Service Planning and Integration Report

Montgomery County Department of Transportation

Executive Summary

Montgomery County has been a leader in developing transit alternatives that provide enhanced mobility and reduce reliance on single occupant vehicles for transportation within the County and to neighboring areas. The County operates an expansive local bus system, known as Ride On that is an important component of a balanced transportation system. In addition, the Washington Metropolitan Area Transit Authority (WMATA) operates numerous Metrobus routes and the Maryland Transit Administration (MTA) operates express commuter routes along several corridors in the County. These bus services complement a rail transit system that consists of two branches of the Metrorail Red Line, and MARC Commuter Rail Service. New transit services envisioned for the County in the short term, include the Corridor Cities Transitway and the Purple Line, projects that are currently in advanced stages of planning and design by the Maryland Transit Administration

This report presents a brief overview of the proposed RTS including service criteria guidelines, and detailed service plan concepts for each corridor. The service plan concepts present a corridor description which reviews the existing state of the corridor including: sources of activity, demographics, and land use. The corridor specific concepts review the planned land use so that changes in the characteristics of the corridor over time can be understood. The corridor specific sections review the existing transportation network in the corridor, and identify the transit service operations today. The existing routes are categorized as primary and secondary with respect to the RTS operations. Primary service operates along the same roadway as the RTS, and secondary service intersects or connects points along the corridor with other transit service. The existing transit service review also identifies key stops and current boardings and alightings for those stops.

The service concept plans also provide preliminary direction on the integration of the local service with the RTS service. The plans review potential fleet requirements in terms of number of vehicles required to meet the service levels. The plan also provides an operational effort estimate based on the revenue hours and required fleet.

Full implementation of the RTS concept is possible, and may even be desirable. If implementation needs to occur in phases, several logical configurations for each corridor are developed. These phasing plans are a potential path forward for increasing service levels as the system is developing; however, the service could be deployed in its full configuration at any time. The goal of the implementation strategy is not to prescribe a serial process that needs to be done in order to have a successful RTS or a substitute for the RTS. It simply identifies different service levels that can be established serially or independently as the RTS planning and implementation continues and evolves.

Citizen input is an important part of any transportation plan. The work done as part of this study received input and guidance from a study working group chaired by Dan Wilhelm, and a Steering Committee. The RTS Steering Committee included:

- Arthur Holmes, Jr., Chair, Montgomery County Department of Transportation, Director
- Shyam Kannan, WMATA, Managing Director of Planning
- Leif Dormsjo, Maryland Department of Transportation, Acting Deputy Secretary
- Mark Winston, County Executive's Transit Task Force
- David Hauck, County Executive's Transit Task Force
- Dan Wilhelm, County Executive's Transit Task Force
- Casey Anderson, Maryland-National Capital Parks & Planning Commission, Planning Board Member
- Steve Silverman, Montgomery County Department of Economic Development
- Joe Beach, Montgomery County Deparment of Finance
- Marc Hansen, Montgomery County Office of the County Attorney
- Jennifer Hughes, Montgomery County Office of Management & Budget
- David Dise, Montgomery County Department of General Services

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Introduction Service Planning and Integration

Montgomery County has been a leader in developing transit alternatives that provide enhanced mobility and reduce reliance on single occupant vehicles for transportation within the County and to neighboring areas. The County operates an expansive local bus system, known as Ride On that is an important component of a balanced transportation system. In addition, the Washington Metropolitan Area Transit Authority (WMATA) operates numerous Metrobus routes and the Maryland Transit Administration (MTA) operates express commuter routes along several corridors in the County. These bus services complement a rail transit system that consists of two branches of the Metrorail Red Line, and MARC Commuter Rail Service. New transit services envisioned for the County in the short term, include the Corridor Cities Transitway and the Purple Line projects that are currently in advanced stages of planning and design by the Maryland Transit Administration.

Building upon the strength of the existing and planned transit system, the County is exploring the development of a system of interconnected high quality bus services. Applying many of the characteristics of Bus Rapid Transit (BRT), this system known as the Rapid Transit System (RTS), will connect many of the existing transit facilities, will provide high quality, high capacity links in underserved corridors, and will enhance the transit network that currently exists. The RTS is intended to increase the travel options available to County residents, workers, and visitors. With the RTS in place, economic development and population growth can continue as planned.

Several studies of this system have been completed in recent years. The purpose of this study is to build upon the body of knowledge that has been developed and provide guidance for further RTS planning along the designated key corridors. This study examines how RTS could function, how the corridors can be linked together, and the potential for how other services might be modified to respond to the implementation of RTS.

Coordination of the RTS with Metrorail, MARC, Ride On, Metrobus and other bus operations within Montgomery County requires a detailed review of those systems and how they could function with the proposed RTS. The first step in the process is to evaluate the proposed RTS corridors and determine how best to integrate the corridors and develop preliminary service plan concepts to serve as a starting point for detailed corridor project planning and implementation. These service plan concepts provide the base for the next stage of the RTS planning. It is envisioned that future studies will be done for each corridor at a more detailed project planning level and will rely on the information in this document as guidance. The concept service plans laid out in this document provide a path forward by specifying an operations structure for the corridor as well as highlighting areas where service connects and integrates to establish better transit connectivity across the County.

This report presents a brief overview of the project, RTS service criteria guidelines, and detailed service plan concepts for each corridor. The service plan concepts present a corridor description which reviews the existing state of the corridor including: sources of activity, demographics, and land use. The corridor specific concepts review the planned land use so that changes in the characteristics of the corridor over time can be understood. The corridor specific sections review the existing transportation network in the corridor, and identify the transit service operations today. The existing routes are categorized as primary and secondary with respect to the RTS operations. Primary service operates along the same roadway as the RTS, and secondary service intersects or connects points along the corridor with other transit service. The existing transit service review also identifies key stops and current boardings and alightings for those stops.

Each corridor-specific chapter presents the RTS concept for the corridor along with a rationale for the service proposed and key stops. The chapters present the structure of the route with the service characteristics for peak and non-peak service. The RTS routes have been structured as trunks and branches. The trunk portions focus on the segments with higher levels of service. The rationale being that there are portions of each route where demand is greater and service levels should respond to that demand. The branches represent segments along the corridor where demand is not as high or the trunk service is split between different alignments to respond to demand patterns and provide improved connectivity across corridors. The frequency on branch segments can be a combination of two branch services from different corridor trunks which result in increased transit accessibility across the system. The objective in this approach was to balance the operational resources with the demand as well as to enhance mobility and minimize required transfers throughout the system.

The service concept plans also provide preliminary direction on the integration of the local service with the RTS service. The plans review potential fleet requirements in terms of number of vehicles required to meet the service levels. The plan also provides an operational effort estimate based on the revenue hours and required fleet.

Full implementation of the RTS concept is possible, and may even be desirable. If implementation needs to occur in phases, several logical configurations for each corridor are developed. These phasing plans are a potential path forward for increasing service levels as the system is developing; however, the service could be deployed in its full configuration at any time. The goal of the implementation strategy is not to prescribe a serial process that needs to be done in order to have a successful RTS or a substitute for the RTS. It simply identifies different service levels that can be established serially or independently as the RTS planning and implementation continues and evolves.

Study Process

This study started with a comprehensive review of all the previous work done on the RTS. It followed that task with a compilation of existing conditions data including transit routes, demographics, land use, and bus boardings and alightings by stop location. The data were used to evaluate and analyze travel patterns and travel demand. An important input into the process for developing the service concept

plans was the draft *Countywide Transit Corridor Functional Master Plan* (CTCFMP). As this study was being completed the County Council adopted a revised CTCFMP, that differed slightly from the draft.

Additional sources from previous planning efforts for the RTS included:

- Countywide Bus Rapid Transit Study (PB) - July 2011
- Montgomery County Transit Task Force Report - May 2012
- Councilmember Elrich's Plan - 2008
- Institute for Transportation and Development Policy (ITDP) – Demand and Service Planning Study – December 2012
- Veirs Mill and Georgia Avenue BRT New Starts Studies - current
- Corridor Cities Transitway FEIS – November 2010
- Purple Line FEIS – September 2008
- WMATA Priority Corridor Network (PCN) Evaluation Study – May 2010
- Metropolitan Washington Council of Governments (MWCOG) Multimodal Hot Spots Study (and data/GIS layers) – November 2011

As the study progressed there was a need to modify the corridors based on the dynamics of other ongoing studies and the review of past reports. The original corridors were:

- Georgia Avenue (MD 97) North – from Olney to Glenmont
- Rockville Pike/Frederick Road (MD 355) North – from Clarksburg to Rockville Metrorail Station
- Rockville Pike/Frederick Road (MD 355) South – from Rockville Metrorail Station to Friendship Heights Metrorail Station
- Veirs Mill Road (MD 586) – from Rockville Metrorail Station to Wheaton Metrorail Station
- Randolph Road – from Tech Road to White Flint Metrorail Station
- Colesville Road/Columbia Pike (US 29) – from Burtonsville to Silver Spring Metrorail Station
- Corridor Cities Transitway (CCT) – from Metropolitan Grove to Shady Grove Metrorail Station
- Intercounty Connector (ICC) – from US 1 to Shady Grove Metrorail Station

Based on the service integration goal of this study, as well as the review of past studies, the corridor list was modified to address the need for an integrated system that improved transit connectivity across the County. The modifications to the proposed RTS from the originally identified corridors are as follows:

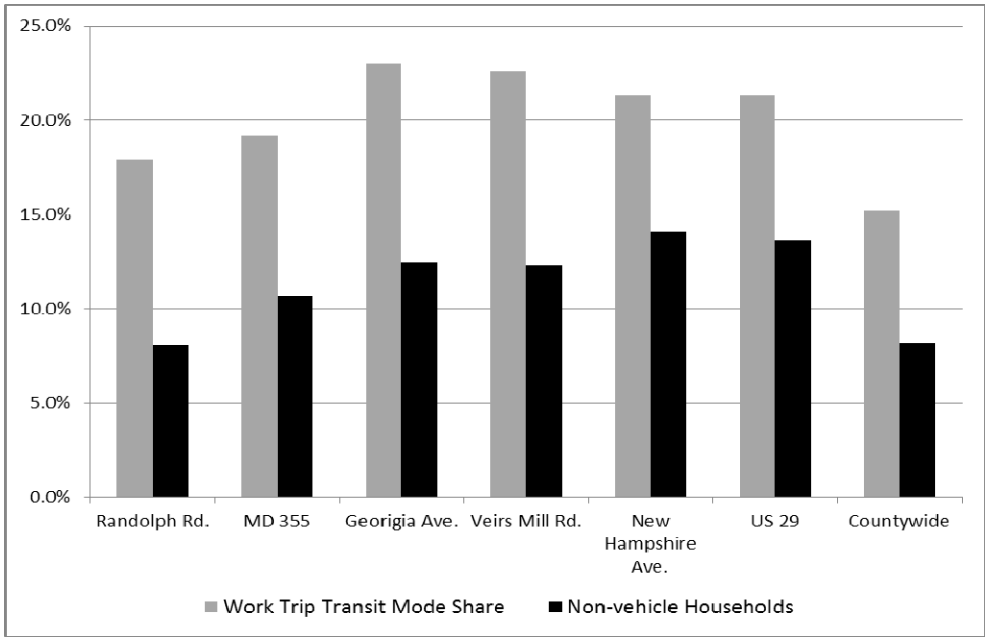
- Rockville Pike/Frederick Road (MD 355) was combined to form one complete corridor from Clarksburg to Friendship Heights.

- The connectivity between Veirs Mill Road (MD 586) and University of Boulevard (MD 193) was determined to be important, given the high ridership on existing bus routes; therefore, MD 193 was included from Wheaton to Langley Park.
- Georgia Avenue (MD 97) RTS service was extended to connect with Veirs Mill Road and University Boulevard with a continuation to Silver Spring.
- Based on the connectivity between the Randolph Road and US 29 corridors it was evident that the New Hampshire Avenue (MD 650) corridor from the Colesville area to Fort Totten should be included in this study.
- The RTS on Randolph Road was connected to the North Bethesda Transitway, providing one seamless link across the County.

The study was adjusted to look at the new modified list of corridors which were substituted for the ICC and CCT corridors. Since the ICC is open, the County determined that there was no need to advance RTS on the ICC at this time.

The service planning and integration effort for this study was based on providing connectivity, increasing access to high quality transit service, and enhancing transit mobility across the County. The service planning concepts reflect the goal of providing a high quality transit system that links activity centers and clusters. The integration concepts developed as part of this study focused on enhancing the mobility by providing the ability to transfer between the RTS corridors and other transit modes including Metrorail, MARC, and other bus services. The service integration concept was used as an input to the specific corridor service planning and guided the development of the route structure and service levels. A key input into this effort was existing demographic and key trip data along each corridor. Figure 1-1 provides an overview and comparison of each corridor as well as a countywide benchmark.

Figure 1-1 Key Demographic Comparison



Service Integration Concept Overview

The corridor-specific service plan concepts provide greater detail on the RTS service integration for each corridor. Figure 1-2 provides a schematic of the RTS system. The CTCFMP provided the basis for the corridors; the service plan concepts presented in this report propose limited deviations and modifications at the termini as well as RTS route integration across corridors. The initial service integration concepts from this study should provide a basis for moving forward and providing guidance and input into more detail corridor level planning activities. The linked system overlays provide beneficial connectivity, accessibility, and mobility through the system as a whole.

Figure 1-2 shows in schematic form the routes/lines, where they intersect with Metrorail and MARC service, transfer nodes within the RTS, and shared route structures. The system map also shows key stop locations, but not all stop locations. It highlights the connection with the Purple Line which will be the first fixed guideway transit providing east-west mobility across the County. The differences from past service maps include:

- The MD 355 corridor, where some operations will have termini at Metropolitan Grove and Montgomery College Rockville Campus, as well as Clarksburg and Friendship Heights.
- The Veirs Mill Road line, where the integration concept shows termini at Montgomery College Rockville Campus and branch service to both Langley Park and Silver Spring.
- The Georgia Avenue line which has termini at Olney with branch service and termini at Langley Park and Silver Spring.
- The Randolph Road line which has termini at Montgomery Mall and White Oak, but different branch service from New Hampshire Avenue to White Oak.
- The New Hampshire Avenue line which goes from Colesville to Fort Totten with the trunk service having termini at White Oak.
- The US 29 line which has termini for the trunk service at Silver Spring and White Oak, but branch service to Burtonsville.

Key multimodal nodes in the system are locations where Metrorail, major park and ride facilities, MARC, RTS, and local bus routes intersect the corridors. For the MD 355 line, this would include Metropolitan Grove, Montgomery College Rockville Campus, Shady Grove Metrorail station, Rockville Metrorail station, White Flint Metrorail station, and Bethesda Metrorail station. The Veirs Mill line serves as a major connector across the RTS. It connects at Randolph Road, Georgia Avenue, US 29, and New Hampshire Avenue. These are all key nodes that provide transfer opportunities across multiple modes. For the Veirs Mill line, the key nodes include the Montgomery College Rockville, Rockville Metrorail station, Wheaton Metrorail station, Silver Spring Metrorail station, and the Langley Park transit center.

Figure 1-2 System Overlay Concept

The Georgia Avenue line is a radial route and provides connections with Veirs Mill Road, while the branch service connects to US 29 and New Hampshire via University Boulevard. The US 29 service is a radial route that connects with the RTS services on Randolph Road, New Hampshire Avenue, and at Four Corners with both the Veirs Mill Road line and the Georgia Avenue line. Similarly, the New Hampshire Avenue line connects with Randolph Road, US 29, and the Langley Park transit center with service that has termini points there including Veirs Mill Road lines and Georgia Avenue lines.

