Recommended Network
March 8, 2017
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Where are we now?</td>
<td>4</td>
</tr>
<tr>
<td>Who designed this network?</td>
<td>4</td>
</tr>
<tr>
<td>What happens next?</td>
<td>4</td>
</tr>
<tr>
<td>Learn more</td>
<td>4</td>
</tr>
<tr>
<td>About the team</td>
<td>4</td>
</tr>
<tr>
<td>How Did We Get Here?</td>
<td>7</td>
</tr>
<tr>
<td>Phase One: Input on general and abstract trade-offs</td>
<td>9</td>
</tr>
<tr>
<td>Walking vs. waiting</td>
<td>9</td>
</tr>
<tr>
<td>Maximizing ridership vs. maximizing coverage</td>
<td>11</td>
</tr>
<tr>
<td>Phase Two: Input on Network Concepts</td>
<td>13</td>
</tr>
<tr>
<td>Degree of change</td>
<td>13</td>
</tr>
<tr>
<td>Responses to the Concepts</td>
<td>17</td>
</tr>
<tr>
<td>Policy direction for the RTNP</td>
<td>20</td>
</tr>
<tr>
<td>Phase Three: Draft Recommended Network</td>
<td>21</td>
</tr>
<tr>
<td>Survey results</td>
<td>21</td>
</tr>
<tr>
<td>Specific comments and changes</td>
<td>25</td>
</tr>
<tr>
<td>Recommended Network</td>
<td>28</td>
</tr>
<tr>
<td>Policy basis</td>
<td>29</td>
</tr>
<tr>
<td>Design principles</td>
<td>29</td>
</tr>
<tr>
<td>Consistent route spacing</td>
<td>29</td>
</tr>
<tr>
<td>Directness</td>
<td>29</td>
</tr>
<tr>
<td>Through-routing across town</td>
<td>29</td>
</tr>
<tr>
<td>Consistent frequencies</td>
<td>30</td>
</tr>
<tr>
<td>BRT and an integrated network</td>
<td>30</td>
</tr>
<tr>
<td>Citywide Map, Daytimes and Saturdays</td>
<td>31</td>
</tr>
<tr>
<td>Downtown Map, Daytimes and Saturdays</td>
<td>32</td>
</tr>
<tr>
<td>Citywide Map, Nights and Sundays</td>
<td>33</td>
</tr>
<tr>
<td>Downtown Map, Nights and Sundays</td>
<td>34</td>
</tr>
<tr>
<td>North Side Detail Map</td>
<td>35</td>
</tr>
<tr>
<td>East End Detail Map</td>
<td>35</td>
</tr>
<tr>
<td>Southside Detail Map</td>
<td>36</td>
</tr>
<tr>
<td>West End Detail Map</td>
<td>37</td>
</tr>
<tr>
<td>Table of Route Frequencies and Spans of Service</td>
<td>38</td>
</tr>
<tr>
<td>Measuring coverage and access to frequent service</td>
<td>39</td>
</tr>
<tr>
<td>Measuring equity in service changes</td>
<td>40</td>
</tr>
<tr>
<td>Costs</td>
<td>43</td>
</tr>
<tr>
<td>Recommended future service enhancements</td>
<td>44</td>
</tr>
<tr>
<td>Next Steps</td>
<td>45</td>
</tr>
<tr>
<td>What happens next?</td>
<td>46</td>
</tr>
<tr>
<td>What about the long term?</td>
<td>46</td>
</tr>
</tbody>
</table>
1 Introduction
Where are we now?

At the beginning of 2016, the City of Richmond began a conversation with stakeholders, riders, community members and elected officials about whether and how to change the city’s transit network.

The goal of this process was to create a blueprint for changes to the transit network that can be put into place soon. This blueprint was developed assuming that funding for transit would remain constant over the next two years, neither increasing nor decreasing significantly.

Richmond’s transit network has not been thoroughly re-thought for decades, and many of its features are out-of-date. In addition, the Pulse BRT line will open in late 2017. This has presented an opportunity to redesign local transit services to create an integrated network with BRT.

Who designed this network?

This network was designed through collaboration among City of Richmond planning and transportation staff, GRTC staff, and consulting transit experts (with national firms Jarrett Walker + Associates and Michael Baker International).

This network represents some key choices about the future of transit in Richmond. Those choices were made not by the technical experts, but by Richmond and GRTC stakeholders. The choices, and the many ways that people weighed in on them, are described in the next chapter.

A Draft Recommended Network was reviewed by the public, stakeholders and decision-makers in January and February of 2017. Based on their comments, some refinements were made to the network, before its presentation here as the Final Recommended Network for the City of Richmond.

What happens next?

The Recommended Network has been delivered to GRTC. GRTC will now take the network through its own internal and external processes, before implementing it in 2017 or 2018.

Learn more

For the full story of this process, we encourage the reader to read three earlier reports:

- The Phase 1 Choices Report, released in Spring 2016, available in small and large sizes from the project home page: www.richmondtransitnetwork.com or directly from this link.
- The Phase 3 report on the Draft Recommended Network, released in January 2016, available in small or large sizes from this page: www.richmondtransitnetwork.com/Pages/New-Network.aspx or directly from this link.

About the team

The team that created this Plan includes staff from the City of Richmond and GRTC, and experts from the consulting firms Michael Baker International, and Jarrett Walker + Associates.
GRTC routes within Henrico County need not change as a result of this Plan. However, where those routes connect with the City of Richmond network is proposed to change. Exact routing of GRTC routes within Henrico County will be determined by GRTC and Henrico through a separate process.

Routes 1a, 1b, 1c combine to form Frequent Route 1 on Hull.

Routes 2a, 2b, 2c combine to form Frequent Route 2 on Semmes.

