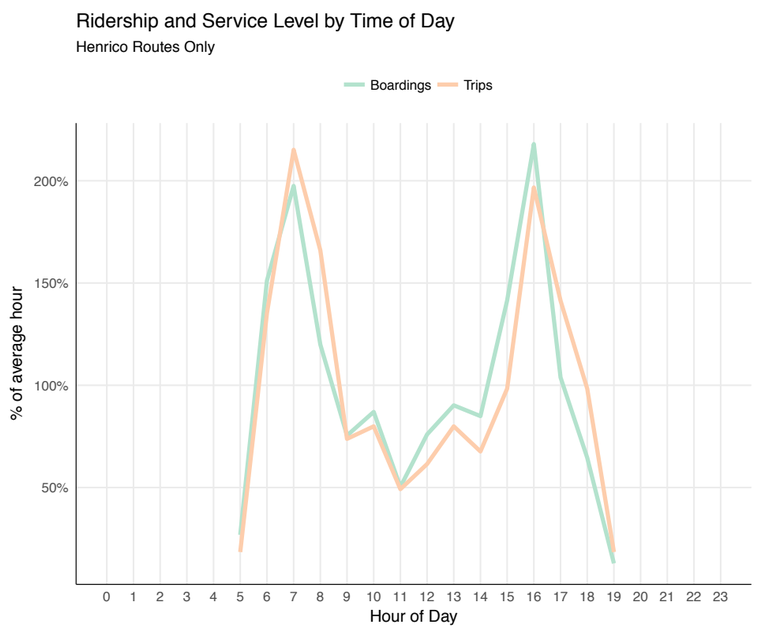


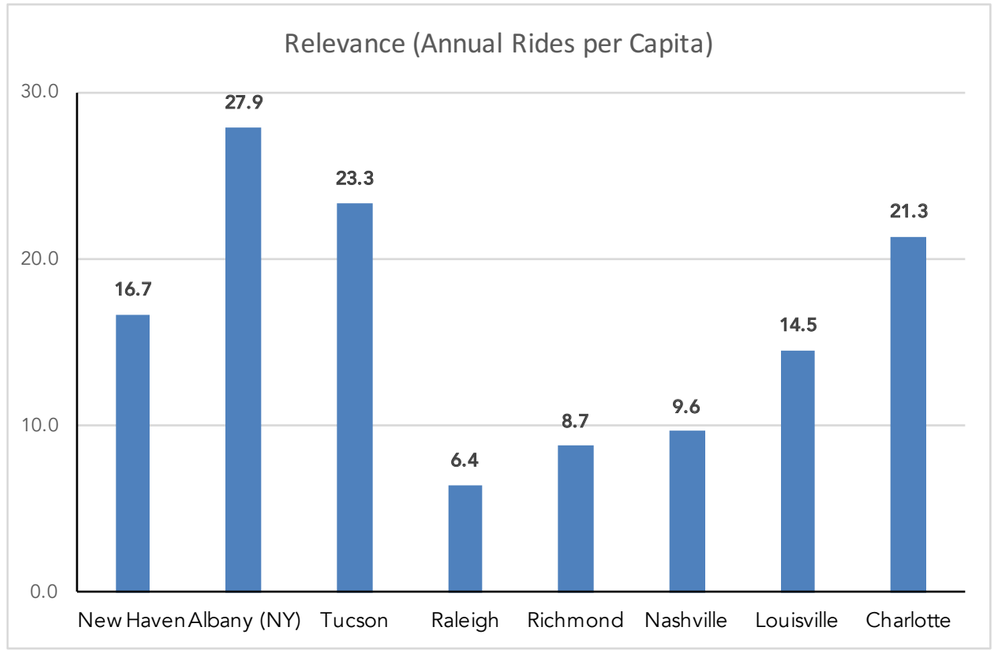
Figure 35: This graph shows that the number of boardings on GRTC's existing network in Henrico is higher during the weekday morning and afternoon peaks (6-8 AM and 2-5 PM) than at other times. This reflects higher demand for transit service at peak hours. Is it more important to provide better service to match higher peak demand, or to provide service at all times of day (and on weekends) to accommodate all trips?

Is the Current Level of Service Enough?

The Richmond region currently invests less in service per capita than many of its peers, and receives proportionally low ridership per capita as a result. Ridership and productivity have also declined since 2012.

While it is certainly possible to increase transit ridership without raising more money, doing so requires cutting low-ridership coverage services.

If Henrico County does decide to shift resources from coverage services to higher-ridership services, there may still be an appetite in the county for higher levels of service overall. With the recent development of higher-density, mixed-use nodes in places like Rocketts Landing and Libbie Mill and plans for similar redevelopment at Innsbrook, a reassessment of the total amount of service provided is worthwhile.



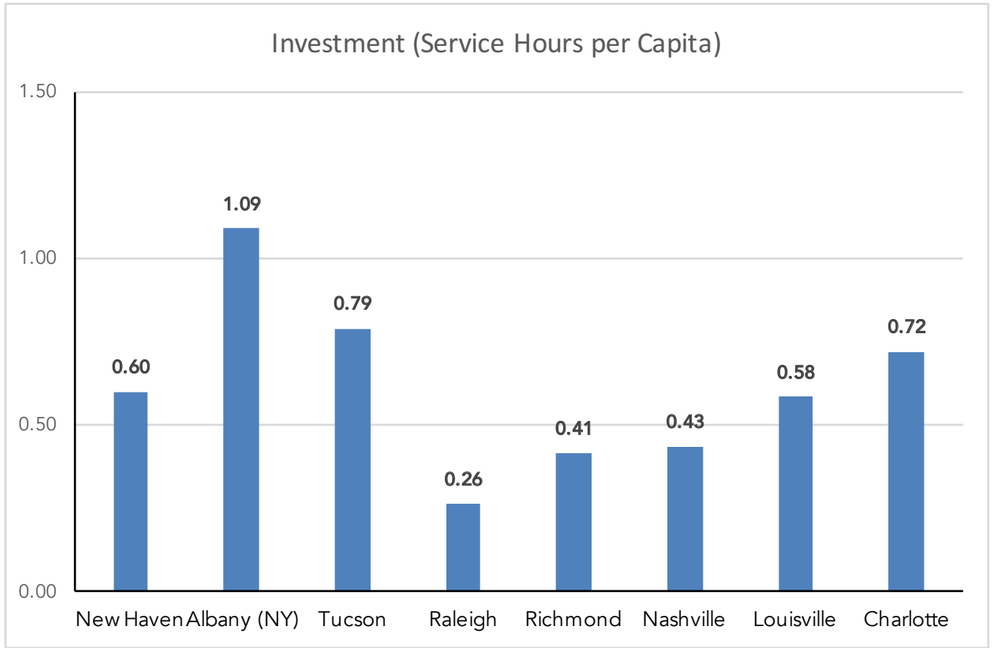


Figure 36: The charts at right reveal a similar pattern in both Investment (service per capita) and Relevance (ridership per capita), while controlling for the size of each region. This suggests that, in urban transit systems, *"You get what you pay for."*