Study Limits

The service concept plans are one of many potential operating scenarios. They should serve as a context for future planning efforts providing a rationale for the concepts, service levels, route structure, key stops, multimodal nodes, fleet requirements, operation cost, and an implementation strategy. The plans are based on the corridor structure outlined in the draft CTCFMP, but they are flexible enough to provide guidance for future detailed planning efforts. The plans do not identify right-of-way needs or requirements and they do not prescribe a specific transitway treatment or location for such treatment (e.g., median lane, curb lane, etc.). The concept plans do not provide an operational schedule, but they do provide service levels for peak and non-peak operations. The concept plans do not develop feeder bus service for each corridor, but they do categorize what exists today and address the primary services that would be parallel to the RTS. The concept plans do not provide a detailed cost estimate, but they do provide the potential operations level of effort for the service. Travel demand and ridership forecasts were not part of this effort, although the ridership forecast in the draft CTCFMP provided one source of guidance in structuring the routes and determining service levels. This study does not address any lane repurposing issues which would be expected to be part of future detailed corridor studies.

This study was based on previous work and findings provided in the reports outlined early in this section, the MWCOG Cooperative Land Use Forecast Round 8.2, current land use and development, and the proposed transit services as documented in the current regional Constrained Long Range Plan (CLRP).

The next steps in the development of the RTS should be based on the concepts outlined in this report. Each corridor will need to be studied in greater detail. These studies should incorporate a more disaggregated and robust level of planning including ridership estimates, revenue and cost projections, environmental impacts, traffic analysis, and restructuring of the local bus service.

RTS Service Criteria Guidelines

It is important to define the principles, policies, and service criteria for Rapid Transit System (RTS) in order to differentiate it from local fixed route transit, express bus, and limited stop bus, such as MetroExtra. The RTS service criteria guidelines are representative of a high quality transit mode. RTS should have similar span of service, frequencies, and quality of service as a rail transit mode. RTS service levels should be based on passenger demand (current and future), corridor land use plans, operating funds available and the ability to attract and retain riders from other forms of transportation.

This section of the report serves as a framework of industry standards for Bus Rapid Transit (BRT)[1]. It provides potential service guidelines for Montgomery County's RTS. The objectives for establishing these guidelines are as follows:

- Use recommended levels of RTS service as the guidance for comparison and decision making including frequency, span of service, etc.;
- Enable the public to have a clear understanding of what RTS service can offer in terms of service quality and reliability; and
- Identify how future RTS service can integrate with existing transit.

BRT systems are built with a mix of physical characteristics which impact service quality. BRT service can range from express buses that run in mixed traffic or in curb lanes to independent grade separated busways. Transportation planners must decide on a variety of factors to determine the physical design and service characteristics. Generally, grade separated systems and busways require a significantly higher capital investment; however they also tend to produce the greatest benefits in terms of travel time savings, increased ridership, and operational efficiency.

Service standards are often selected based on employment and population densities, overall size of the service area, existing use of public transit, and current demands and constraints on access to Central Business Districts (CBDs) as well as the future vision and role the service plays in achieving growth policy plans. The specific service standards are the result of the demands for transit in a community, the costs and benefits of different features, and the financial resources capacity to fund the service.

Bus Rapid Transit varies based on the service features incorporated into the system. BRT systems across the United States and Canada employ different running ways, incorporate different station features, vehicle features, spans of service, frequencies, and intelligent transportation technologies. Table 2-1 describes industry recommended service criteria and presents potential recommendations for RTS

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[1] TCRP Report 118, *Bus Rapid Transit Practitioner's Guide*, Section S-2. Available online at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf, as of December 23, 2013.

service in Montgomery County, Maryland. It should be mentioned that most BRT applications within the United States to date have been in dense, metropolitan core areas, which differ in many ways from the wide variety of area types served by the potential RTS system in Montgomery County. The information in the table, and that which follows in the more detailed sections, was developed based on two TCRP Reports: *TCRP Report 118 Bus Rapid Transit Practitioner's Guide* and *TCRP Report 90 Bus Rapid Transit Volume 2: Implementation Guidelines.*

Table 2-1 RTS Service and Physical Criteria Summary

	Criteria	Range	Recommendation for Montgomery County
Service Criteria	Frequency	4-10 minute headways during peak 6-10 minute headways during off-peak	Trunk line should have headways of 10 minutes or shorter during peak periods, as suggested by ridership patterns, and no more than 15 minutes during off-peak period.
	Span of Service	14-20 hours per day, 7 days per week	17 hours per day, 7 days per week
	Service/ Operations Plan	Express Service Commuter Express Service Feeder Service Connecting Service	Basic all-stop service in most corridors and Commuter Express Service (i.e., very limited stop with large portions that run closed door).
	Station Spacing	0.13 – 2.2 miles	0.25 – 1.0 mile
Physical Criteria	Running Way	Separate busway Median busway HOV lane Curb or shoulder bus lane Mixed traffic	Median busway Curb bus lane Mixed traffic
	Fare Collection	On-board Off-board	Off-board payment equipment at high use stations
	ITS	AVL Passenger information Traffic signal priority Queue jumps Vehicle guidance and control	AVL Passenger information Traffic signal priority Queue jumps
	Vehicles	Standard 40 foot vehicle Articulated 60 foot vehicle	Special design standard 40 foot, low floor vehicles initially; 60 foot as demand warrants.
	Station Requirements	Level boarding Unique brand Bicycle storage Lighting Safety/security features Passenger information Concrete stopping pads capable of handling conventional and articulated vehicles	Level boarding Unique brand Bicycle storage Lighting Safety/security features Passenger information Concrete stopping pads capable of handling conventional and articulated vehicles

Service Guidelines for RTS

Frequency[2]

Options

The minimum level of service for BRT is typically higher than the minimum level of service for local routes. In most North American BRT systems, frequencies usually range from four (4) to 10 minutes during the peak, six (6) to 20 minutes during midday, 10 to 30 minutes in early evening, and 12 to 30 minutes in late evening. Saturday frequencies are usually similar to weekday off-peak frequencies and Sunday frequencies usually fall between Saturday and weekday evening frequencies. Table 2-2 describes typical frequencies used in North American BRT service by type of service and time of day.

Table 2-2 Typical Service Frequencies (in minutes)

Service Type	Peak	Midday	Evening	Saturday/Sunday
Base	5 – 8	8 – 12	12 – 15	12 – 15
Feeder	5 – 15	10 – 20	10 – 30	10 – 30
Connecting Buses	5 – 15	5 – 20	10 – 30	10 – 30
Express	8 – 12	10 – 15	–	–
Commuter Express	10 – 20	–	–	–

The base service is core service that stops at each location on the BRT system and provides the longest span of operation. Feeder service starts off the BRT corridor and either terminates at BRT stations or operates within the BRT corridor for the remainder of the route. Connecting bus routes are similar to feeder routes they may cover longer distances Express service usually operates in the peak periods. Buses typically serve locations where riders gather, such as a park and ride lot or key transfer node and the buses may skip other stops. This type of service primary serves commuters traveling long distances. Commuter express service typically can be service that is similar to express service but is usually over longer distances and the vehicle is a more comfortable option such as a coach bus. The service usually has very low frequency and operates only in the peak period.

Considerations

Overall, BRT frequencies along the trunk route should reflect service frequencies of rail service. During times of very low demand (i.e., late nights, early mornings,

[2] TCRP Report 90, Section 8-2.2, *Bus Rapid Transit Volume 2: Implementation Guidelines.* Available online at: http://www.trb.org/Main/Blurbs/153530.aspx, as of December 23, 2013.

holidays) service on the BRT corridor can be provided by parallel local services. A maximum service headway of 10 to 12 minutes for base service should be in place. However, interlining express service with the base, all-stop service can result in more frequent service. It is also important to take into consideration that to qualify for a Small Starts grant under the FTA, a project is required to offer a minimum of 10 minute frequency service during peak periods and 15 minute service during off-peak periods.

Montgomery County Guideline

For the Montgomery County RTS a reasonable guideline for the County would be that the headway be no longer than 10 minutes during peak periods, with high demand routes providing more frequent service with headways as warranted. In the off-peak periods, if the transit demand does not warrant 10 minutes headways then headways no longer than 15 minutes are recommended. Branch service may have a higher frequency in the peak periods but the effective headway on the branch segments should meet the 10 minute (maximum headway) recommendation. This recommendation will assist the County in establishing RTS as a premium service and will not preclude the use of FTA Small Starts grant.

Span of Service[3]

Options

Span of service defines the period during which BRT service is provided. This includes both hours of service during the day and days of service over the week. The standard service design is to offer service seven days per week, including holidays. If service is not provided on weekends, late night, or holidays, then there should be a substitute service available, such as a parallel local route. The preferred approach is to offer service 18 to 20 hours per day. To qualify as a Small Start under the FTA guidelines, a corridor based project is required to offer service at least 14 hours per day. Most BRT systems in the United States operate from 5AM to 1AM.

Considerations

A long service span of at least 18 to 20 hours, seven days per week ensures that BRT is able to serve most workers and residents. In particular, it is important to meet the following objectives:

- Satisfy the requirements of the County's Subdivision Staging Policy within the Local Area Policy Review (LATR) and Transportation Policy Area Review (TPAR);
- Serve shift workers whose commutes are typically outside of traditional work times;
- Support opening and closing times for malls and major retail destinations;
- Support transportation to classes at colleges and universities;
- Support opening and closing times for community facilities; and

[3] APTA Standards Development Program, *Bus Rapid Transit Service Design.* Available online at: http://www.apta.com/resources/standards/Documents/APTA-BTS-RTS-RP-004-10.pdf, as of December 23, 2013.

- Serve operating hours of popular entertainment activities such as theaters and sporting events.

While the FTA requires a minimum span of service of 14 hours per day, most BRT systems in North America operate between 18 to 20 hours per day, specifically to meet the demand identified in the previous bullet points. A nascent BRT system typically operates on its full span of service from its initial operating day. However, it is possible for a BRT corridor to begin operating under a limited span of service and increase the span as ridership responds.

Montgomery County Guideline

The recommendation is for Montgomery County to implement RTS service highly tailored to the corridor in which it is operating and to have it complement Metrorail service with service for 17 hours during a typical weekday. In corridors that have ridership supporting all day service RTS should ultimately aim to operate seven days a week and follow the same operating hours of Metrorail. The span of service should be expanded on specific corridors that warrant it based on existing land use and transit ridership. Having some flexibility in the hours of operation while still holding the span of service, cost inefficiency will reduce costs while retaining applicability of Small Start funding.

Service and Operations Plan[4]

Options

Arterials: Along arterial roadways, where passing opportunities are limited, a basic all-stop BRT service should be provided. This service may be augmented by conventional local bus routes.

Expressways: Along expressways, in both mixed traffic and reserved lanes, express bus service may be provided. This service may operate all day or in rush hour only.

Busways: Along busways with provisions for passing at stations, the basic all-stop service can be complemented by rush hour or all day express service. Local feeder and connecting bus routes can serve busway stations. This combination of services maintains service clarity, while also providing fast, transfer free rides for commuters.

According to TCRP Report 90, BRT basic services operate at least from 6AM to midnight. Suggested hours for various types of service are as follows:

- Basic All-Stop Services – Weekday, all day
- Express Service – Weekday, peak periods/peak direction
- Commuter Express Service – Weekday peak periods/peak direction
- Feeder Service – All day, generally seven days a week
- Connecting Service – All day, generally seven days a week

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[4] TCRP Report 90, section 8.2, *Bus Rapid Transit Volume 2: Implementation Guidelines.* Available online at: http://www.trb.org/Main/Blurbs/153530.aspx, as of December 23, 2013.

In some cases, "feeder" service can run during off-peak periods and be replaced by express service during weekday peak periods. Express service generally would be limited to weekdays.

When BRT operates on its own right-of-way, the service pattern that works best features all-stop service at all times of day complemented by an "overlay" of integrated express service for specific markets during peak periods. During off-peak periods, the integrated overlay routes operate as feeders to BRT stations. BRT can also operate as an overlay on existing local bus service.

Considerations

The service plan should balance providing point-to-point service with easy to understand, high frequency service throughout the day. The service plan also needs to comply with the County's Subdivision Staging Policy and meet the requirements established in the TPAR to balance the transportation area network. Also, the operating plan must be supported by infrastructure since different operational strategies require passing lanes at stations and other similar running way/station configurations.

Montgomery County Guideline

RTS in Montgomery County may operate in a variety of environments, in both mixed traffic and in dedicated lanes. The standard service plan would run basic all RTS stop services seven days a week, for at least 17 hours a day. The core RTS routes could be overlaid with local bus along the same corridor and with connecting feeder routes at major stations. In select cases where the corridor is still developing, express service and commuter express service may be implemented first in a corridor only to offer initial RTS type services for long distance and commuter users.

Station Spacing[5]

Options

Station spacing is typically determined by land use and trip generators along a corridor. According to APTA, the major factors to determine are:

1. Maximum acceptable and desirable walking distances.

   Walking distance depends on an agency's service standards but is typically between 0.25 to 0.33 miles (i.e., a 5 to 10 minute walk). Longer station spacing may also be appropriate if the main objective of the BRT service is to simply connect to major activity centers or if the alignment does not follow a typical arterial transit corridor.

2. Whether or not a parallel local service is available.

Station locations is informed by the corridor characteristics, including:

- Location of major origins, destinations and activity nodes;
- Location of major cross streets and transfer points;

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[5] APTA Standards Development Program, *Bus Rapid Transit Service Design.* Available online at: http://www.apta.com/resources/standards/Documents/APTA-BTS-RTS-RP-004-10.pdf, as of December 23, 2013.

- Density and land use patterns in the corridor; and
- Impacts to overall travel time on the RTS orridors

Considerations

Ultimately, station spacing should reflect the speed and service objectives of the BRT service. The further apart stations are spaced, the greater operational efficiency, but in less dense areas this benefit may come at the cost of reduced ridership. Stations can be spaced farther apart in higher density areas but typically are spaced closer together to better serve residential areas. The configuration of local bus service in the corridors also influences station spacing.

In the United States, station spacing ranges from 0.13 mile to 0.50 mile in Cleveland's HealthLine to 0.54 mile to 2.20 miles in Los Angeles' Orange Line. Station spacing along arterial streets typically range from about 0.25 mile to 1.2 miles, with most systems exceeding 0.5 mile for spacing.

Montgomery County Guideline

It is recommended that Montgomery County space RTS stations 0.25 mile (high density areas) to 1.0 mile apart (low density areas) along the corridor, with flexibility within this range dependent on land use density, activity centers, and key origins and destinations.

Physical Criteria for RTS

Running Way[6]

Options

Separate: A separate running way, or busway, is a dedicated portion of the road that only carries transit vehicles. It can include at-grade or grade separated intersections with cross streets and free flow ramps to and from other types of BRT running ways.

Busways, which are separated bus only lanes, typically involve substantial development costs. They are typically constructed in larger urban centers. They are used as extensions of rail transit lines, median arterial busways, and for radial busways from the central business district. The most advanced busways can include features to mechanically or electronically guide transit vehicles in the facility.

Freeway: A freeway running way is built within the limits of the cross section of a freeway, either as part of new construction or by retrofitting an existing facility. The running way's geometry is controlled by the geometry of the freeway's general traffic lanes.

The running way typically can have one of three forms:

- Median busway: A dedicated bus facility in the median area usually separated physically from other forms of traffic and with free flow ramps to and from other types of BRT running ways.

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[6] TCRP Report 118 Bus Rapid Transit Practitioner's Guide, Section 4. Available online at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf, as of December 23, 2013; APTA Standards.

- HOV lanes: A running way shared with high occupancy vehicles on either the median side or the outer lanes of the freeway and not necessarily separated physically from the general traffic lanes.
- Shoulder: Permitted use of the outside shoulder of the general traffic lanes by BRT vehicles. Sometimes limited to peak hour periods or congested conditions and usually with various operating constraints, such as maximum operating speeds.