Final Recommended Network

Daytime Weekday and Saturday Frequency:

- **Bus Rapid Transit**: Every 10-15 minutes, all day
- **Frequent Network**: Every 15 minutes, all day
- Every 30 minutes
- Every 60 minutes
- **Peak Only**: Express Service

GRTC routes within Henrico County need not change as a result of this Plan. However, where those routes connect with the City of Richmond network is proposed to change. Exact routing of GRTC routes within Henrico County will be determined by GRTC and Henrico through a separate process.
1: INTRODUCTION

RECOMMENDED NETWORK
Richmond Transit Network Plan

FINAL RECOMMENDED NETWORK
Daytimes, on weekdays and Saturdays

1 - Chamberlayne / Hull
2 - North / Semmes
3 - 4th / Route 301
4 - Cary / Main / Whitcomb
5 - Church Hill
65 - Maymont
9 - VUU/ Hermitage

DOWNTOWN ROUTINGS
Transit Service Type and Frequency:

- **Bus Rapid Transit**: Every 10-15 minutes, all day
- **Frequent Network**: Every 15 minutes, all day
- **Every 30 minutes**
- **Every 60 minutes**
- **Temp. Transit Plaza**

(Express buses are not shown)
2 How Did We Get Here?
The Richmond Transit Network Plan process began in early 2016, and ends with the publication of this final report.

The RTNP included three phases of public input on the plan.

In Phase One, in the spring of 2016, the City and consulting team presented people with abstract choices and trade-offs, and received people’s general guidance in response.

In Phase Two, in the summer of 2016, the team presented people with three different, detailed Network Concepts for Richmond, and received people’s responses to the specific trade-offs and ideas shown in those Concepts.

Input received during both of these phases was used, in the fall of 2016, to develop the Draft Recommended Network.

In Phase Three, in January and February of 2017, the Draft Recommended Network was put forward for consideration by the public, bus riders, a Stakeholder Committee, and City Council. Our team gathered input on the Draft through public meetings, surveys and conversations. That input was used to make some changes to the network. The result is the Recommended Network.

For readers who wish to learn more about the questions asked in Phases One and Two; the ways that input was gathered; the numbers of people who gave input; and the summary of their input, please see the Draft Recommended Network Report.

In this report, we summarize the input received in the three phases. We give a detailed account of input received during Phase Three, and changes made to the network in response to that input.
Phase One: Input on general and abstract trade-offs

In Phase One of public engagement, before any new networks for Richmond were designed, this consulting team asked people to weigh-in on some of the trade-offs that arise in every transit system. These trade-offs were described in detail in the Choices Report, which is linked from the “Learn more” section of page 4.

For charts reporting the results of polls and surveys on these questions, please see the Draft Recommended Network Report, which is also linked from page 4.

Below, we describe each of the trade-offs and summarize the input from all sources.

Walking vs. waiting

In any transit network, there is a basic trade-off between walking farther to service, or waiting longer for service.

A transit agency can concentrate its service into fewer, more frequent routes...but they will be spaced farther apart. Or it can spread its service out into more routes, that are closer together...but then they run infrequently. Within a fixed budget,

TRADE-OFFS BETWEEN WALKING AND WAITING

Dividing transit service among more streets inevitably leads to lower frequencies on each street, and therefore longer waits. When parallel routes are consolidated onto a few main streets, frequency is better and waits are shorter. However, more walking is required. Many people dislike both walking and waiting, but in any transit network they must be traded-off against one another.

Imagine you are Ms. Smith, living at 8 and 2nd Street. In the example to the right, Ms. Smith wants service that comes more frequently. Ms. Smith is busy, and wants to travel when she is ready to travel, not every 30 minutes as dictated by a bus schedule. She hates when she misses her bus by a minute and must wait a long time for the next one.

In the example on the left, Ms. Smith gets a shorter wait, for a longer walk, but her total time is still 3.5 minutes faster on average. Not everyone is comfortable walking farther and some people would prefer a longer wait over a longer walk.

PLACE A STICKER WHERE YOU THINK WE SHOULD FOCUS

Figure 2: The trade-off between a network designed to minimize waiting and a network designed to minimize walking was shown to people at public meetings using this board. They were invited to place a sticker on the spectrum, at bottom, to express how they thought the trade-off should be made in Richmond. Their responses are shown in the photo at the top of the next page.
the basic math of transit forces a trade-off between offering shorter waits and offering shorter walks.

When asked how they would like to see this trade-off made, Richmond stakeholders, bus riders and members of the general public tended to support longer walks in exchange for shorter waits. Among people who took the on-board survey, there was a modest preference for less waiting. Among web survey respondents, there was a very strong preference for less waiting. And among public meeting attendees (whose sticker-votes are shown at right) there was also a strong preference for less waiting in exchange for more walking.

Figure 3: People at public meetings said that, on average, they would like the Richmond Transit Network to minimize waiting time, rather than minimize walking distances.
Maximizing ridership vs. maximizing coverage

The trade-off between walking and waiting can also be described as a trade-off between maximizing ridership and maximizing coverage.

When transit agencies concentrate their service into fewer, but more frequent, routes, it nearly always leads to higher ridership. Yet, within a fixed budget, this means less service can be spread out to cover everyone.

In response to questions about this trade-off, most people said that they wanted GRTC to spend somewhat more of its budget providing frequent, high-ridership service, and somewhat less of its budget on low-ridership coverage services.

An interest in this direction of change, among a majority of respondents, was consistently heard from the different groups of people who attended public meetings (their responses are shown at right), took the web or on-board survey, and were on the Stakeholder Committee.

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.

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.

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 4: When people at public meetings were presented with the abstract trade-off between high ridership and high coverage, on average they valued higher ridership (and higher frequency) over higher coverage.
Peak vs. all-day, all-week service

The more service an agency concentrates on the peaks (rush-hours), the less service is available to keep frequencies high at other times of day, and on weekends.

People were asked how much the City’s transit network should focus on providing service during the peaks, as opposed to providing a consistent level of service all day and week. Members of the Stakeholder Committee expressed strong support for shifting service away from the peaks. Attendees of public meetings expressed even stronger support for that shift.

Existing riders were more likely to say that peak service is the most important. However, most surveys were administered on-board buses and at the Transfer Plaza during rush-hours, so the people responding to this question were in effect selected for their existing interest in rush-hour service. Riders surveyed at other times would likely have a different response.

In consideration of all of this input from diverse Richmond transit stakeholders, the study team (including City staff, GRTC staff, and consultants) decided to build less peaking, and more all-day all-week service, into the Recommended Network.

Figure 5: While GRTC’s service “peaks” a great deal during morning and evening rush hours (the blue line in this graph), boardings are highest in the early afternoon (orange). In the midday, boardings are quite high, compared to the amount of service GRTC is supplying. The efficiency of this peaked service pattern is discussed in more detail in the Choices Report, linked from page 4.

Figure 6: At public meetings, when asked how they would like GRTC to balance peaked service (with higher frequencies and special routes during rush hours) and all-day, all-week service, most people said that all-day, all-week service was more important to them.
Phase Two: Input on Network Concepts

In order to help people understand key trade-offs and develop confident opinions, the consulting team created three different “Network Concepts.”

These three Concepts illustrated two separable choices, as illustrated in the triangle at right:

- How much should the network change?
- How should Richmond balance ridership and coverage goals? (And, relatedly, how should walking and waiting be traded-off?)

For maps of these three Concepts, please see the Phase 2 report, linked from page 4.

Degree of change

The Concepts illustrated a spectrum from very little change to a great deal of change. (Small versions of each Concept map are shown on the next page. Full-sized maps of the Concepts are still available in the Phase 2 materials linked from page 4.)

The “Familiar” Concept showed how the transit network could be redesigned to accommodate BRT, but with minimal other changes.

The “High Coverage” and “High Ridership” Concepts were blank-slate redesigns of the transit network, completely re-thinking the shape of the transit network, to fit modern-day Richmond. They would both incorporate and take advantage of the Pulse BRT.

The High Ridership Concept concentrated service into frequent lines, in places where ridership potential is highest. A much greater number of residents and jobs in the City would be close to frequent, direct service than are today.

The High Coverage Concept, in contrast, spread service out to cover a large geographic area, but with low-frequency routes. Many fewer residents and jobs would be close to frequent service in the High Coverage Concept. However, more residents and jobs would have access to some service, even if it comes infrequently and therefore isn’t very useful.

The number of people who would be covered by any service, or by frequent service, was measured for the three Concepts, and reported in the Phase 2 and Phase 3 reports, which are linked from page 4.

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Figure 7: The three Concepts presented during Phase 2, for public input, illustrated two different spectrums of choices: on relating to the degree of change, and one relating to the trade-off between high ridership and high coverage.
Figure 8: In Phase Two of the RTNP, detailed alternative Concepts were created for public consideration. They differed in terms of how much change they showed from the existing network and existing speeds, and what percentage of the budget was spent on frequent, high-ridership lines.
STOP SPACING AND SPEEDS

The High Coverage and High Ridership Concepts assumed another type of change, which was the average spacing of bus stops.

Today, GRTC bus stops are spaced very close together. This causes many bus lines to be slow, because the bus must stop at nearly every block for passengers getting on or off. When bus lines are slow, it makes passengers’ trips take longer. It also costs GRTC more to operate a slow bus line than a fast one. If service can be sped up, GRTC will have more budget left to spend on higher frequencies or longer routes.

The High Ridership and High Coverage Concepts were both built on the assumption that GRTC would speed up its routes within the City of Richmond, by changing the average spacing of bus stops from every block to every three blocks.

The Familiar Concept was built on the assumption that bus stop spacing would not change. Routes would remain slower, with bus stops every block in some places, and less of the budget would be available for higher frequencies or greater coverage.

Figure 9: In web and on-board surveys, drawings were used to help people understand the relationship between bus stop spacing and bus speeds.
In response to the Concepts and to pointed questions about bus stop spacing, people expressed strong support for wider spacing of GRTC bus stops, even though this would result in slightly longer walks to a bus stop for many people.

Removing bus stops is one of the hardest things any transit agency can undertake, even when it results in faster trips for passengers, and more useful service.

The Richmond Transit Network Plan presents the City and GRTC with a rare opportunity to make a holistic change, city-wide, so that no rider, neighborhood, route or community is singled out for this difficult change. Instead, everyone would bear the burden and the benefits of the change at once, all together.

At the end of Phase 2 of public input, in December 2016, GRTC began applying a more consistent spacing to its bus stops, across the city. By the time GRTC implements this Recommended Network, the task of re-spacing bus stops across the city will already be mostly finished. Some bus stops will be moved because the routes they serve will move to entirely different streets, due to this Recommended Network. Aside from those, any bus stop removals for the purpose of improving bus speeds will be limited to downtown and along Broad Street.

Figure 10: a survey on the web and at the Transfer Plaza, people expressed strong support for wider bus stop spacing. This chart shows the combined responses from 700 web and rider surveys.
Responses to the Concepts

In a web survey, which was also given to bus riders at the downtown Transfer Plaza, people were asked to assign each of the three Concepts a “star” ranking, from 1 to 5 stars. The chart at right shows how many times each Concept received each potential ranking.

The Familiar Concept received the most low rankings (1 or 2 stars) (shown in tan and green bars). It also received the fewest high rankings (4 or 5 stars) (orange and red bars).

This indicates that, among Richmond’s transit stakeholders, there is an appetite for change. This may also relate to the slower bus speeds (due to closer bus stop spacing) in the Familiar Concept.

Public input on the High Coverage and High Ridership Concepts made clear that there is much more support for moving towards higher frequencies, higher ridership, and lower coverage, than there is for maintaining the current high levels of coverage and low frequency.

In the chart at right, the High Ridership Concept received by far the most “5 star” ratings (in red). It received a similar number of 4 star ratings as the High Coverage Concept (in orange). It received fewer 1

Figure 11: In a web survey and an intercept survey at the downtown Transfer Plaza, people were asked to rank the three Concepts from 1 to 5 stars.

and 2 star ratings than the High Coverage Concept (in tan and green).

These results suggest that Richmond would value a shift towards higher frequency and ridership, though not quite as far of a shift as was illustrated in the High Ridership Concept.
Acting on public input

Two major choices were presented during Phase 2:

- A choice about how much to change the network and bus stop spacing.
- A choice about the direction to move with that change.

In order to summarize and quantify the public input received on these two choices, the consulting team added more detail to the “Triangle of Choices” diagram (first shown on page 13).

The triangle at right shows more detailed information about how the three Concepts related to one another. This triangle was been used for conversations among City staff and elected officials, about what policy direction to set for the design of the Draft Recommended Network.