Urban Street: An urban street running way is developed within the limits of the roadway cross section either as part of new construction or by retrofitting an existing facility. The running way can have one of three forms:

- Busway: A dedicated bus facility in the median area, or parallel and on one side of a street, sometimes shared with other high occupancy vehicles and sometimes physically separated from other forms of traffic with some form of transit priority at locations where it intersects with other traffic.
- Bus lanes: Similar to a median busway, but typically located on the outside of the arterial roadway and sometimes shared with other high occupancy vehicles. Typically, the bus lane is not physically separated from the general traffic lanes. Variations of this form include shared use of the lane for commercial access and right turns. A variation on this type of facility would be the Business Access Transit (BAT) lanes. This is a type of bus lane that is specifically tailored to operations in business core areas.
- Mixed use lane or mixed traffic lane: Mixed use of a lane by both transit vehicles and general traffic. Intersection treatments such as roadways widening and added auxiliary lanes at intersections provide buses with the ability to "jump the queue" at such locations and provide some level of improved service times and reliability. BRT typically runs in mixed traffic during the "last mile" of the corridor where the running way terminates into a central business district. Mixed traffic can significantly reduce vehicle travel speeds during peak congestion.

Three treatments that can help to make BRT running more reliable, in areas with significant right-of-way constraints are as follows:

- Bidirectional lane: A bidirectional lane is an exclusive single lane that allows BRT vehicles to pass in one direction through a constrained section. This strategy is used when there is enough room to install only a single lane and the headways are restricted in length. A bidirectional lane helps to improve reliability on BRT systems that run in mixed traffic.
- Reversible lane: A reversible BRT lane is a single, exclusive lane; however it adapts to the direction of travel that accommodates peak travel. BRT vehicles will travel in one direction in the morning peak period and in the other direction in the afternoon peak period. This allows BRT vehicles to bypass the most congested traffic in the peak direction during the peak traffic period. In the off-peak direction, the BRT vehicle must use a mixed traffic lane.
- Peak hour exclusive lane: During the peak travel period, the curbside general purpose lanes or the parking lane areas are restricted for BRT vehicles. This allows for time travel savings during the most congested times. These lanes are also generally available for right turning vehicles.

Considerations

A high degree of right-of-way segregation has higher capital investment costs than BRT systems that operate in mixed traffic. Busways on separate rights-of-way provide the highest level of BRT service in terms of travel speeds, service reliability, BRT identity, and passenger attraction. However they can be costly and difficult to build, especially in major transit corridors and in locations with existing development. BRT operations in mixed traffic flow can be implemented quickly at minimum cost, but can subject buses to general traffic delays.

Montgomery County Guideline

Busways on separate right-of-way provide the highest quality of BRT service. However, they can be costly and dependent on land available for the right-of-way. Therefore, on-street BRT operations in median busways, bus lanes, or even mixed traffic often become necessary. Given the existing level of development in Montgomery County, existing traffic conditions, and current mode shares it is recommended that the County evaluate the following guidelines for running ways:

- Master plan consistency as well as meeting the requirements of the TPAR for the specific policy area;
- Where feasible contiguous median busways;
- Bus lanes in locations where median busways are not feasible due to right-of-way constraints and other factors; and
- Mixed traffic in segments that have challenges due to right-of-way, engineering, as well as adverse impacts on roadway capacity. In these cases the possibility of bidirectional, reversible or peak hour exclusive lanes could also be evaluated in combination with ITS treatments.

Fare Collection

Options[7]

Fare collection methods vary between systems. Some South American cities use fare gates at BRT stations. European systems typically use a proof of payment system. Most North American BRT systems have on-board fare collection. The following bullets summarize the range of off-board fare collection methods used:

- Prepayment: Passengers pay fares and then pass through turnstiles or barrier gates to board buses, which eliminates on-board payment.
- Vending machines and proof of payment: Boarding passengers can use fare or ticket vending machines located on station platforms to purchase tickets and then board buses through all doors. Passengers are then required to show a validated ticket to a fare inspector as requested.
- Proof of payment: Boarding passengers can use a ticket vending machine, pass, or smart card. Passengers are subject to random checks from fare inspectors who give fines or penalties to violators.

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[7] TCRP Report 90, section 8.3, *Bus Rapid Transit Volume 2: Implementation Guidelines.* Available online at: http://www.trb.org/Main/Blurbs/153530.aspx, as of December 23, 2013.

North American BRT systems use a number of on-board fare collection methods including:

- Conventional on-board collection: Conventional on-board fare collection allows passengers to use cash, transit passes or smart cards as payment. Payment must occur at the front door of the vehicle while the driver verifies payment.
- Passes: Weekly or monthly transit passes can be used to board relatively quickly and has been used to board through multiple doors.
- Smart Cards: ITS smart card technology uses radio frequency transmission to access stored value on electronic fare media. Individual accounts can be managed online and stored values uploaded automatically without the use of a vending machine. Boarding passengers can swipe a smart card at multiple doors.

Considerations

The benefit of off-board fare payment is that it speeds up the time required to board the bus. Off-board fare collection also allows boarding and alighting to occur at all doors, rather than boarding through the front door and alighting through the rear door. To the extent that any BRT stations could only be accessed by paying customers, off-board payment can also help to provide a sense of security at the station for passengers waiting to board the vehicle. Off-board fare payment can also make the BRT feel more like a rail system and can assist in creating a more transit friendly image of the system. Off-board fare collection can also provide reliable passenger counts. The disadvantage of off-board fare payment is the increased cost of the infrastructure and the physical space at the station. There is also some potential lost revenue due to fare evasion with an off-board system. European BRT systems and some North American systems use proof of payment systems to reduce fare evasion; however, this requires additional labor costs to employ fare inspectors.

Montgomery County Guideline

The use of SmarTrip technology is common in the Washington, DC metropolitan area and should be used as a part of a cashless RTS system. In addition, it is recommended that Montgomery County implement an off-board fare collection system for Montgomery County RTS.

Intelligent Transportation Systems (ITS)[8]

Options

Automatic Vehicle Location (AVL): AVL allows a bus' movement to be monitored in real-time. This enables operations to monitor headway and schedule adherence and make adjustments as needed. It also gives agencies the opportunity to provide real-time bus schedule information to patrons at stops and online or through mobile devices. AVL systems require three components: (1) a method of determining vehicle location, (2) a means of communicating the vehicle's location to a main center, and (3) a central processor to store and manipulate the information.

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[8] TCRP Report 118 Bus Rapid Transit Practitioner's Guide, Section 4. Available online at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf, as of December 23, 2013.

AVL systems provide a constant stream with the location of all vehicles in real time, automatically or manually recorded events (e.g., stops, door opening, lift deployment, etc.) associated with a trip, time, and location. AVL data also provides speed and headways.

Passenger Information: ITS can provide real-time information to passengers online, at stops, and on the vehicle itself. Passenger information and how it is provided is important to the public's understanding of the system and ease of use. BRT systems should utilize a combination of static information (e.g., transit schedules, fares, and routes) and dynamic information (e.g., delays and actual arrival/departure information). Information can be delivered in a variety of ways including kiosks, mobile devices, and displays for dynamic and static information.

Traffic Signal Priority (TSP): TSP modifies the normal signal timing operation along a corridor to provide an advantage for transit vehicles over non-transit vehicles. TSP is typically a relatively minor adjustment to extend a green light phase or to truncate a red light to the benefit of an approaching transit vehicle. It is possible to coordinate TSP with the AVL system to provide priority only if the corresponding bus is behind schedule. TSP can improve schedule reliability and improve travel speeds. TSP is often used in conjunction with queue jump lanes to minimize the travel time delays at intersections for transit vehicles. Major intersections are enhanced with special priority lanes, often right hand turn lanes that permit transit through movements before the general purpose lanes. Through the use of TSP, queue jumps enable transit vehicles to bypass long queues at congested points, reducing transit delays, improving travel speeds, and increasing schedule reliability.

Vehicle guidance and control: Guidance systems can be used either throughout a bus route or only when the bus approaches a station. Guidance systems can be physical, optical, or electronic. Physical systems use a guideway that may connect to the bus through guide wheels or guide rail, which means the driver only needs to control acceleration and braking. Optical systems use painted stripes on the road to control lateral distances and guide the bus forward. Electronic control systems can fully automate the control of the bus through GPS, magnetic markers, or other accurate positioning technology.

One specific application of vehicle guidance is precision docking, which is used to maneuver the vehicle into the loading area. Sensors on the vehicle determine the distance to the curb as they dock the vehicle at the station. Drivers have the ability to manually override precision docking in the case of an emergency. Vehicle guidance for docking allows for safer boarding and alighting for people with disabilities, the elderly, and children.[9] Technology can also help avoid both front and rear end collisions. Radar can detect how the transit vehicle is approaching other vehicles and warn the driver or automatically reduce the vehicle's speed to avoid the crash.[10]

Considerations

ITS features improve the reliability of BRT service as passengers are able to access information in real-time about schedule adherence. Queue jumps and TSP enable transit vehicles to receive priority under certain circumstances over general traffic.

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[9] TCRP Report 90, Section 7-6.1, *Bus Rapid Transit Volume 2: Implementation Guidelines.* Available online at: http://www.trb.org/Main/Blurbs/153530.aspx, as of December 23, 2013.

[10] TCRP Report 90, Section 7-7.2, *Bus Rapid Transit Volume 2: Implementation Guidelines.* Available online at: http://www.trb.org/Main/Blurbs/153530.aspx, as of December 23, 2013.

Guidance systems such as precision docking can have a positive impact on dwell time, improving the ability to stop the vehicle at the right location every time. Automated guidance and collision warning systems can provide for safer bus operations, reducing negative impacts to travel times.

Montgomery County Guideline

Montgomery County has an existing AVL system on local transit vehicles as well as on regional, WMATA vehicles. Any new vehicles purchased for RTS would have an AVL system. Vehicle guidance and control systems are considered to be outside of the scope of what can be implemented at this time. The County is currently evaluating implementing TSP at intersections along RTS corridors to improve service reliability. Queue jumps should be considered at key intersections where RTS is operating in mixed traffic. This will provide a travel time and reliability benefits to those segments not operating within a median or curb bus only lane. All RTS stops and stations should be equipped with real time transit displays. Information should also be easily accessible online and on mobile devices.

Station Requirements[11]

Options

BRT stations are typically spaced further apart, with distances typical of rail transit. There is a suite of options available for BRT stations. Typically, specially branded BRT shelters with raised platforms, pre-boarding payment options, and security features are implemented as part of the system. Station features that are implemented typically vary by the running way design (e.g., curbside bus stop, median arterial busway, or grade separated busway). Possible station features include:

- Lighting
- Security phones
- Temperature control in ground for patron safety
- Seating
- Trash containers
- Public address/automated passenger information systems
- Platform height (standard, raised, or level platform)
- Platform layout (single vehicle length, extended platform with unassigned berths, extended platform with assigned berths)
- Passing capability (bus pullout or passing lanes at stations)
- Station access (pedestrian linkages, park and ride facility, bike share, and car share)

Specially designed BRT shelters on busways may include many of the features listed above while curbside BRT systems that run in mixed traffic typically accommodate fewer special features, and might just be a unique shelter with special lighting. The

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[11] TCRP Report 118 Bus Rapid Transit Practitioner's Guide, Section 4-53. Available online at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf, as of December 23, 2013.

level of station features and amenities are directly tied to project costs. Basic stations ("enhanced stops") can cost as low as $25,000 while stations with additional features can cost several million dollars. The most expensive aspect of a station is typically the additional passing lane.

Considerations

- Well designed and well placed stations can reduce travel times because buses can achieve higher operating speeds between stations and because passenger boarding and alighting can be made more efficient.
- Enhanced BRT stations can attract additional riders by providing a range of amenities for passengers while they are boarding and alighting. In particular, this can be achieved through transit supportive land use decisions. BRT stations can enhance adjacent developments and encourage additional nearby development.
- Platforms level to the bus allow for reduced boarding and alighting time and overall system reliability and performance.
- Station access components like pedestrian linkages and park and ride facilities provide improved access to attract passengers.

Montgomery County Guideline

RTS stations in Montgomery County should include the following minimum bus station amenities:

- A permanent weather protected structure that is convenient, comfortable, safe, and fully accessible.
- Passenger information, lighting, and security provisions.
- Stations and vehicles should have a consistent, uniquely branded design theme.
- Linear parallel berths are desirable for most RTS stations.

Stations at major transfer hubs in the system could include additional amenities such as bike sharing stations and bicycle racks, carsharing access, and potentially other support facilities such as restrooms. The size of the RTS station and its amenities should also reflect the intensity of the surrounding land use and level of transfers between modes. In many cases, these types are stations are located at existing transit facilities.

Each berth should be at least 45 to 50 feet long for a 40 foot bus and at least 65 to 70 feet long for a 60 foot articulated bus. Berths should be at least 11 feet wide. A minimum of two berths should be provided in each direction of travel, although the exact number of berths must be decided by bus flow rates and dwell times and station area constraints.

RTS platforms can be either center platforms or side platforms. Side platforms are common along streets and busways. Center platform configurations are more typical outside of the U.S. and are considered more efficient as vehicles can have doors on

both sides. Side platforms should be about 10 to 12 feet wide.[12] Platform design should accommodate space for fare collection and passenger queuing. Side platforms provide much more flexibility in vehicle types and station configuration and are likely to be the most prevalent station type within the system.

Vehicles[13]

A number of manufacturers have developed specialized vehicles for BRT that do not look like typical buses. This does not mean that every BRT system in the country uses specialized vehicles for their BRT service. A specialized vehicle can provide greater capacity, easier boarding/alighting, and provide for a positive image of the system that separates it from local bus service.

Options

The following bullets provide a summary of features to consider in vehicle selection:

- The size of the vehicle
- Vehicle styling
- Low-floor boarding
- Fuel technologies
- Automatic vehicle location (AVL) technology
- Driver assist and automation systems
- On-board bike storage

Considerations

Larger buses provide added capacity and can accommodate a higher ridership demand. However, larger buses may also require a new garage and storage facilities. Buses should be large enough to reasonably accommodate peak hour loadings while maintaining a balance with station capacity and adequate frequency. Low-floor boarding, as well as the number and size of doors, are important as they facilitate passenger flow and reduce variability in dwell time. Vehicles that have doors on both sides of the vehicle allow for access from center platform stations in the median and can reduce overall boarding times, and impact passenger capacity. Another consideration when choosing vehicles that differ significantly from the existing fleet is the potential need for added maintenance capabilities as well as difficulties with flexibility in spare vehicles and fleet size. The following table describes how vehicle size accommodates capacity.[14]

Vehicle styling can have an impact on service success. Buses that appear modern can give the appearance of a higher quality service. Using vehicles that look different from an agency's other services create a visual message that the BRT service is unique and enhances the overall BRT service image.

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[12] TCRP Report 118 Bus Rapid Transit Practitioner's Guide, page 4-58. Available online at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf, as of December 23, 2013.

[13] TCRP Report 118 Bus Rapid Transit Practitioner's Guide, Section 4-61. Available online at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf, as of December 23, 2013.

[14] TCRP Report 118 Bus Rapid Transit Practitioner's Guide, Exhibit 4-74, Page 4-61. Available online at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf, as of December 23, 2013.

Table 2-3 Typical BRT Vehicles

Length	Width	Floor Height	Number of Door Channels	Number of seats (including ADA seating)	Maximum capacity (seated and standing)
40 foot	96 – 102 inches	13 – 36 inches	2 – 5	35 – 44	50 – 60
45 foot	96 – 102 inches	13 – 36 inches	2 – 5	35 – 52	60 – 70
60 foot	98 – 102 inches	13 – 36 inches	4 – 7	31 – 65	80 – 90
80 foot	98 – 102 inches	13 – 36 inches	7 – 9	40 – 70	110 – 130

Montgomery County Guideline

Vehicles should be selected, and designed, for the type of services offered and the nature of the markets served. The following bullets provide general guidelines:

- Length of vehicle will range from 40 to 45 feet for a single unit vehicle and from 60 – 82 feet for articulated and double-articulated vehicles.
- Vehicles should be easy to access, and comfortable to ride.
- Vehicles should be easy to board and alight. Low floor heights of 15 inches or less above the pavement are desirable.
- Generally, one door channel should be provided for each 10 feet of vehicle length.
- Station design will determine the requirement and need for door configuration and if doors on both sides of the vehicle are required.
- Vehicles should be standard, stylized, and specialized for RTS service.
- Clean fuel technologies, such as natural gas and diesel-electric hybrids, should be considered.