On the following page, public input is mapped onto this triangle.
Figure 12: Each person’s response to the two key choices can be represented as a single dot in this diagram. At left, the responses from the 652 people who completed surveys on both the Concepts and stop spacing are summed. At right, the responses of the members of the Stakeholder Committee are summed in the same way.
Policy direction for the RTNP

Before designing the Draft Recommended Network, City staff reviewed input from Phases 1 and 2, from the general public, current bus riders, and the Stakeholder Committee. Based on this input, they recommended to the consulting team that the Draft Recommended Network be designed to be similar to the High Ridership Concept, but with slightly less frequency and slightly more coverage.

In the Draft and Final Recommended Networks, about 70% of the budget is spent pursuing maximum ridership, while 30% is spent providing coverage in places where ridership is naturally low. At the same time, the network is designed with the assumption that bus stops in the urban, walkable parts of Richmond will be spaced out to an average of three blocks, or about 1,000 feet.

This policy position represents the “center” of input received from all sources in Phase 2, and is consistent with the more general input from the public in Phase 1. This policy position represents slightly less of a shift than would be supported by members of the Stakeholder Committee, but reflects the majority opinion of the general public and current riders.

Figure 13: After considering public input from all sources, and from Phases 1 and 2, the City asked the consulting team to design a Draft Recommended Network that is similar to the High Ridership Concept, but with slightly less emphasis on frequency, and slightly more emphasis on providing coverage.
Phase Three: Draft Recommended Network

Based on public input collected in Phases One and Two, this consulting team, together with City and GRTC staff, designed a Draft Recommended Network.

The policy basis and principles of this network are described starting on page 29.

Survey results

In Phase Three, the City solicited both open-form comments on the Network, and responses to survey questions asking for people’s general reactions to the network.

People’s responses to the Draft Recommended Network were mostly positive, with the largest exception being people who were concerned about reductions in service on Route 64X, the commuter express service from Huguenot Road and Forest Hill Avenue to downtown. In fact, 17% of all people who commented on the network were commenting on Route 64X (though the route carries, on average, less than 300 riders per day).

The reduction in 64X frequency is being addressed by City and GRTC staff, as described later in this section. In the meantime, total responses to the network are shown here with Route 64X commenters split apart, so that the strong reactions to a small (and separable) issue can be evaluated separately from responses to the whole network.

Among all respondents, 45% said the Draft Recommended Network would be better for them.

While 43% said it would not be better for them, many these respondents were responding to the 64X cuts specifically. Their responses are shown in grey, at right.

When asked if they thought the network would be better for the city, 55% of respondents said it would. Setting aside 64X riders, only 21% of respondents responded negatively to the statement that the network would be better for the city.

Clearly the recommended reduction in service on the 64X...
would have severe consequences for its riders, and their input had a strong effect on the total survey results.

The 64X carries about 300 riders per day, from Richmond’s western boundary with Chesterfield County to downtown. 85 people commented on the 64X in this survey.

City actions in response to this input are described later in this section.

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**Figure 15:** When responses are split based on whether or not the respondent also commented on 64X changes, a very different pattern of support or opposition becomes clear. Fortunately, funding for the 64X is a very separable issue from the design of the rest of the City.
Overall, support for the Draft Recommended Network was high across most of the City of Richmond. More than half of residents in every part of the city except Southside responded positively. Among Southside commenters, however, 39% of responses specifically referenced the recommended cuts to 64X service. When that issue is set aside (as demonstrated by the chart at right, bottom) negative responses in the Southside are much fewer. Of all respondents who live in the City of Richmond, 55% responded that the plan would be good for the City, and an additional 10% had a neutral response.

Figure 16: When responses from City residents are split by location, support in Southside and downtown appears low at top). However, further splitting negative responses from all responses (at bottom) reveals that a great deal of the concern from Southside and Chesterfield is related to cuts to the 64X. Concerns among downtown residents may relate to current conditions at the Temporary Transfer Plaza.
On average, minorities responded more positively to the recommended network than whites, with 58% of minority respondents saying that the recommended network is better for the city compared to 46% of whites. (Among all of the people who took the survey, about 59% reported their race as white and 41% reported their race as black or other minority.)

Figure 17: Positive responses to the Draft Recommended Network were slightly more prevalent among minority respondents (top). Positive responses were also slightly more prevalent among low-income respondents.
Specific comments and changes

Some changes were made in creation of the Final Recommended Network, based on public input gathered in January and February. Other changes were not made, despite public comments requesting them, for the reasons explained below.

A complete log of comments received, and the transit planning team’s responses, is available on the project website.

EAST END

In the Draft network, there was a frequent (red) Route 5 in the East End. Members of the public asked that Route 5 get closer to more important destinations, and thereby provide shorter walks.

In response, in the Final Recommended Network, Route 5 was lengthened and deviated to additional places. As a consequence, the frequency of Route 5 had to be reduced.

In addition, Route 41 was added to Oakwood. (This was affordable, within the fixed budget, because of the remaining savings from the reduction in frequency on Route 5.)

In total, areas of the East End that are east of Mechanicsville will have shorter walks to service, but longer waits for service.

SOUTHSIDE

In the Final Recommended Network, the routing of Route 2c was changed slightly, around Hull Street, due to technical problems with making certain turns.

Service on the Ruffin Shuttle (Route 17) was increased to include Saturdays (also peak-only), to accommodate Saturday work shifts in the area.

Some commenters requested closer coverage of the Springhill neighborhood, between Semmes and the river (where Routes 70 and 71 go today). There are two reasons this change was not made in the final Network.

First, Routes 2 and 3 (frequent routes that pass this neighborhood) are expected to attract high ridership, and therefore to have full buses just as they head north over the river. When a transit route deviates off its most direct course, so close to downtown, when it is most likely to be full, it has the biggest (negative) impact on riders. (In contrast, deviating near the ends of routes, when the buses are mostly empty, has less negative consequences.)

Second, in order to make the deviation less severe, any route passing through Springhill would naturally take the Lee Bridge into downtown. This would cause it to not pass through the intersection of Cowardin and Semmes, and as a result Routes 2 and 3 would not intersect on the Southside. This would eliminate an important feature of the frequent network: the ability for people to travel within the Southside, with a quick transfer, without going all the way downtown.

The Springhill neighborhood has been treated consistently with other Richmond neighborhoods in this respect. The deepest corner of Springhill is about 1/5 mile from frequent service on Semmes, which is no more than (and in most cases less than) the walking distance to frequent service offered in other parts of town.

Some commenters asked for more service at the Walmart on Forest Hill.

While today there are a large number of boardings at that Walmart (on Route 70), boardings on Route 70 between Westover Hills to Hathaway are very low. The farther away a place is, the more it costs to get service out to it. Because Walmart’s is so far away from other high-ridership places, boardings at the Walmart would have to be extraordinarily high to justify the high
cost of sending high frequency service over such a long distance.

Boardings at the Walmart are not that high, and the distance is unfortunately immutable. However, in recognition of how important access to the Walmart is to many Richmond residents and workers, the area is covered with lower-frequency service.

WEST END
The routing of Route 10 was changed slightly to address technical issues with wide turns through Carytown.

A number of commenters pointed out that there is an area within the Fan that is a long walk from any service at all. The center of this zone is at approximately Granby and Hanover. This is the place from which walks are longest to service, in the Fan.

From this place, the BRT stop at Allison & Broad would be a little less than 1/2 mile away. Frequent service to VCU and downtown, on Cary and Main Streets, would be a little more than a 1/4 mile walk away. These distances are consistent with the walking distances offered elsewhere in dense parts of the City, such as the areas in between Routes 9, 1, 2 and 3 on the Northside, and a few places along Riverside Drive on the Southside.

A few commenters objected to the loss of Route 16 and other services in the far West End. Ridership relative to cost has been low in the far West End, not because people there care less about transit, but because there simply aren’t very many people there compared to the other places GRTC routes go. Route 16 is the third-least-productive route in the City network today, and boardings along Monument and Patterson west of I-195 are generally quite low.

By City policy, only 30% of the budget is now reserved for predictably low-ridership routes and places. That limited budget must be used to spread a modest amount of service across a wide geographic area. As a result, some of the low ridership service areas for existing Routes 1, 2 and 16 receive reduced frequency and span in this Recommended Network. Frequency and span are prioritized on corridors and in places where there are the most people and activities.

DOWNTOWN
Numerous people commented on the Temporary Transfer Plaza, expressing concern about the comfort of passengers currently waiting at the Plaza, and concern that the Draft Recommended Network would perpetuate those conditions.

The Draft Recommended Network was designed to have routes come to a central transfer point in downtown, at night and on Sundays. This will allow passengers to transfer among them with a short wait. During the day, most routes are more frequent, and as a result people will transfer between routes wherever they intersect - on Broad Street, in other places downtown, and at transfer points elsewhere in the city. Waiting times for most routes will be shorter, whether someone is transferring or not.

The City and GRTC continue to work on improving conditions at the Transfer Plaza, either at its current location or a new location that is also central to downtown. Nothing in the Final Recommended Networks precludes making improvements to the Transfer Plaza or moving it to another location (as long as that location is very central to downtown).

ROUTE 64X
Comments about the cuts to 64X frequency shown in the Draft Recommended Network dominated the negative responses in the survey. 85 people submitted negative comments on the 64X service cut (and most of them had a negative response to the network overall).
Boardings data and comments received through the recent web survey suggest that many, if not most, riders of the 64X are Chesterfield County residents. Thus it is hard for the City of Richmond to justify funding the 64X at its full existing level, when there are so many other pressing needs and demands within the City for this plan to address.

City and GRTC staff are working to identify another source of funding, in addition to the City sources used by this Recommended Network, so that GRTC can continue to operate the 64X at its existing levels. GRTC is also conducting a survey of 64X riders to better understand their travel patterns, origins, destinations and preferences.

In response to these comments, the service on Route 64X (a peak-only express from Stony Point to downtown) was changed in the Final Recommended Network. Instead of providing 3 trips over 3 hours during each peak, the route would offer 4 trips over 2 hours during each peak. This change offers a higher frequency, over a shorter period of time, and allows people to reach jobs that start earlier. This change did not affect costs.

**NETWORK-WIDE**

A number of people asked that low-frequency routes operate for longer spans of service each day. This is an understandable desire, since people’s lives operate for much more hours of the day than the lowest-frequency routes in this Network. However, due to cost constraints, and due to the City’s policy of limiting to 30% the amount of the transit budget that is used to cover low-ridership areas, there are not currently resources available to run low-frequency coverage routes for more hours of the day. Late-night service has been prioritized on the higher-frequency routes in places with more residents and activities.

Increasing the span of service on all routes would require more funding. However, this is an enhancement the consulting team recommends, should additional funding become available, because it would improve the coverage outcomes of this network. The estimated costs of this enhancement and others are reported in the table on page 44.
3 Recommended Network
In this chapter, we present maps of the Recommended Network, and information about how it would operate and how it would perform.

This Network was developed by a team of technical experts from the City of Richmond, GRTC, and consulting firms. The policies that guided the design of this network are based on public input on key transit choices and trade-offs.

A Draft version of this network was presented to the public, current GRTC bus riders, the Stakeholder Committee, and elected and appointed officials in January and February 2017. Feedback on the Network in general, and comments on specific details, were considered in the development of the final Recommended Network.

The Richmond City Council adopted a resolution of support for this network, and the policies underlying it. The GRTC Board will consider adopting a larger GRTC network plan, incorporating this recommendation, in 2017.

The maps on the following pages show the network at different times and on different days; at the citywide and downtown scales. The table on page 35 shows the frequency of each route, and its branches, over the hours of each day and the days of each week.

Policy basis
As shown in the diagram on page 20, this network is designed to fulfill a policy direction that:

- About 70% of the operating budget in the City of Richmond should be spent on maximizing ridership.
- The remaining 30% should be spent covering those places where transit service is valued, even if ridership relative to cost is low.
- On average, urban and walkable parts of the city will have 5 bus stops per mile, per direction. Routes in suburban, less-walkable parts of the city may have stops spaced closer together, based on the availability of sidewalks and local street connections.

This network was designed to fit within existing resources for transit. Specifically, within GRTC's expected 2017-2018 budget for fixed-route service in the City of Richmond. It would cost $35.5 million to operate, including 3% set aside for contingency.

Design principles
In addition to public input, certain principles of good transit design are reflected in the Recommended Network.

Consistent route spacing
The spacing between parallel routes should be consistent across the city, to the extent that the street network allows it. However, major barriers to walking (such as uncrossable roads, or a lack of through-streets) may sometimes argue for closer or wider spacing between routes.