Vehicle specifications for Montgomery County RTS will be determined after detailed operating plans are developed for each RTS corridor in Montgomery County that will establish the vehicle needs. As ridership grows, the County may seek to purchase additional high capacity articulated buses to meet peak demand in specific corridors or in specific segments of corridors. While the need for these vehicles is clear, they must also be evaluated in terms of the storage capacity at existing County maintenance and garage facilities. New vehicles that significantly vary from the existing Ride On fleet may require new facilities or significantly modified facilities to service and store them.

County Policy

The Montgomery County Council adopted the Countywide Corridor Functional Master Plan and included the following guidelines for the RTS:

- Designating exclusive or dedicated bus lanes, wherever there is sufficient forecast demand to support their use and where subsequent analysis shows that acceptable traffic operations can be achieved to promote optimal transit speeds in urban areas and surrounding suburban areas;
- Implementing transit facilities and services where and when they would serve the greatest number of people on individual corridors and where there would be an improvement to the overall operation of the county's transportation network;
- Supporting policies and programs that increase the comfort and safety of pedestrians and bicyclists traveling to and from transit facilities; and
- Minimizing the construction of additional pavement to limit impacts on the environment and on adjacent communities.

The recommended guidelines presented here are complementary to the Council's recommendations. They provide more detail and guidance for planning activities that will follow.

Summary

Montgomery County is planning a BRT system, the Rapid Transit System, as part of enhancing transit service on selected corridors. Because BRT does not have a precise definition, a range of potential options has been described in this section. In defining the scope of the potential service criteria and recommending guidelines well suited for the Montgomery County RTS it is important to keep the objectives of RTS service guidelines in line with the service criteria. That is, 1) the service criteria need to meet the demonstrated current and future need of transit demand in Montgomery County; 2) the RTS needs to be effective in attracting riders from other modes, specifically private automobiles; and 3) the RTS needs to be cost effective to implement and maintain.

RTS in Montgomery County, as envisioned by the community, would provide service in at least six corridors, comprised of both east-west and north-south corridors. Many of these existing corridors have high local bus usage while others provide critical connecting services to major bus transfer hubs and rail stations. The primary goal of the proposed RTS service should be to provide operational improvements that increase operating speeds within these corridors resulting in ridership gains, increased mobility between the major activity hubs in the county, and provide premium rapid transit service to support and enhance ongoing and planned land use development in the County.

There are a number of key features unique to RTS that the County should implement as the system is developed. These features include specially branded upgraded vehicles that are differentiated from local bus service vehicles, widely spaced bus stations with enhanced amenities, off-board fare payment to expedite boarding, infrastructure (busways/bus lanes), and ITS features along the corridor to improve travel time and reliability. Because of the diverse nature of land use across the different corridors the specific RTS guidelines for each corridor need to be customized to fit each individual corridor. The resulting RTS system will provide another layer to the existing integrated system of transportation options to better serve the needs of both existing and future residents of Montgomery County.

Randolph Road Corridor Service Plan

Randolph Road, in combination with Old Georgetown Road and other streets within the Rock Spring and Montgomery Mall area provide an important cross-county transit connection. The conceptual service plan for the Randolph Road corridor is based on an earlier Rapid Transit System (RTS) draft corridor plan for Randolph Road and the North Bethesda Transitway as outlined in the Montgomery County Planning Department's draft report *Countywide Transit Corridors Functional Master Plan,* July 2013 (CTCFMP). The concept focuses on providing a faster transit option that connects activity centers and multimodal hubs on the western side of Montgomery County with the eastern side. The service integration concept developed as part of this project for the Randolph Road RTS proposes for the route to travel between Montgomery Mall and White Oak.

General Corridor Overview

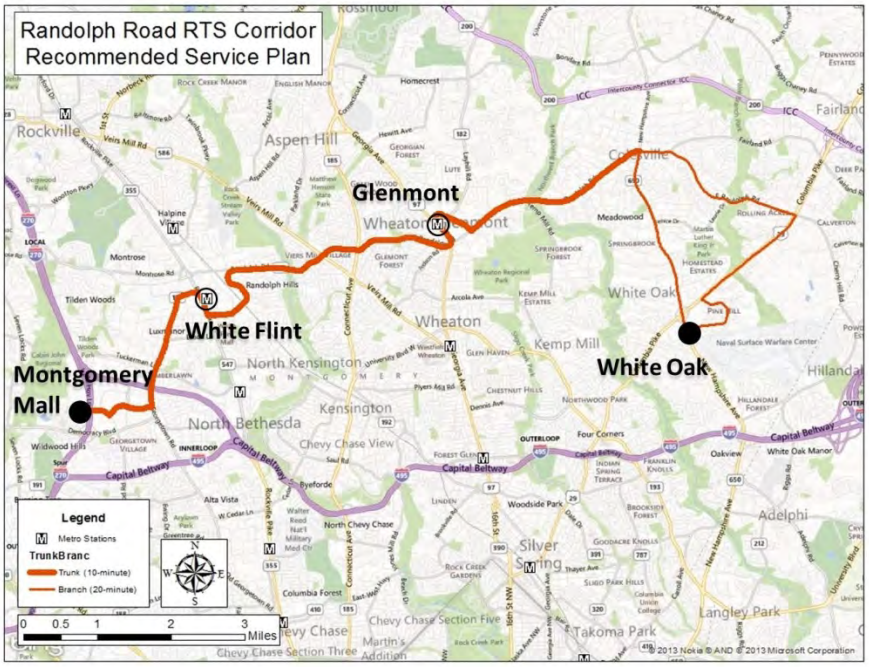
The draft CTCFMP proposes a corridor segment between Montgomery Mall and the White Flint Metrorail station via Fernwood Road, Rock Spring Drive and Old Georgetown Road. In the CTCFMP this service was defined as a revised alignment for the North Bethesda Transitway. The Adopted Functional Master Plan differs from the draft Plan slightly and recommends two alternatives for this segment. Both alternatives would begin at the Montgomery Mall and travel east along Fernwood Road and Rock Spring Drive. One alternative would follow the same routing proposed in the draft plan. The other alternative would terminate at the Grosvenor Metrorail station, traveling north along Old Georgetown Road and east along Tuckerman Lane, the alignment long-proposed as the North Bethesda Transitway.

The draft CTCFMP also proposed a service along Randolph Road between the White Flint Metrorail station and White Oak. The adopted CTCFMP proposes two alternatives to the western connection with the White Flint Metrorail station. The first follows a western route along Randolph Road from Veirs Mill Road then south along Parklawn Drive and Nicholson Lane to White Flint. The second alternative travels north along Veirs Mill Road to the future extension with Montrose Parkway, south along this extension to Rockville Pike and then to White Flint. This work relies on the western route since it better serves land use along the existing corridors.

The concept proposed for the Randolph Road RTS creates a seamless route that travels from the Montgomery Mall to White Oak, providing connections with other RTS routes at key intersections; the North Bethesda Transitway and the Randolph Road RTS routes as shown in

Figure 3-1[1]. The Randolph Road RTS route is approximately 16 miles long (the North Bethesda Transitway is approximately 4 miles long, and Randolph Road is approximately 12 miles long).

Figure 3- 1 Randolph Road RTS Corridor



The Randolph Road RTS will provide a faster option for people traveling across the county. The route will connect major activity and multimodal centers at the Montgomery Mall, White Flint, Glenmont and White Oak. The Randolph Road RTS will provide a connection between the two ends of the Metrorail Red Line. The terminus at the Montgomery Mall and I-270 can provide a potential for future connections to Tysons Corner and other Northern Virginia destinations.

Existing Sources of Activity

The following sources of activity are located along the Randolph Road RTS:

- Westfield Montgomery Mall
- Rock Spring Business Park
- Walter Johnson High School
- White Flint Metrorail Station
- Wheaton High School
- Glenmont Metrorail Station

[1] The Montgomery County Council approved the Countywide Transit Corridors Functional Master Plan in November 2013. As part of the approval the Council proposed some changes to the Randolph Road and North Bethesda Transitway corridor.

- John F. Kennedy High School
- White Oak Shopping Center
- Tech Road Industrial Park
- U.S. Food and Drug Administration

Existing Demographics

Studies of transit riders show a willingness to walk up to a ½ mile to access high quality transit service like the RTS. To provide an understanding of the potential transit market, demographic data along the proposed Randolph Road RTS was compiled. The data is based on the 2011 American Community Survey data for Census tracts that fall within the ½ mile boundary. The data is summarized in Table 3-1. The table also lists the County totals for each characteristic to provide context of how the corridor relates to the County as a whole. Based on these figures, the Randolph Road RTS has a slightly higher percentage of commuters using transit compared to the County as a whole. The corridor also has a higher percentage of households living below the poverty line. These households might be more dependent on transit as result of limited auto availability and household income.

Table 3-1 Demograhic Data for Randolph Road Corridor

Census Group	Randolph Road Corridor	Montgomery County
Population	114,518	959,738
Male (%)	47.8%	48.0%
Female (%)	52.1%	52.0%
Median Age	41.4 years	40.5 years
Workers 16 years and older	61,351	508,645
Public transit is primary means of travel to work (% of workers 16 and older)	10,977 (17.9%)	77,077 (15.2%)
Households	41,150	355,434
Avg. Annual Median HH Income	$97,811	$111,751
Below the poverty line (Households)	2,558 (6.2%)	20,712 (5.8%)
Non-vehicle ownership (Households)	3,318 (8.1%)	29,018 (8.2%)
Source: 2007-2001 American Community Survey 5-Year Estimates		

Existing Land Use

The westernmost section of the Randolph Road corridor terminates at a regional shopping mall. Westfield Montgomery Mall is a typical suburban shopping mall with retail uses concentrated in the center of the property and parking surrounding the exterior. There are some other suburban retail shopping centers surrounding the mall as well as medium-density residential. East of the mall there is a suburban office park with relatively tall buildings that have ample surface parking and long setbacks from the sidewalks. South of the office park, along Democracy Boulevard exists single family residential housing.

The proposed RTS route would travel from the mall through the office park and then north on Old Georgetown Road where the predominant use is single-family residential, oriented away from the street, also scattered office, religious and educational buildings. The route would then approach White Flint from the west via Executive Boulevard where intensity of

land use increases with medium and higher-density residential land use. There are high-rise condominiums, medium-density apartments and townhouses located on both sides of the road. The buildings do not necessarily front to the road; and some have long setbacks.

The area around the White Flint Metrorail station contains the highest intensity land use in the corridor with high rise condominiums and office buildings surrounding the station. As you move east away from the station along Nicholson Lane, lower density retail and off-street parking becomes the predominant land use. The White Flint Mall is a short walk south of Nicholson Lane. As Nicholson Lane becomes Parklawn Drive, three and four-story offices and apartment buildings fill the corridor. Parklawn Drive merges into Randolph Road and there is a mix of shopping centers and residential uses. Immediately after the shopping center, Randolph Road is almost exclusively single family residential, with an occasional church or small office building offering some land use diversity. This pattern continues until the Veirs Mill Road intersection where there is a mix of shopping centers and small office buildings. Continuing east past Veirs Mill Road, the corridor again consists mostly of single family residential. East of the Glenmont Metrorail station, there are multifamily, low-rise apartments. The RTS route would pass by Glenallen Elementary School and John F. Kennedy High School. The area around these schools is residential. There are limited commercial uses and shopping areas at the intersection of New Hampshire Avenue and Randolph Road. East of New Hampshire Avenue the residential area is setback from the road and divided into internally organized subdivisions. At US 29 and Randolph Road, there are commercial, industrial, and shopping areas.

Planned Land Use Changes

The master plan updates for subareas along the corridor show areas increasing in employment and household densities with other areas planned to remain relatively unchanged. Some early phases of the RTS may become operational in the next few years, and Bus rapid transit can impact land use along a corridor. Good planning can be a key aspect of ensuring that an area can develop into a walkable, mixed-use area that can support high quality transit[2]. The denser development that provides easy access to transit will help not only peak period commuter riders but also attract non-commuting shopping and recreational riders.

The 2002 Approved and Adopted Potomac Sub-Region Master Plan does not propose any significant land use changes to the area around the Montgomery Mall. The Plan does support recommendations for the North Bethesda Transitway and two multimodal transit centers. One transit center would be at the Montgomery Mall which is in the corridor; while the second would be located at the Traville Development north of the corridor[3].

The White Flint Sector Plan covers the area of the corridor surrounding White Flint Metrorail station. The plan seeks to continue and complete the vision of White Flint as an urban center by putting in place policies that transform a currently auto-oriented development into a transit supportive mixed-use development that promotes and relies on non-motorized travel as well as transit. The sector plan for the area has a goal to improve the jobs/housing balance by adding more residential space and lowering the ratio of jobs to dwelling units. The plan

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[2] More Development for Your Transit Dollar: An Analysis of 21 North American Transit Corridors, Institute for Transportation & Development Policy

[3] 2002 Approved and Adopted Potomac Subregion Master Plan, Montgomery County Planning Department – Maryland-National Capital Park and Planning Commission, April 2002

calls for an increase in density immediately around the Metrorail station and a tapering of density and building heights at greater distances from the station. Plans recommend increased green and open spaces to break up large impervious areas found in this section of the County. Envisioned improvements to the streetscape will promote greater walking and bicycling along with improved accessibility to transit[4].

The Glenmont Sector Plan, approved by the County Council in November 2013, focuses on maintaining the residential base of the Glenmont area. The plan does recommend concentrating transit oriented, mixed use development around the Metrorail station. There is a goal to improve the walkability of the area. Services and amenities will be focused on the local residents, with the Glenmont Shopping Center as the focus of community services, activities and expanded housing. Non-residential floor area could increase by as much as 200,000 square feet under the plan and housing units by roughly 2,000 additional units. This growth still retains the 0.3 jobs to 1 housing unit ratio currently found in this area[5].

Another major change proposed for this corridor is the new master planning effort for White Oak. The site is currently the location of low density auto oriented development. The consolidation of the Federal Drug Administration (FDA) has provided a catalyst to redevelop the area. The County's plan is to take advantage of the existing major developments of Hillandale, White Oak and the FDA, then promote infill development including mixed use and transit oriented development which integrates the existing residential neighborhoods and three major activity centers. The master plan covers an area of roughly 3,000 acres on the eastern side of US 29 from Cherry Hill Road to the Northwest Branch Stream and the Capital Beltway. Expansion of the Federal Research Center and the FDA are expected to occur in the near term. The development of the Life Sciences center, (including relocation of the Washington Adventist Hospital and the redevelopment of the White Oak Shopping Center), could impact the area and increase the demand for more transportation capacity in this area. Given the capacity constraints on the existing transportation network, the importance for future high quality transit services is recognized as a need for continued development and economic growth. The ability to have the Randolph Road RTS and the US 29 RTS implemented as part of the redevelopment could help mitigate the traffic impacts.

The Metropolitan Washington Council of Governments Cooperative Land Use Forecast Round 8.2 shows how the corridor is projected to change between 2010 and 2040. The land use forecast shows development that has been approved and can be expected to occur. Unlike the proposed updates to the sector plans, the land use forecast represents development that is already planned for and could be occurring.

Figure 3-2 shows the total corridor change in households and employment from 2010 to 2040. Table 3-2 shows the total corridor household and employment densities along the Randolph Road corridor. The table provides details about the lowest and highest observed values as well as the average value for the corridor. These values can be compared against values for residential and non-residential densities as shown in the Institute for Transportation Engineers (ITE) publication, *A Toolbox for Alleviating Traffic Congestion,* shown in Table 3-3. The data in Table 3-3 represent land area that can be developed versus gross land area in the TAZ plots. Land that can be developed would exclude parks and wetlands in the TAZ. Since

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[4]Midtown on the Pike White Flint Sector Plan, Montgomery County Planning Department – Maryland National Capital Park and Planning Commission, April 2010.

[5] Glenmont Section Plan, Montgomery County Planning Department – Maryland National Capital Park and Planning Commission, November 2013

most of the TAZs along the corridor covers land that can be developed, the ITE data in Table 3-3 provides an approximate guide for understanding potential service levels. A land use density threshold for transit supportive areas on gross land area used in local planning studies in the region is three households per gross acre and/or four jobs per gross acre. Based on the maximum densities, the corridor could support bus service at a 10 minute frequency.