Directness
Routes are designed to be as direct as possible between major activity centers.

Through-routing across town
Routes may cross the City of Richmond, passing through downtown but not necessarily terminating there. This will allow for faster and more reliable cross-town travel by passengers, and also some operational efficiencies.

However, this will require GRTC and the City to develop driver break facilities at the outer ends of routes, so that drivers needn’t take breaks mid-route while their buses are full of passengers.
Consistent frequencies
Routes will have consistent headways, or frequencies. This means that the number of minutes between arriving buses will be consistent for long periods of the day.

Whenever possible, routes will have “clockface” frequencies that divide evenly into an hour: every 10, 15, 20, 30 or 60 minutes. A bus that comes every half hour will arrive predictably, at approximately 7:02 am, 7:32 am, 8:02 am, 8:32 am, and so on.

BRT and an integrated network
In planning for The Pulse BRT, members of the public expressed a strong interest in a city-wide network plan, that would spread the benefits of BRT line beyond the Broad Street corridor.

A transit network can be liberating to large numbers of people because it is more than the sum of its parts. No single route can bring all of a city’s opportunities within reach of a person, but a well-designed citywide network has that power. In particular, a frequent network, on which transfers between frequent routes are fast and reliable, provide the kind of “anywhere-to-anywhere” freedom that attracts large numbers of people to transit.

The Pulse BRT will provide a fast, frequent backbone of service for the Richmond transit network. The Recommended Network takes advantage of The Pulse, making connections to it using other frequent routes (such as Route 8 in the East End), and reducing the costly, duplicative routes that currently run parallel and close to the BRT corridor, freeing up those resources to provide service in other places.

At the end of this chapter, we recommend some future service enhancements in order of priority, should additional funding become available. The priority order of these enhancements changed slightly in response to public comments on the Draft Recommended Network.
GRTC routes within Henrico County need not change as a result of this Plan. However, where those routes connect with the City of Richmond network is proposed to change. Exact routing of GRTC routes within Henrico County will be determined by GRTC and Henrico through a separate process.

Routes 2a, 2b, 2c combine to form Frequent Route 2 on Semmes.

Routes 1a, 1b, 1c combine to form Frequent Route 1 on Hull.

---

**Final Recommended Network**

Daytime Weekday and Saturday Frequency:

- **Bus Rapid Transit**
  - Every 10-15 minutes, all day
- **Frequent Network**
  - Every 15 minutes, all day
- **Every 30 minutes**
- **Every 60 minutes**
- **Peak Only**
- **Express Service**

GRTC routes within Henrico County need not change as a result of this Plan. However, where those routes connect with the City of Richmond network is proposed to change. Exact routing of GRTC routes within Henrico County will be determined by GRTC and Henrico through a separate process.
3: RECOMMENDED NETWORK

FINAL RECOMMENDED NETWORK
Daytimes, on weekdays and Saturdays

1 - Chamberlayne / Hull
2 - North / Semmes
3 - 4th / Route 301
4 - Cary / Main / Whitcomb
5 - Church Hill
6 - Maymont
7 - Nine Mile
9 - VUU/ Hermitage
15 - Oak Grove

DOWNTOWN ROUTINGS

Transit Service Type and Frequency:

- **Bus Rapid Transit**
  - Every 10-15 minutes, all day

- **Frequent Network**
  - Every 15 minutes, all day

- **Every 30 minutes**

- **Every 60 minutes**

- **Temp. Transit Plaza**

(Express buses are not shown)
Final Recommended Network

Service frequencies:
- **Bus Rapid Transit**
  - Every 15 minutes
- Every 30 minutes
- Every 60 minutes after 10 pm
- Every 60 minutes
- Every 30 minutes
- Service ends at 10 pm

**EVENING & NIGHT SERVICE**
The frequencies shown are offered from 7 pm to 1 am on weeknights. On weekends and holidays, these frequencies are offered from 7 pm to 10 pm, and then lower frequencies are offered until midnight.
3: RECOMMENDED NETWORK

FINAL RECOMMENDED NETWORK
Weekday nights and Sundays

DOWNTOWN ROUTINGS

Transit Service Type and Frequency:

- **Bus Rapid Transit**
  Every 10-15 minutes, all day

- **Every 30 minutes**

- **Temp. Transit Plaza**

This network would operate during the following periods:

- **Weekdays:** 7pm to end of service
- **Saturdays:** 7pm to end of service
- **Sundays:** All day

At night and on Sundays, when the frequencies of all routes are lower, transfers made at random between a pair of routes will take longer. For this reason, the network will include a timed-transfer downtown, in which all buses arrive downtown at the same time, and sit together for a few minutes so that passengers can transfer among any two routes.

For more information about the frequencies of route branches at night, see the map of Evenings & Late Night Service, and the table of Route Frequencies and Span.

During evenings, nights, Sundays and holidays, all routes will make a timed-transfer downtown. In this timed-transfer, routes come together at the same time, every half hour. Transferring between them is very reliable for passengers, and usually requires only a short wait.
3: RECOMMENDED NETWORK

SOUTH SIDE DETAIL
RECOMMENDED NETWORK

Transit Service Type and Frequency:
- **Bus Rapid Transit**: Every 10-15 minutes, all day
- **Frequent Network**: Every 15 minutes, all day
- **every 30 minutes**
- **every 60 minutes**
- **Peak Only**
- **Express Service**

![Map of Richmond Transit Network with various transit routes and service types highlighted.

Recommended Network
Richmond Transit Network Plan
Final Recommended Network
Route Frequencies and Spans of Service

3: RECOMMENDED NETWORK

HENRICO COUNTY ROUTES: With the exception of Route 7, GRTC routes that are planned and funded by Henrico County are not included in this table.

FREQUENCY
- 10 minute
- 15 minute
- 30 minute
- 60 minute

* Route 64 - Stony Point Express: The 64x is budgeted to have 4 trips each in the AM and PM peak periods under this plan. The City and GRTC are working to find additional funding from other sources to provide 2 additional trips in both the AM and PM peak periods.
Measuring coverage and access to frequent service

The chart at right shows how the Recommended Network performs in terms of access to any service and access to frequent service. For comparison, the same measures are shown for the existing GRTC network, and for the existing GRTC network plus the Pulse BRT that will open in 2017.

The Recommended Network will continue to get service within 1/2 mile of the same number of jobs and residents as have access today. Meanwhile, it will vastly increase the number of jobs and residents near frequent service. This is also an expected result, because this is the very strategy that will lead to higher ridership.

This network offers very slightly less access to frequent services for residents than did the Draft Recommended Network. This is because of the change of Route 5 from a shorter, frequent route to a longer, less-frequent route. However, many East End residents are still walking distance from BRT or Route 4, so the reduction in frequent service access is small, and access to service of any frequency within a short walk has increased.

How would the Final Recommended Network change access?

<table>
<thead>
<tr>
<th>Access to Any Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXISTING</td>
</tr>
<tr>
<td>EXISTING + PULSE BRT</td>
</tr>
<tr>
<td>RECOMMENDED + PULSE BRT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jobs within 1/2 mile of any route (excl. expresses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXISTING</td>
</tr>
<tr>
<td>EXISTING + PULSE BRT</td>
</tr>
<tr>
<td>RECOMMENDED + PULSE BRT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Access to Frequent Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXISTING</td>
</tr>
<tr>
<td>EXISTING + BRT</td>
</tr>
<tr>
<td>RECOMMENDED + BRT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residents within 1/2 mile of any route (excl. expresses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXISTING</td>
</tr>
<tr>
<td>EXISTING + BRT</td>
</tr>
<tr>
<td>RECOMMENDED + BRT</td>
</tr>
</tbody>
</table>

*Residential calculations are based off 2014 5-year Estimates at block group level from the American Community Survey dataset, while job calculations are based of block level data from LEHD’s LODES 2014 dataset.

Figure 18: The charts at right show how much access the Recommended Network provides to any service, and to frequent service, for residents and jobs within the City of Richmond. (Additional jobs and residents are covered by GRTC services outside of the City boundaries.)
Measuring equity in service changes

Title VI of the 1964 Civil Rights Act requires that no program receiving federal funding discriminate against people on the basis of their race, color or national origin. This and other Federal laws make clear that transit service changes may not result in disparate impacts on people of color. Additional laws require that transit service changes may not result in disproportionate burdens on low-income people.

An equity analysis was performed on the Final Recommended Network, measuring how access to service would change for low-income and minority residents of Richmond, compared to non-low-income and non-minority residents.

GRTC is currently in the process of updating its Title VI policy, which sets thresholds for how much impact borne by low-income or minority residents is too much. This process will be completed before any service changes are made as a result of the Richmond Transit Network Plan.

In the analysis presented here, the Final Recommended Network – including the Pulse BRT line – was compared to the existing network.

This analysis uses the “Person-Trips” method. This method measures impacts to each Census Block Group (a group of several Census Blocks). It takes into account not just the presence or absence of service near people, but the quantity of service. The quantity of service is measured by the number of trips a bus makes past each Census Block Group each year. The more frequent and long-running a route is, the more trips it makes past each Census Block Group that it passes.

The number of bus trips running past each Census Block Group is then multiplied by the number of people in question living in each Census Block Group.

For example, “Minority Person-Trips” describes how many times a real event would occur, each year: a bus would drive past a Census Block Group where a minority person lives. The more minority

Figure 19: This pair of maps shows which parts of Richmond are home to predominantly low income residents (at left) or minority residents (at right).
residents that bus passes, and the more times it passes them, the larger the “Minority Person-Trips” number becomes.

The change in bus trips past Census Block Groups is shown in the map at right. Trips to the downtown Block Group decline, mostly because fewer routes drive in a loop around the Transfer Plaza. Trips to Southside Plaza increase, because that is a natural place for transit routes in Southside to meet and facilitate transfers. Other areas experience modest increases or decreases in trips. However, the map at right does not speak at all to whether bus trips are getting close to where people live, it only reports how bus trips past geographic areas would change. The question of how well the Recommended Network gets service close to people is answered by the “Person-Trips” calculation, on the next page.

Figure 20: This map shows how much the number of bus trips passing by each Census Block Group would change in the Recommended Network. The large decrease in downtown is mostly due to a reduction in block-circling at the Transfer Plaza.
On average, service access would be improved for minority and low-income Richmond residents (as shown in the table below) in the Recommended Network, as compared to the existing network. Service access would also be improved for non-low-income and non-minority residents. (However, service access for minority residents improves by a great deal more than for non-minority residents.)

This change is largely due to the addition of BRT and to the redesign of the network to concentrate service on corridors where the most people live.

In the Draft Recommended Network report, worse results were reported here. This is because the Recommended Network includes the restoration of through-routes (which do not terminate downtown, but connect different sides of the city through downtown). This change requires a different methodology in order to accurately count bus trips in and around downtown - in earlier analyses, bus trips in the Draft Recommended Network were under-counted in downtown. The results reported here come from a methodology that more accurately measures service into and through downtown.

<table>
<thead>
<tr>
<th>“Person-Trips” (service access weighted by population)</th>
<th>Existing Network</th>
<th>Final Recommended Network</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Income Residents</td>
<td>4,180,628,718</td>
<td>4,554,940,423</td>
<td>9%</td>
</tr>
<tr>
<td>Non-Low-Income Residents</td>
<td>5,382,522,947</td>
<td>6,039,903,172</td>
<td>12%</td>
</tr>
<tr>
<td>Minority Residents</td>
<td>5,374,687,005</td>
<td>6,285,795,610</td>
<td>17%</td>
</tr>
<tr>
<td>Non-Minority Residents</td>
<td>4,188,464,660</td>
<td>4,309,047,985</td>
<td>3%</td>
</tr>
<tr>
<td>All Residents</td>
<td>9,563,151,665</td>
<td>10,594,843,595</td>
<td>11%</td>
</tr>
</tbody>
</table>

Figure 21: This table summarizes the change in service access for Richmond residents, when categorized based on race or income.
## Costs

### Operating

The major costs of transit relate to the time that buses are driven on a route, rather than distance. For that reason, in designing a transit network, the “design budget” is often set in terms of hours of service provided, or “service hours.”

The Recommended Network would require 344,483 service hours to operate. This operating cost includes all GRTC routes in the City of Richmond, the 64X express route, and The Pulse BRT. It does not include routes funded by Henrico County (like Route 7), nor express and seasonal routes funded by other partner agencies.