The figures on the following pages show the household density (households per square mile) and employment density (employees per square mile) in 2010 and the forecasted density for 2040. Figures 3- 7 through 3–10 show the changes in density from 2010 to 2040 for both households and employment. The changes are shown both in the percentage change which allows for the observation of greatest change over the 30-year period, and absolute change which shows the magnitude in the change.

Figure 3-2 Randolph Road Corridor Projected Changes

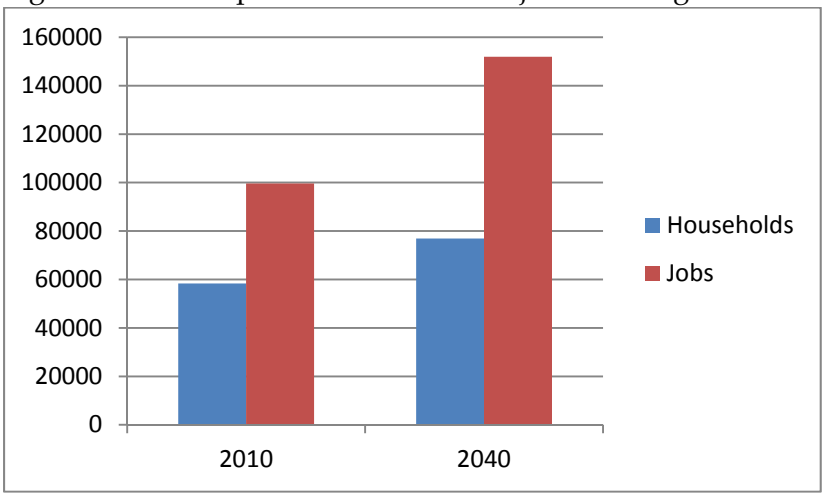


Table 3-2 Randolph Road Corridor Household and Employment Densities (2010 & 2040)

	2010 Household Density (HH/Acre)	2040 Household Density (HH/Acre)	2010 Employment Density (Emp/Acre)	2040 Employment Density (Emp/Acre)
Minimum	0	0	0	0
Maximum	11	84	35	127
Average	3	8	5	12

Table 3-3 ITE Residential and Non-residential Densities for Transit Service[6]

	Frequency (20-hour service day)	Dwelling Units per Acre	Employees per Acre
Bus	1 bus/hour	4-5	50-80
Bus	1 bus/30 minutes	7	80-200
Bus	1 bus/10 minutes	15	200-500
Light Rail	Every 10 minutes	35-50	500+

[6] Institute of Transportation Engineers, A Toolbox for Alleviating Traffic Congestion, 1989.

Figure 3-3 Randolph Road Household Densities (2010)

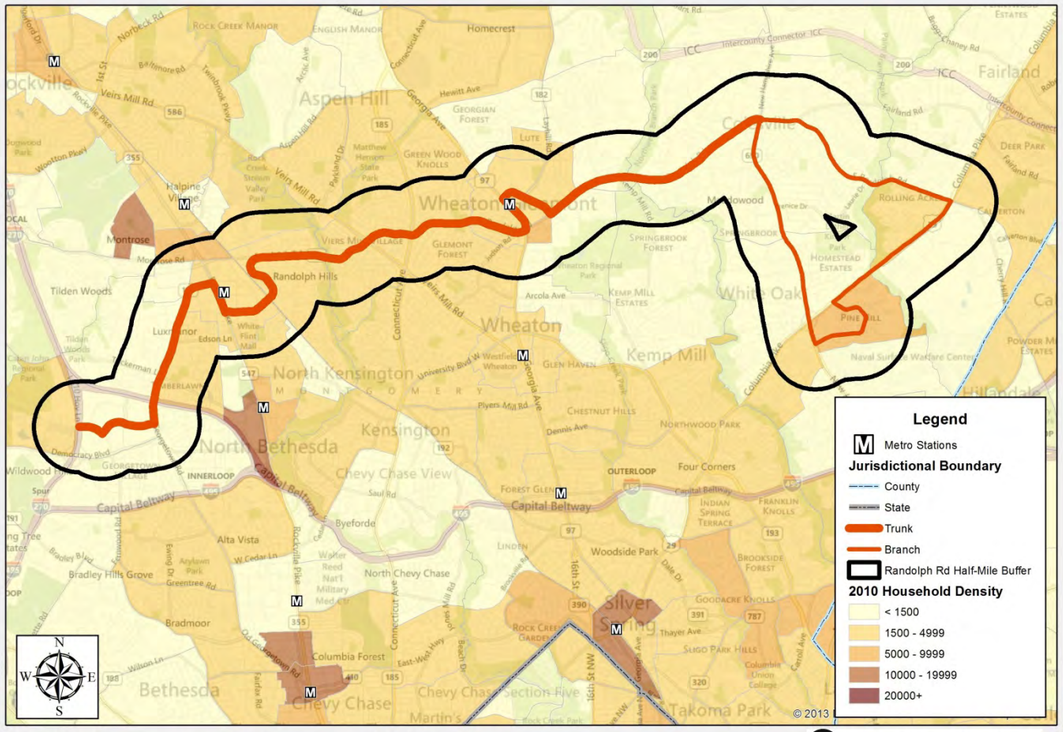


Figure 3-4 Randolph Road Household Densities (2040)

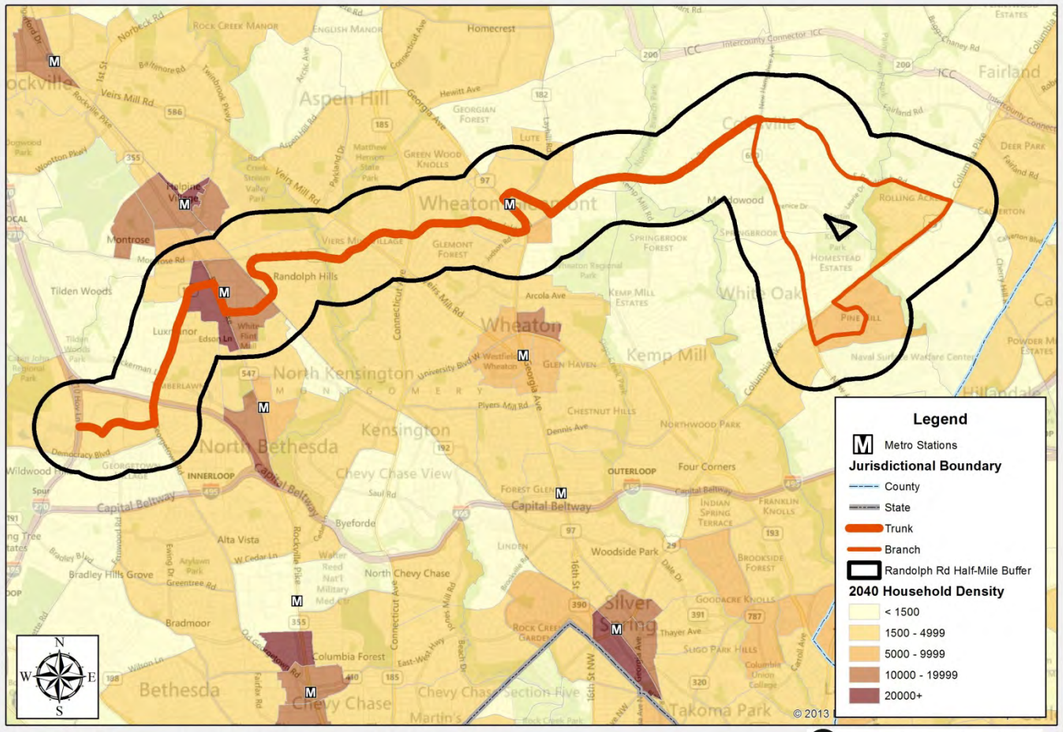


Figure 3-5 Randolph Road Employment Densities (2010)

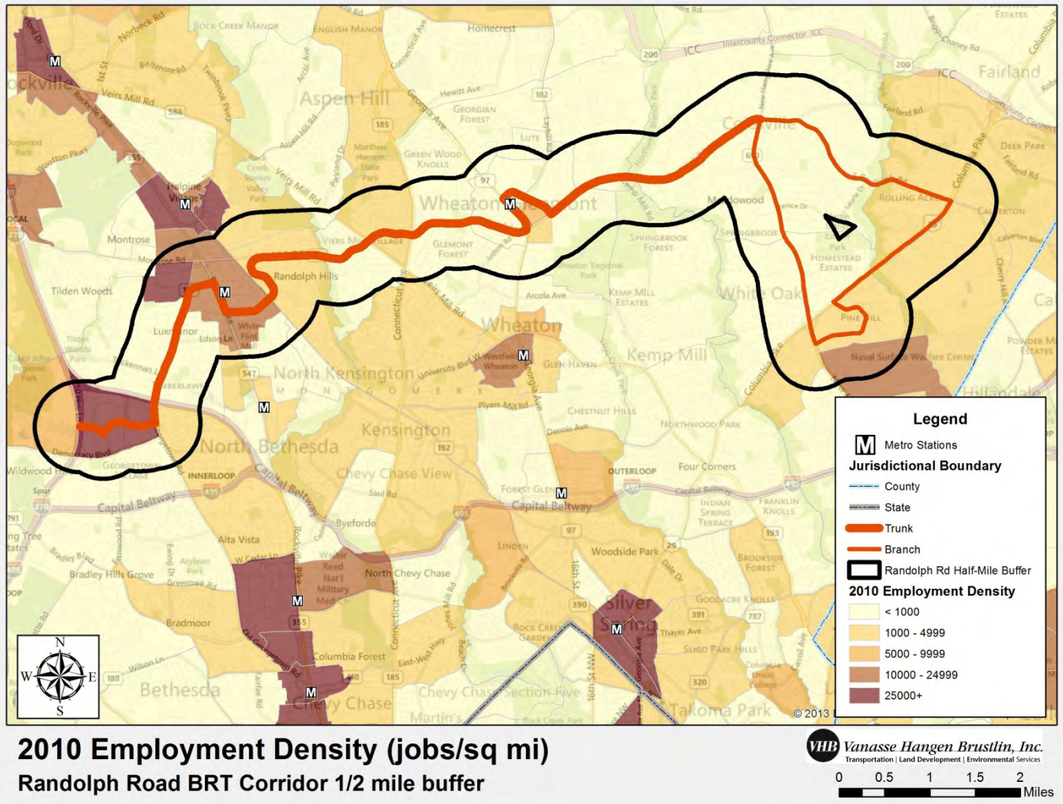


Figure 3-6 Randolph Road Employment Densities (2040**)**

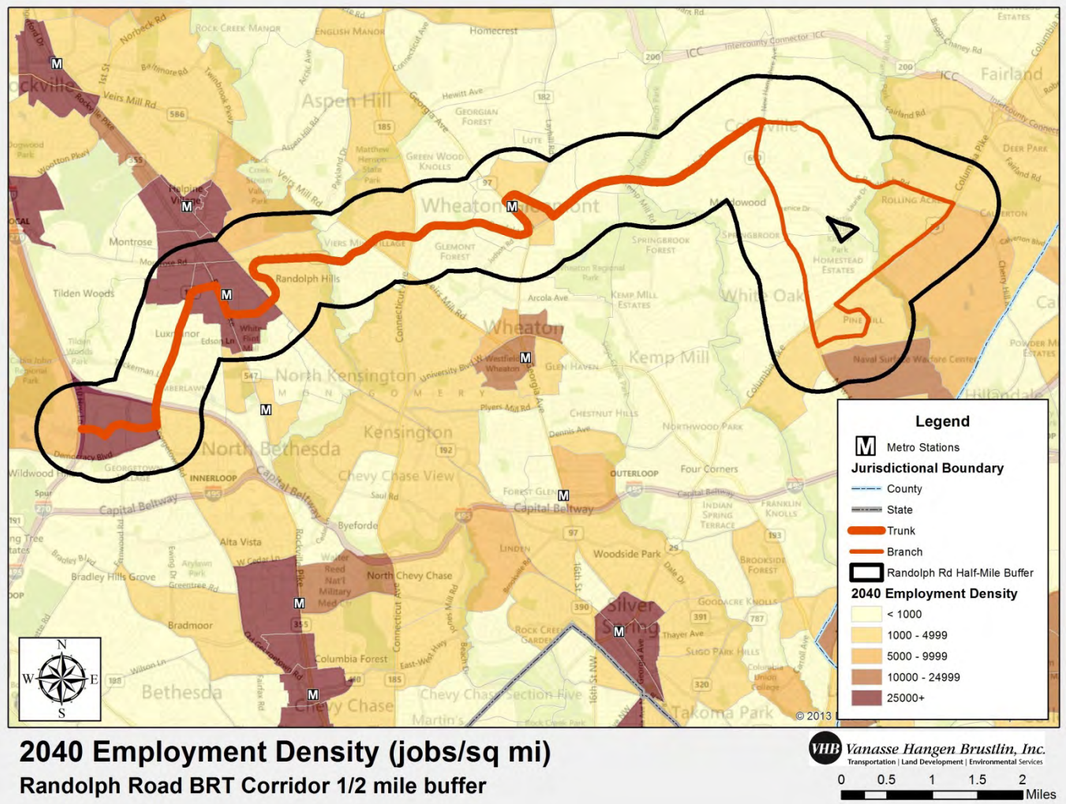


Figure 3-7 Randolph Road Change in Household Densities - Percent (2010-2040)

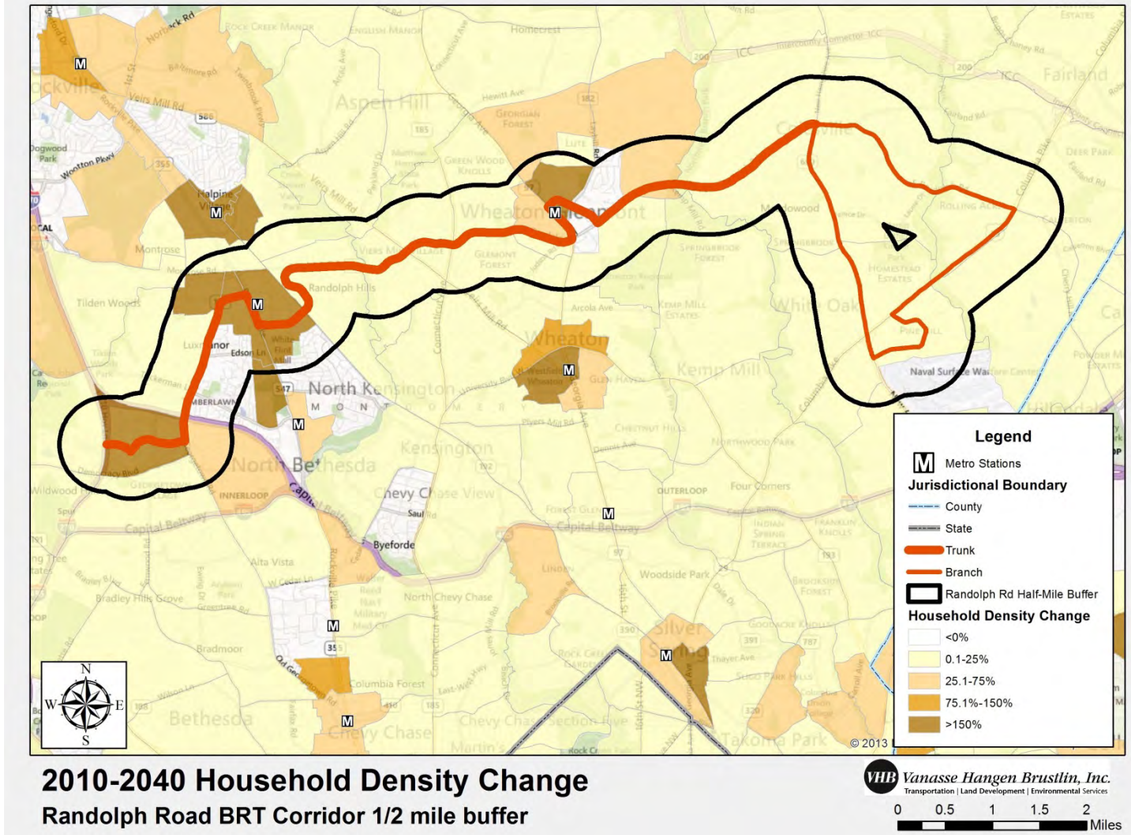


Figure 3-8 Randolph Road Change in Employment Densities - Percent (2010-2040)