GRTC estimates that its operating cost for delivering each service hour will be $100 in fiscal year 2017-8. This means that the cash operating budget for the Recommended Network would be about $34.4 million, which is within GRTC’s expected operating revenues for City of Richmond transit services in 2017-8.

In addition, before setting this operating budget for the Recommended Network, the study team set aside 3% of expected 2017-8 operating revenues for one-time implementation costs and contingency.

### Capital

While the Recommended Network is designed to function within existing financial and physical resources, certain small capital improvements will be necessary in order to implement it.

The most urgently-needed improvements mostly relate to bus stops and driver break facilities.

The change in service patterns downtown will require moving many bus stops, and will benefit from the creation of a few “super-stops” at downtown locations where multiple routes come together, and people can be expected to transfer between them.

This Recommended Network converts many radial routes that currently end downtown into crosstown through-routes. These provide more mobility for passengers (without the hassle, or the cost, of a transfer). However, these through-routes do not provide a break for drivers downtown. Thus GRTC and the City may need to make some small capital investments in new driver break facilities at the outer ends of routes, so that drivers needn’t take mid-route breaks downtown while their buses are full of waiting passengers.

When frequencies are lower at night and on Sundays, all routes are designed to make a timed connection downtown. Buses from all routes will dwell for five minutes at a single point downtown, allowing passengers to quickly and reliably transfer from any route to any other route.

This “night line-up” (which also takes place all day on Sundays and holidays) will require space for at least 13 buses to dwell near one another. The existing Temporary Transfer Plaza is large enough to accommodate the night line-up, though it may require improvements for this use.

### Annual Operating Cost for Recommended Network (in Service Hours)

<table>
<thead>
<tr>
<th>Local City network</th>
<th>312,400</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Pulse BRT</td>
<td>32,083</td>
</tr>
<tr>
<td>Contingency (3%)</td>
<td>10,096</td>
</tr>
<tr>
<td>Total Service Hours:</td>
<td>354,579</td>
</tr>
</tbody>
</table>

With contingency funds, the total operating cost in 2017-8 is estimated to be $35.5 million.
Recommended future service enhancements

The tables on this page show the service enhancements that the consulting team recommends, should additional revenue become available. Some of these enhancements were included in the High Ridership or High Coverage Concepts, but had to be cut to create a network that compromised between those two ends of the spectrum.

These enhancements have been divided into two lists: those that are likely to grow ridership relative to cost, and those that would provide valued coverage, but are unlikely to grow ridership relative to cost.

The enhancements are listed in priority order. Each of the enhancements is presumed to take place after the enhancements above it, and its total costs include some costs already borne by earlier enhancements. The costs of certain enhancements will be different if they are implemented out of this sequence.

All of the costs quoted here assume an approximate hourly service cost of $105, which is higher than GRTC’s current cost of service.

<table>
<thead>
<tr>
<th>Enhancements to Increase Ridership</th>
<th>Operating cost, plus above costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increase frequency on Route 10 to every 15 mins</td>
<td>$2.35 million</td>
</tr>
<tr>
<td>2. Increase frequency of Route 7 within Richmond to every 15 mins</td>
<td>$1.2 million</td>
</tr>
<tr>
<td>3. Operate Routes 1, 2, 3, 4, 7, 8 &amp; 10 at every 15 mins on Sundays</td>
<td>$1.8 million</td>
</tr>
<tr>
<td>4. Extend 15 minute frequency on all frequent routes to 10 pm</td>
<td>$2.3 million</td>
</tr>
<tr>
<td>5. Increase Route 9 frequency to every 15 mins</td>
<td>$1.35 million</td>
</tr>
<tr>
<td>6. Increase Route 8 frequency, nights and Sundays, to every 30 mins</td>
<td>$0.3 million</td>
</tr>
</tbody>
</table>

Figure 22: Making each of the enhancements listed in the table above to the Recommended Network would likely increase ridership relative to cost. The enhancements listed in the table below are unlikely to increase ridership relative to cost, but would provide valued coverage. The costs in each table are cumulative within each table. For example, the costs of #3, above, assume that #1 and #2 have already been implemented.

<table>
<thead>
<tr>
<th>Enhancements to Increase Coverage</th>
<th>Operating cost, plus above costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Extend evening service to 8 pm on low-frequency routes</td>
<td>$0.25 million</td>
</tr>
<tr>
<td>2. Extend night service to 2 am on all routes</td>
<td>$1.4 million</td>
</tr>
<tr>
<td>3. Lengthen Route 2A to reach Stony Point Fashion Park (6.1 miles)</td>
<td>$0.75 million</td>
</tr>
<tr>
<td>4. Lengthen Route 17 (Ruffin/Bells shuttle) to Southside (6.7 miles)</td>
<td>$0.25 million</td>
</tr>
<tr>
<td>5. Lengthen Route 65 to the University of Richmond (7.3 miles)</td>
<td>$0.4 million</td>
</tr>
<tr>
<td>6. Lengthen Route 60 to cover entire BRT corridor (8.8 miles)</td>
<td>$1.25 million</td>
</tr>
</tbody>
</table>
Next Steps
What happens next?
The Recommended Network will be passed from the City of Richmond to GRTC, for implementation concurrent with BRT.

What about the long term?
While this plan is about the immediate redesign of the existing transit network, it can and should affect long term planning of the city and its transit system.

GRTC is beginning its own long-term plan (called a Transit Development Plan) in the spring of 2017. This long-term plan includes GRTC’s other partners, Henrico and Chesterfield Counties. The Transit Development Plan will incorporate the recommendations from this Plan.

In this shorter-term process, the City of Richmond has taken the step of defining high frequency transit corridors. This can help guide future discussions about where major new developments, and especially affordable housing and job centers, should be encouraged.

Over the next few years, the City of Richmond will likely undertake updates to citywide land use plans. This updated network plan highlights corridors on which transit is most likely to be frequent and therefore useful, for the long term.

In most cities, permanent and frequent transit corridors are places where higher density development can be accommodated, which contributes to transit’s success and to economic vitality. This network plan is one step in an iterative land use and transit planning conversation for the city, which can and should continue indefinitely, helping to build a more prosperous, fair and livable Richmond.