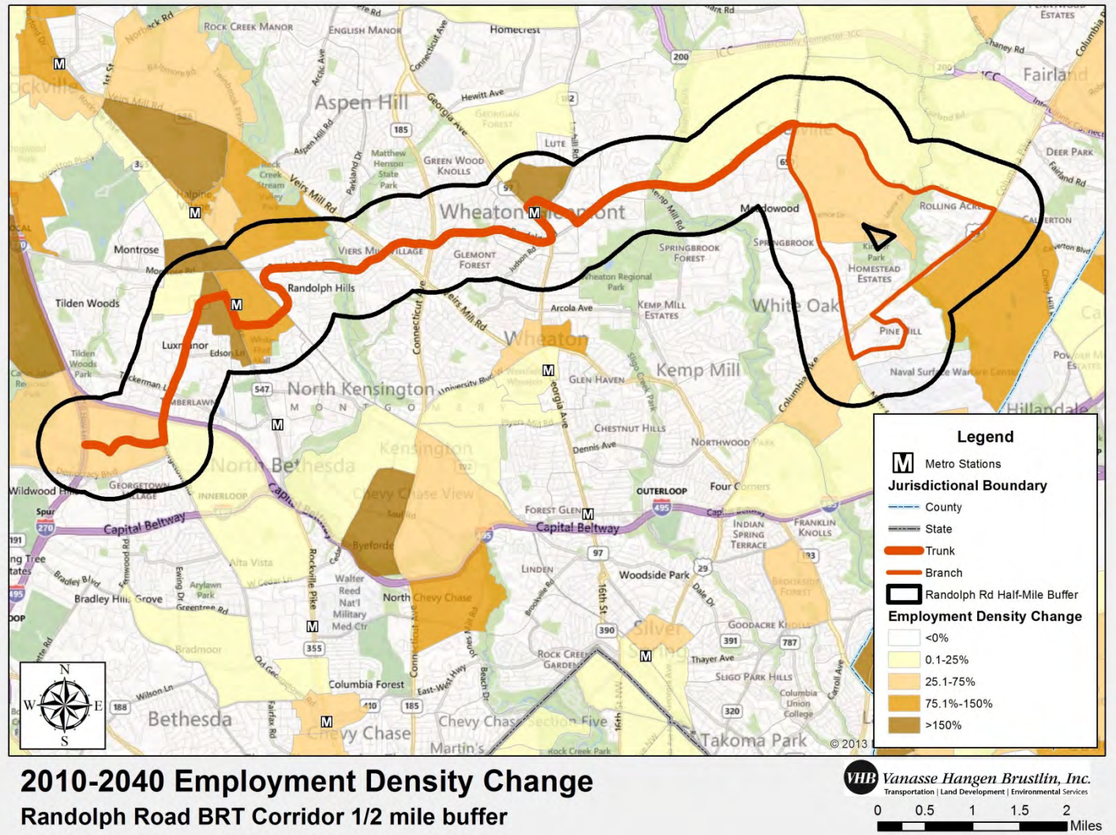


Figure 3-9 Randolph Road Change in Household Densities - Absolute (2010-2040)

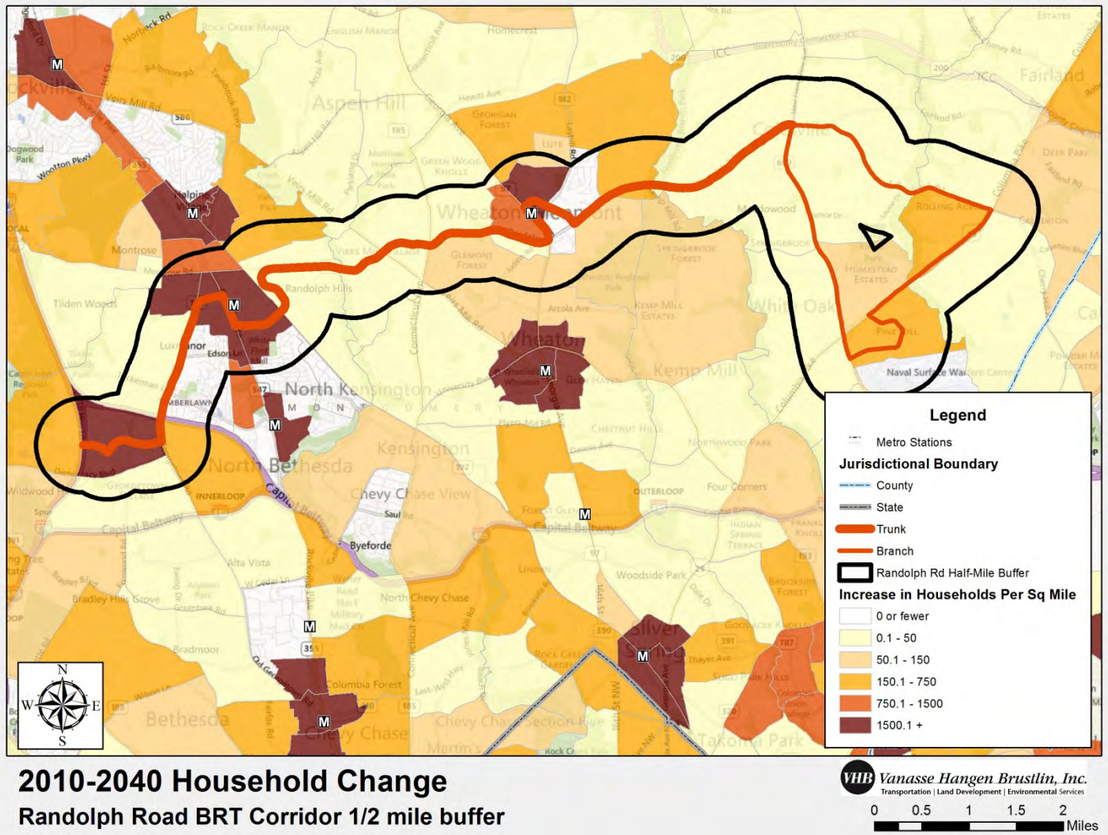
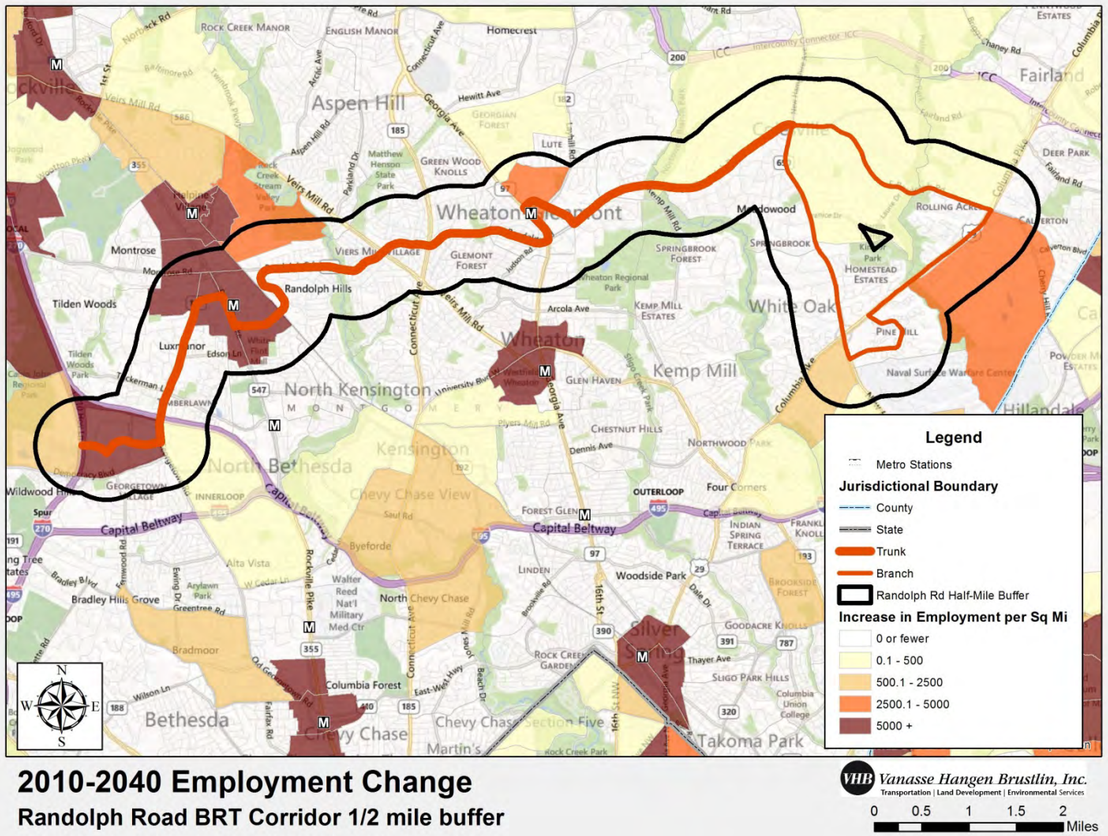


Figure 3-10 Randolph Road Change in Employment Densities - Absolute (2010-2040)



The greatest changes in household growth are forecasted around Rock Spring, White Flint and Glenmont. These are areas where household growth is planned to balance better with employment. The White Oak area shows moderate growth in households but the MWCOG Land Use Forecast Round 8.2 does not include all the growth currently being discussed for the White Oak area. These same areas are also forecasted to witness greater changes in employment growth along the corridor.

Transportation Network

Existing Transit Characteristics

While serving origin and destination locations are an important element of the RTS, it is also important to facilitate transfers between the RTS and other buses and modes that operate along the corridor. There are a number of Ride On and Metrobus services that will operate either along or intersect with the Randolph Road RTS. Figure 3-11 details which of these services interact with the Randolph Road RTS.

Service Characteristics for Primary Routes

There are Metrobus and Ride On bus routes operating along the Randolph Road corridor. The routes and service characteristics are described below. Average weekday ridership for each route was examined for the year spanning September 2011 to August 2012.

Metrobus:

- Route C8, College Park to White Flint Metrobus line, operates between the White Flint Metrorail Station and the College Park – University of Maryland Metrorail station, overlapping the Randolph Road corridor from the White Flint Metrorail station to New Hampshire Avenue. The route provides a 30-minute frequency with a 65-minute runtime. The C8 carried approximately 2,000 riders on an average weekday.

Montgomery County Ride On:

- Route 10, operates between the Twinbrook Metrorail station and the Hillandale Shopping Center on New Hampshire Avenue. The line serves Randolph Road from Parklawn Drive to US 29. The route operates with a 30-minute peak frequency and a 66-minute runtime. The Ride On Route 10 averages roughly 2,000 riders per weekday.

- Route 26, operates between the Montgomery Mall and the Wheaton Metrorail station. The route operates with a 20-minute peak frequency and a 72-minute runtime. The Ride On Route 26 averages roughly 3,200 riders per weekday.

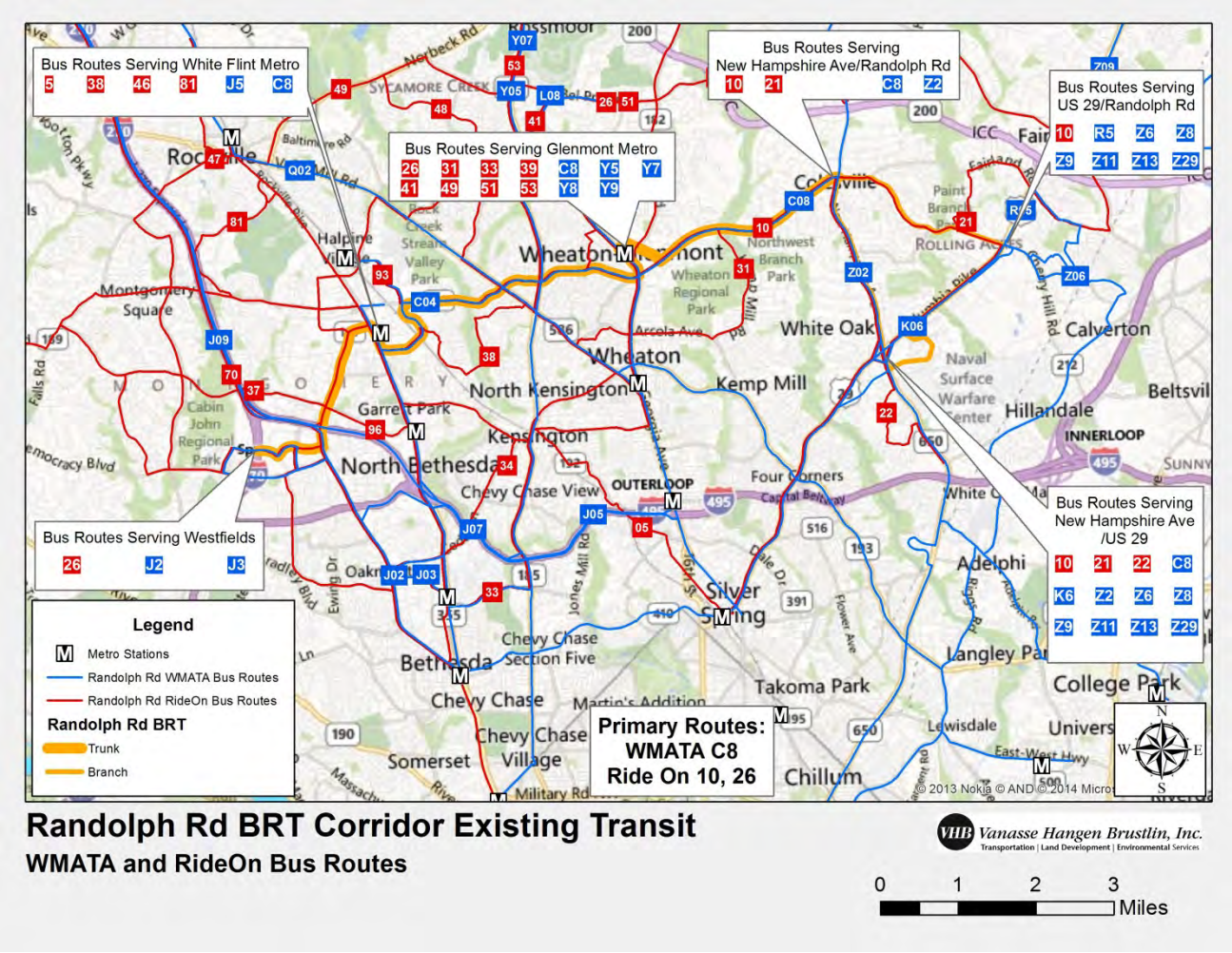
Major Feeder Routes and Connections

The White Flint Metrorail station and Glenmont Metrorail station are the termini for the major feeder routes in this corridor. Both are multimodal hubs providing heavy rail service into the urban centers and core. The following routes (Table 3-4) currently terminate at points along the Randolph Road RTS or cross the service corridor.

Table 3-4 Bus Service Randolph Road Corridor

Operator	Route Name	From	To
WMATA	C8	College Park UMD Station	White Flint Station & Rockville Pk
WMATA	J2	Montgomery Mall Transit Ctr & Westlake	Silver Spring Station
WMATA	J3	Montgomery Mall Transit Ctr & Westlake	Silver Spring Station
WMATA	J5	Twinbrook Station	Silver Spring Station
WMATA	K6	Lockwood Dr & White Oak S/C	Ft Totten Station
WMATA	R5	Plum Orchard Dr & Broadbirch Dr	Ft Totten Station
WMATA	Y5	Montgomery General Hospital	Silver Spring Station
WMATA	Y7	Montgomery General Hospital	Silver Spring Station
WMATA	Y8	Montgomery General Hospital	Silver Spring Station
WMATA	Y9	Montgomery General Hospital	Silver Spring Station
WMATA	Z2	Georgia Av & Olney Sandy Spring Rd	Silver Spring Station
WMATA	Z6	Burtonsville S/C & National Dr	Silver Spring
WMATA	Z8	Greencastle Park & Ride	Silver Spring Station
WMATA	Z9	Burtonsville	Silver Spring Station
WMATA	Z11	Greencastle Park & Ride	Silver Spring Station
WMATA	Z13	Silver Spring Station	Greencastle Park & Ride
WMATA	Z29	South Laurel Park & Ride	Silver Spring Station
Ride On	5	Twinbrook Station	Bonifant St
Ride On	10	Powder Mill Rd & New Hampshire Ave	Twinbrook Station
Ride On	21	Briggs Chaney Park & Ride	Dixon Ave
Ride On	22	Powder Mill Rd & New Hampshire Ave	Dixon Ave
Ride On	26	Glenmont Station	Westfield Montgomery Mall
Ride On	31	Glenmont Station	Medical Center Station
Ride On	33	Glenmont Station	Medical Center Station
Ride On	38	Wheaton Station	Westfield Montgomery Mall
Ride On	39	Briggs Chaney Park & Ride	Glenmont Station
Ride On	41	Grand Pre Rd & Grand Bel Manor	Glenmont Station
Ride On	46	S Campus Dr & Campus Dr	Medical Center Station
Ride On	49	Rockville Station	Glenmont Station
Ride On	51	Glenmont Station	Norbeck Rd Park & Ride
Ride On	53	Shady Grove Station	Glenmont Station
Ride On	81	Rockville Station	White Flint Station & Marinelli Rd

Figure 3-11 Existing Local Bus Service along Randolph Road



Corridor Key Stops and Stations

The White Flint and Glenmont Metrorail stations have the highest boardings and alightings along the Randolph Road corridor as indicated below. The Glenmont station provides metered parking, daily parking, car sharing, bicycle racks and bicycle lockers. The White Flint station provides parking and bicycle facilities. All of the Metrorail stations are major multimodal hubs providing connections between various bus routes from Ride On and Metrobus, as well as other shuttles.

In addition to the Metrorail stations, the following high demand stops were identified with greater than 200 boarding or alightings per day. These key stops include:

- Westfield Montgomery Mall
- Randolph Road and Veirs Mill Road
- White Oak

Table 3-5 displays the boardings and alightings associated with the stops discussed above. The ridership data that was supplied by Montgomery County.

Table3- 5 Key Bus Stop Ridership

Stop	Boardings	Alightings
Montgomery Mall	450	400
White Flint Station	1,050	900
Randolph Rd & Veirs Mill Rd	1,075	800
Glenmont Station	1,675	1,650
White Oak	850	800

Other Transit

There are two Metrorail stations located on the Randolph Road corridor. Both are located on Metrorail's Red Line which provide access to downtown Washington, DC. The White Flint station is located along the Red Line segment that travels through Rockville and terminates at Shady Grove. The Glenmont Metrorail station is located at the terminus at the other end of the Red Line. This segment includes connections to Silver Spring transit center and the Metrorail Yellow and Green Lines.

RTS Concept

Summary of CTCFMP Service

In the Planning Board draft of the *Countywide Transit Corridors Functional Master Plan* (CTCFMP), ridership estimates for the North Bethesda Transitway and Randolph Road corridors were calculated under different scenarios for the year 2040. The scenarios test different transitway treatments for their impacts on ridership. The North Bethesda Transitway scenario tested in the Draft CTCFMP was connecting Montgomery Mall and the Grosvenor Metrorail station with service also along Old Georgetown Road. The Build 1 and Build 2 scenarios, which prescribed two-way median busways, resulted in approximately 4,000 daily riders. Scenario 2A, which removed the Old Georgetown Road corridor overlap, resulted in 10,000 daily riders. The report never modeled the proposed alignment to White Flint, but hypothesized that the ridership potential of joining the North Bethesda Transitway and the Old Georgetown Road North corridor would be greater because of the potential for connections to greater land use potential and future connections to Fairfax County, Virginia.

There are two scenarios for this corridor in draft CTCFMP. The scenarios test different alignments with two-way median busways on Randolph Road for the full length of the corridor. The highest ridership segment was between Glenmont and New Hampshire Avenue, and the lowest was between New Hampshire Avenue and US 29. These scenarios were also tested with the land use changes proposed as part of the *White Oak Science Gateway Master Plan* and the *Glenmont Sector Plan*. The resulting ridership increased to over 20,000 daily riders. Due to the challenges of providing a two-way median busway, scenario 2A tested a combination of curb lane busway and mixed traffic. The resulting ridership was lower but still considered reasonable.

The approved CTCFMP does not prescribe the type of busway treatment (i.e., curb vs. median), but instead states the number of lanes and right-of-way required. The approved plan busway treatment will be determined in later studies.

Recommended Service Plan

The recommended service concept for the Randolph Road corridor is to combine the North Bethesda Transitway and Randolph Road corridors into a single corridor with a trunk (primary) service and branch (secondary) service at the eastern end. The trunk service will operate between the Montgomery Mall Transit Center and Randolph Road at New Hampshire Avenue. The concept would have two branches that connect the corridor to White Oak. The first branch would travel south along New Hampshire Avenue to White Oak and the second branch would continue east along Randolph Road and south along U.S. 29 to White Oak. The branches will provide complete coverage of the entire corridor while also adding service along the trunk to provide the highest level of service on the portions with the greatest demand. The branch along New Hampshire Avenue will also result in a high level of service when combined with other RTS service concepts along New Hampshire Avenue.

The two branches for this service allow for connectivity to the proposed Life Sciences development and the industrial park located at US 29 and Randolph Road/Cherry Hill Road. The land use along Randolph Road east of New Hampshire Avenue is not very transit-supportive and presents challenges for achieving high levels of patronage. Reflective of the lower land use intensity in this portion of the County, one branch would continue on

Randolph Road east to US 29 and the other branch would continue to and from White Oak via New Hampshire Avenue. This would provide added transit service between the Colesville area and White Oak complementing the New Hampshire Avenue RTS. The land use along New Hampshire Avenue includes development that has greater transit accessibility than the eastern segment of Randolph Road. This branch also allows for the Randolph Road RTS to have quicker access to the FDA campus.

This corridor connects North Bethesda/Rockville with Aspen Hill/Glenmont and White Oak. Table 3-6 shows transportation demand data from the MWCOG Regional Cooperative Forecast. The data shows the total growth in home-base work trips by productions and attractions. A production is a trip end connected with a residential land use of a home-based trip or the origin of a non-home-based trip. An attraction is a trip end connected to a non-residential and use of a home-based trip or the destination of a non-home-based trip.

Table 3-6 Growth in Home-Based Work Production and Attraction by Location

Planning District	Productions			Attractions		
	Existing	Year 2040	Growth	Existing	Year 2040	Growth
White Oak	18,350	19,950	9%	14,000	27,450	96%
Aspen Hill	73,100	83,900	15%	25,800	31,850	23%
Rockville/North Bethesda	54,450	101,750	87%	118,700	183,950	55%

There are significant increases in productions and attractions for the corridor. For the productions side, the increase in households and higher residential density are in White Flint. In terms of attractions North Bethesda and White Oak show significant increases in jobs. Based on the MWCOG Household Travel Survey, the current commuter mode share for travel across the County is relatively modest at approximately five percent. Given the planned development, the travel demand forecast shows a doubling of total person trips by the year 2040. This planned growth and development is not linked to the operational status of the RTS.

The planned highway improvements in the corridor include the extension of Montrose Parkway from Parklawn Drive to Veirs Mill Road and the addition of lanes on Randolph Road from Parklawn Drive to Rock Creek Park. There are no proposed improvements on Randolph Road east of Veirs Mill Road. There is a new interchange at Georgia Avenue and Randolph Road that will help alleviate congestion at that intersection. The RTS would provide an alternative to single occupancy vehicle travel and a high quality transit connection to serve the planned growth in these districts. It could be a viable supplement to the limited highway improvements in the corridor.

Key Locations

The location of RTS stops is an important factor in the success of the RTS system. Stops that are located at, or within a reasonable proximity to, activity generators (in terms of both residential origins and commercial, medical, government or other destinations) will assist the initial marketing of the service and with ongoing ridership growth. Exact stop locations have not been selected. The more detailed activity to determine the exact stop locations should occur when individual corridor planning takes place.

For the Randolph Road RTS service concept, general stop locations have been delineated by the County's plan. The plan presented seven possible locations for the North Bethesda

Transitway corridor alignment, and 11 for the Randolph Road corridor alignment, with stop locations ranging in distance from 0.30 to 2.5 miles, with an average stop distance of 0.96 miles along both corridors. This is just slightly outside of the desired stop spacing of 0.50 to 0.75 miles between stops. The 0.96 spacing is within a reasonable range of the general criteria and the land uses along the corridor are consistent with the longer stop spacing. Table 3-7 displays the stop locations along the Randolph Road corridor and the distance between each of these stops.

Table 3-7 Stop Locations and Distances for Randolph Road

	From	To	Segment Distance (miles)
Trunk	Montgomery Mall Transit Center	Rock Spring Dr. & Fernwood Rd.	0.513
Trunk	Rock Spring Dr. & Fernwood Rd.	Rockledge Dr. and Rock Spring Dr.	0.325
Trunk	Rockledge Dr. and Rock Spring Dr.	Rock Spring Dr. and MD 187	0.319
Trunk	Rock Spring Dr. and MD 187	MD 187 and Tuckerman Ln.	0.557
Trunk	MD 187 and Tuckerman Ln.	MD 187 and Edson Ln./Poindexter Ln.	0.396
Trunk	MD 187 and Edson Ln./Poindexter Ln.	White Flint Metro Station	0.999
Trunk	White Flint Metro Station	Randolph Rd. and Lauderdale Dr.	1.422
Trunk	Randolph Rd. and Lauderdale Dr.	Randolph Rd. and MD 586	1.245
Trunk	Randolph Rd. and MD 586	Randolph Rd. and MD 185	0.525
Trunk	Randolph Rd. and MD 185	Randolph Rd. and Bluhill Rd.	0.501
Trunk	Randolph Rd. and Bluhill Rd.	Randolph Rd. & MD 97	0.852
Trunk	Randolph Rd. & MD 97	Wheaton Metro Station	0.39
Trunk	Wheaton Metro Station	Randolph Rd. & Glenallan Ave.	0.694
Trunk	Randolph Rd. & Glenallan Ave.	Randolph Rd. & MD 650	2.646
Branch 1	Randolph Rd. & MD 650	Randolph Rd. & Fairland Rd.	0.434
Branch 1	Randolph Rd. & Fairland Rd.	US 29 & Tech Rd.	2.51
Branch 1	US 29 & Tech Rd.	White Oak Transit Center	2.435
Branch 2	MD 650 & Randolph Rd.	MD 650 & Valleybrook Dr.	1.265
Branch 2	MD 650 & Valleybrook Dr.	MD 650 & Jackson Rd.	0.27
Branch 2	MD 650 & Jackson Rd.	White Oak Transit Center	1.094
		Total Trip Distance Branch 1 Total Trip Distance Branch 2	16.8 14.0
		Average Stop Distance	0.96

Service Span and Frequency

The level of service including operating hours and headways for the RTS service should be at a premium level in order to meet passenger demand and obtain high ridership levels. Ideally, the RTS service concept would operate from the early morning until late at night, with 10 minute headways or less. Headways at 10 minute intervals provide a level of service that doesn't require the need to check a schedule and the wait times between vehicles is understood to be frequent enough to meet a choice rider's expectations. This frequency falls in the middle of the range of headways for rapid transit systems in North America and is a reasonable headway expectation for a new service. As service demand increases along the corridor, headways can be further reduced to accommodate the growing demand. The service span was designed to complement and match Metrorail service spans. The initial Randolph Road RTS levels of service for the fully built-out system are displayed in Table 3-8.

Table 3-8 Randolph Road Levels of Service

Period	From	To	Span of Service	Headways	
				Peak	Off-Peak
Weekday	Montgomery Mall	White Oak	6AM-12AM	10	10

Table 3-9 provides a comparison of headway and travel speed savings associated with the Randolph Road RTS service. These savings are a comparison between existing local service and the trunk portion of the RTS corridor. The travel speed savings are based on figures for estimated travel speeds from the *Federal Transit Administration's Characteristics of Bus Rapid Transit for Decision Making*.

Table 3-9 Comparison of Headway and Travel Speeds

Service	Headway (minutes)			Speed (mph)		
	AM	Off-peak	PM	AM	Off-peak	PM
Existing[1]	15	15	15	13.7	14.8	12.6
Randolph Road RTS[2,3]	10	10	10	14.0	17.0	14.0
Difference	5	5	5	0.3	2.2	1.4
Percent Travel Time Savings				2%	15%	11%

1. Headway and speed between Montgomery Mall and White Oak shown, based on Metrobus C8 and Ride On 10 published schedule.

2. Headway is for the trunk portion of the corridor

3. Speed estimate is provided for the trunk portion of the corridor based on type of running way, location, and time of day

The service concept plan initially would have the Randolph Road RTS service offered between the hours of 6:00 AM and midnight from the Montgomery Mall to White Oak with at least 10-minute headways in the peak period and 30-minute headways during the off-peak period. Trunk service between the Montgomery Mall and the Randolph Road/New Hampshire Avenue station would be provided at 10-minute frequency all day. Service to White Oak would be provided at a 10-minute frequency all day, but with service along each

branch from the Randolph Road/New Hampshire Avenue station operating at a 20-minute frequency.

Branches, Overlaps, and Deviations

The only deviation from the route alignment proposed as part of the draft CTCFMP is sending every other trip to White Oak via New Hampshire Avenue. This change improves effective service along New Hampshire Avenue between Randolph Road and US 29. It also provides a faster and more direct connection to the proposed the White Oak Transit Center and the FDA campus. Other deviations off the corridor have been limited to accessing major activity centers (i.e., Glenmont Metrorail station) to reduce the impacts of deviations on travel time. Overlaps with other RTS corridors are proposed and an important element of the whole system. These overlaps are proposed to integrate the individual corridors into a larger RTS network and also provide higher levels of service where the overlaps occur. This corridor as proposed, overlaps with the New Hampshire Avenue corridor and US 29 corridor.

Integration with Local Service

RTS along the Randolph Road corridor would be complemented by some existing service provided by Metrobus and Ride On. Direct duplication of service on this corridor is modest. Currently, the Metrobus C8, Ride On Route 10 and Route 26 provide service along some portion of the corridor. These routes would continue to operate as the local alternative to RTS service, providing service with closer stop spacing. Frequency for these routes can likely be decreased to account for the RTS service also operating within the corridor. Further study of ridership patterns and impacts should be conducted to determine appropriate adjustments.

The remainder of the Ride On and WMATA routes that interact with the Randolph Road corridor will be adjusted as well given future planning efforts. Many of these routes currently use portions of the corridor to access other destinations. Consideration could be given to terminating these routes with the intersection of the RTS, essentially converting the routes into feeder services. This may not be a viable option for all routes and depend on origin and destinations of the riders.

Fleet Requirement

Based on the recommendation to join the North Bethesda Transitway and Randolph Road corridors, create a trunk and two secondary branches. The following vehicle requirements are estimated based on the prescribed headways. During peak service, the requirement would be 23 vehicles, including spares. This would drop to 14 vehicles during the off-peak based on the improved travel times[7].

Operational Hours

A planning-level estimate of the hours of service that would be required to operate the service concept was developed for the Randolph Road RTS. The estimate of operating hours was developed based on the assumptions related to the travel speed that could be achieved associated with various BRT treatments discussed in the draft CTCFMP. These assumptions are not being recommended for implementation, but were necessary to produce an estimate of the number of hours that would be required to operate the service.

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[7] These figures are based on an 11.8 mile long trunk service, and 12.6 and 9.0 mile long branch services. Peak period speeds are assumed to be 17 mph during peak service and 19-21 mph during off-peak service. Spare ratio is 1.2 times the total vehicle requirement.

The assumed speeds allowed for a calculation of the number of vehicles that would be required to operate the service using the prescribed headways discussed above. These assumptions result in typical weekday of 296 service hours. This figure calculates to roughly 99,000 annual service hours. The deadhead hours (i.e., hours to and from the bus garage) have been factored to 15% of the revenue hours, which equates to approximately 114,000 total vehicle hours.

Corridor Outcome and Summary

The implementation of RTS service along the Randolph Road will provide a high quality transit link from east-to-west through central Montgomery County. The service will link persons in residential areas with employment and commercial centers in Rock Spring, White Flint and White Oak. It will also provide high frequency, high speed connections to Metrorail as well as other RTS corridors thereby providing access to other regional job centers. The Randolph Road corridor will not only support the residents that live along the corridor by providing and improved travel alternative, but it will also support the future growth and development of areas such as White Flint and White Oak. These are areas that are seeking to become more transit oriented, and the RTS will provide the high-quality transit necessary to support the planned densities.

MD 355 Corridor Service Plan

The conceptual service plan for the MD 355 corridor is based on an earlier RTS draft corridor plan for MD 355 North and MD 355 South as outlined in the Montgomery County Planning Department's *Countywide Transit Corridors Functional Master Plan Planning Board Draft* from July 2013[1]. This concept focuses on connecting the activity centers, multimodal transit nodes, as well as providing transportation opportunities along MD Route 355 from Clarksburg to Friendship Heights.

General Corridor Overview

The draft *Countywide Transit Corridors Functional Master Plan* (CTCFMP) proposes two segments along the MD 355 corridor; the MD 355 North corridor which provides service from Clarksburg to the Rockville Metrorail station; and the MD 355 South corridor which provides service between the Rockville Metro station and the Friendship Heights Metrorail station at the border of Montgomery County and Washington, DC. The Adopted Functional Master Plan differs from the Draft Plan slightly and recommends that the MD 355 South corridor operate from Rockville Metrorail station to the Bethesda Metrorail station. A key focus of this study is service integration and not guideway type, location or construction

Figure 4-1 MD 355 RTS Corridor

[1] The July 2013 Planning Board Draft of the Countywide Transit Corridors Functional Master Plan was the current plan at the outset of this study. The Draft has been reviewed and adopted with minor changes made by the County Council since the completion of the major planning efforts of this study. These changes have not been reflected because of the schedule of the study, but have been noted where differences occur between the Planning Board Draft and the Adopted Plan.

sequencing. This concept identifies the need for a seamless route along the entirety of the corridor. This concept plan proposes that the MD 355 North and South corridors be combined. This connection links key areas of the previously segmented corridors together creating a synergy between many of the activity centers and multimodal opportunities located between the two previously defined segments. Based on the draft CTCFMP, the RTS for MD 355 is proposed to operate a continuous route from Clarksburg to Friendship Heights, as shown in Figure 4-1[2]. The MD 355 RTS route is approximately 23 miles long (MD 355 North is approximately 14-miles long and MD 355 South is approximately 9-miles long).

The MD 355 RTS service is designed to be a new and faster option for commuters traveling between Clarksburg and Bethesda. The RTS also provides connections to the Metro Red Line and the MARC commuter rail. These other rail modes provide high capacity transit service into the metropolitan area urban core. The RTS route would connect many major activity centers located along MD 355. While many of the users are expected to be commuters, the development occurring around many of the Metrorail stations along MD 355 is creating a more transit- supportive corridor that has the potential to result in greater transit use throughout the day.

Existing Sources of Activity

Traveling along the MD 355 corridor from Clarksburg to Friendship Heights, the following sources of activity are encountered:

- Clarksburg Town Center and CCT connectivity
- Mileston
- Montgomery College Germantown Campus and Holy Cross Germantown Hospital
- Germantown Town Center
- Watkins Mill/Metropolitan Grove
- Lakeforest Mall
- Old Town Gaithersburg
- Shady Grove (Metrorail)
- King Farm
- Montgomery College Rockville Campus
- Rockville Town Center (Metrorail)
- Twinbrook (Metrorail)

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[2] The Montgomery County Council approved the Countywide Transit Corridors Functional Master Plan in November 2013. As part of the approval the Council proposed some changes to the MD 355 North and South corridors. The MD 355 North corridor would continue to run from Redgrave Place in Clarksburg to Rockville Metro. The corridor would have two branches that connect to the Corridor Cities Transitway in Germantown East. The MD 355 South corridor would no longer terminate at Friendship Heights, but would instead terminate at the Bethesda Metro station. These proposals were not considered in the analysis contained in this report due to the timing of their release. Future study of the individual corridors will need to contain a review of the Council recommendations as part of a detailed analysis.

- White Flint (Metrorail)
- Grosvenor-Strathmore Metrorail station
- The National Institutes of Health/ Walter Reed National Military Medical Center (Metrorail)
- Bethesda Central Business District (Metrorail)

Existing Demographics

In order to better understand the potential for the transit use, market demographic data within a ½-mile boundary around the proposed MD 355 RTS line was compiled. The data is based on the 2011 American Community Survey Data for Census tracts that are in the ½-mile boundary. The data is summarized in Table 4-1. The table also lists the County totals for each characteristic so as to provide context of how the corridor relates to the County as a whole. Based on these data, the MD 355 corridor includes almost 20 percent of the County's population. The corridor also has a higher percentage of commuters using transit compared to the County as a whole. The higher commuter transit mode share and high percentage of households with no vehicle available creates an environment where high-quality transit can be successful.

Table 4-1 Demograhic Data for MD 355 Corridor

Census Group	MD 355 Corridor	Montgomery County
Population	191,645	959,738
Male (%)	48.0%	48.0%
Female (%)	52.0%	52.0%
Median Age	39.9 years	40.5 years
Workers 16 years and older	106,377	508,645
Public transit is primary means of travel to work (% of workers 16 and older)	20,399 (19.2%)	77,077 (15.2%)
Households	80,139	355,434
Avg. Annual Median HH Income	$104,813	$111,751
Below the poverty line (Households)	4,390 (5.5%)	20,712 (5.8%)
Non-vehicle ownership (Households)	8,585 (10.7%)	29,018 (8.2%)
Source: 2007-2001 American Community Survey 5-Year Estimates		

Existing Land Use

The northernmost section of the MD 355 corridor, from Clarksburg to Gaithersburg, includes moderate density residential and commercial areas that are auto oriented and representative of typical suburban development patterns. In this section, the residential development features primarily single family homes and townhomes, most of which either face away from MD 355 or are set back from the roadway. The commercial development in this section tends to be typical suburban retail centers with ample parking and large distances from store fronts to the arterial roadway. This type of development, both for residential and commercial, makes it challenging to access transit. This portion of the corridor has seen rapid increases in density, changing land use and increased congestion in recent years.

The section of the MD 355 corridor from Gaithersburg to Rockville features moderate to high density development and relatively high levels of congestion. Within the City of Gaithersburg, MD 355 is a commercial corridor with low-rise buildings facing the roadway and limited setbacks. The remainder of this section of the corridor features a mix of large scale and small scale retail, with most residential development facing away from the roadway. Most of the corridor north of the City of Rockville is suburban in nature and car oriented with many curb cuts and large parking lots. The new development in this portion of the corridor including the large, new neo-traditional King Farm community features mixed use developments with higher densities. The new more urban development encourages transit use by providing improved transit accessibility for both the trip origins and destinations. Continuing this type of development will be important because being able to readily access transit at both ends of the trip makes choosing to use transit for choice a rider possibility for those with other options.

The section of MD 355 from Rockville to Bethesda includes relatively high density development focused around the Metrorail stations. Land use intensity gradually tapers off as the distance away from the rail stations increases. Between Rockville and Bethesda there are four stations. The land use in this section of the corridor has changed significantly in recent years and continues to change primarily due to high density infill development adjacent to the station areas. This infill development is creating a more uniform high density corridor from Rockville to White Flint. This section features a range of land uses from more urban sections with mixed uses, including high rise office and residential buildings facing the roadway, to more traditional strip retail centers with large frontal parking lots and suburban residential developments. South of White Flint, the development pattern is consistently more of a suburban type with lower intensity. The predominant land use is 1950's single family residences, but there are some larger apartments although with large surface parking lots.

The land use changes rapidly south of Cedar Lane inside the Capital Beltway. The National Institute of Health and Walter Reed National Military Medical Center campuses are located just north of the Bethesda Central Business District (CBD). These two campuses are major regional employers and activity centers; both are secure facilities. In the Bethesda CBD, the corridor is in an urban setting. The Bethesda CBD is a major regional commercial and employment center that includes numerous high rise mixed use buildings and low rise retail facing the roadway with limited setbacks. South of the Bethesda CBD, the corridor is more suburban, with single family households on small lots and a large golf course.

Planned Land Use Changes

The master plan updates for subareas along the corridor show areas that are increasing in employment and household densities with a focus on sustainable development. Some early phases of the RTS, or transitional services, may become operational within the next few years. Research has indicated that bus rapid transit can impact land use along a corridor and help development and economic activity. The findings of this research indicate that good land use planning is a key aspect of ensuring that an area will develop into a walkable, mixed use corridor that can support high quality transit[3]. The right type of development will help the proposed RTS along MD 355 yield high ridership both in the peak and the off peak periods.

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[3] More Development for Your Transit Dollar: An Analysis of 21 North American Transit Corridors, Institute for Transportation & Development Policy,

There are areas in the County that are currently being studied for planning updates. Clarksburg is an area that is currently undergoing a review and plan update. The Clarksburg area, at the northern end of the MD 355 corridor, is slated for greenfield development that will include a mixed use Town Center, a major new commercial center, and moderate density residential. This plan update reflects the proposed transit investment in both the CCT and the MD 355 RTS.

The City of Gaithersburg is currently in the process of updating their master plan. This update is being conducted as part of a regular 6-year review of the existing plan. The plan is framed around the State of Maryland's 2009 smart growth legislation. While the plan does discuss specific properties and zoning classifications along MD 355 such as Lake Forest Mall and the fairgrounds, a specific planning effort for the MD 355 corridor has not taken place yet. The plan focuses on rezoning properties known to be in transition along the corridor to allow for a greater intensity of development and infill as well as a mixing of uses. The objective is to allow for the highest and best use of each property along the corridor[4]. Higher levels of employment and household densities along MD 355 will increase accessibility to the RTS.

The Shady Grove Sector Plan, approved in 2006, seeks to transform the area around the Metrorail station into a more intense, mixed use area. The plan proposes to introduce more connectivity and transportation choices, while adding more than 5,000 new residential units and 7,000 new jobs. The plan also includes Transportation Demand Management (TDM) measures to encourage transit use[5]. TDM measures include limited parking, fare subsidies as well as other measures which encourage non-single occupancy automobile modes.

The City of Rockville's master plan is currently being updated. This update will address not only the broader master plan for the entire city, but also *Rockville's Pike Plan*. The *Pike Plan* update is currently underway and a draft version is available. The study area for the Pike Plan includes an almost two mile segment of MD 355 from Richard Montgomery Drive to the City's southern corporate limit. The plan is focused on promoting a mixed use corridor with a robust multimodal network. Projections indicate that approximately 9,000 new residents and 4,500 new jobs could be in the plan area by 2040[6].

The Twinbrook Sector Plan update was completed in 2009. The sector plan envisions the area with greater employment and housing opportunities. The plan seeks to take advantage of the Metrorail station by intensifying development through infill development and allowing for higher building heights. The plan seeks to provide greater connectivity through physical road connections and also more transportation choices[7]. With the RTS passing through this area it will provide additional high quality transit and improved transportation choice.

The redevelopment of White Flint, which is currently underway, is expected to add more than 10,000 residents and 25,000 jobs. The redevelopment is transforming White Flint from a typical suburban area to an urban, transit oriented sector with high rise mixed use

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[4] City of Gaithersburg 2009 Mater Plan - Land Use Plan, City of Gaithersburg, December 20, 2011.

[5] Shady Grove Sector Plan, Montgomery County Planning Department – Maryland-National Capital Park and Planning Commission, March 2006.

[6] Rockville's Pike Plan Planning Commission Redlined Draft, City of Rockville, md-rockville.civicplus.com, accessed December 23, 2013.

[7] Twinbrook Sector Plan, Montgomery County Planning Department – Maryland-National Capital Park and Planning Commission, January 2009.

development and an urban street grid[8]. The location of the current Metrorail station along MD 355 will allow for the ability to transfer between the RTS and Metrorail. This will be a key multimodal connection point.

The sector plan for Bethesda and the Bethesda CBD are in the early stages of being updated. Beginning in 2014, planners will begin working with the public to revisit the existing plan's land use and density recommendations, urban design, mobility and accessibility, and the overall vision for Bethesda.

The Metropolitan Washington Council of Governments Cooperative Land Use Forecast Round 8.2 shows how the corridor is projected to change between 2010 and 2040. The land use forecast shows development that has been approved and can be expected to occur. Unlike the proposed updates to master plans, the land use forecast represents a scenario that balances the development plan with the surrounding growth in the metropolitan region and is tied to economic indicators as well as the County's proposed development policies.

Figure 4-2 shows the total corridor change in households and employment from 2010 to 2040. Table 4-2 shows the total corridor household and employment densities along the MD 355 corridor. The table provides details about the lowest and highest observed values as well as the average value for the corridor. These values can be compared against values for residential and non-residential densities as reported in the Institute for Transportation Engineers (ITE), *A Toolbox for Alleviating Traffic Congestion*, shown in Table 4-3. The data in Table 4-3 represents land area that can be developed, versus gross land area in the Transportation Analysis Zone (TAZ) plots. Land that can be developed would exclude parks and wetlands in the TAZ. Since most of the TAZs along the corridor cover land that can be developed, the ITE data in Table 4-3 provides an approximate guide for understanding potential service levels. A land use density threshold for transit supportive areas on gross land area used in other local planning studies in the region is three households per gross acre and/or four jobs per gross acre. Based on the maximum values corridor wide for land use forecast, the corridor could support bus service at a 10 minute frequency, although the parallel Metrorail service should also be considered in future corridor and service planning efforts.

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[8] Midtown on the pike White Flint Sector Plan, Montgomery County Planning Department – Maryland-National Capital Park and Planning Commission, April 2010.

Figure 4-2 MD 355 Corridor Projected Changes

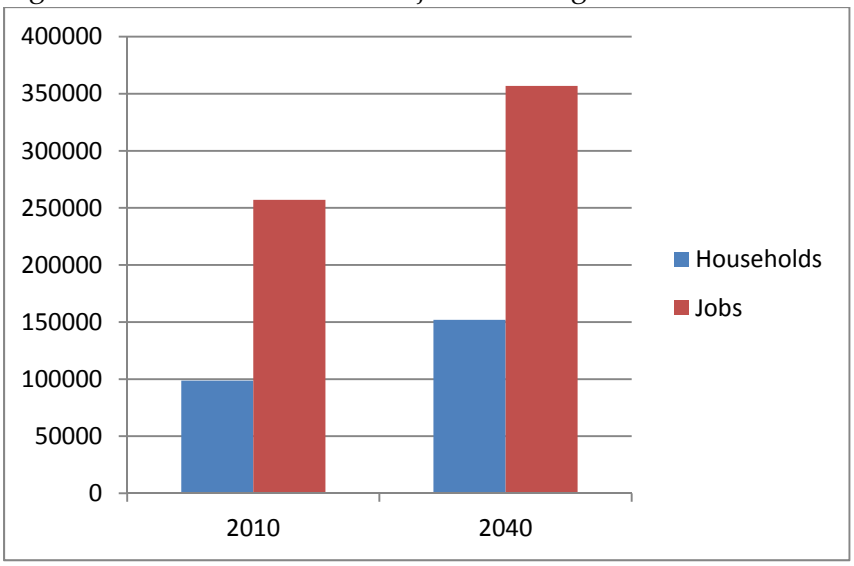


Table 4-2 MD 355 Corridor Household and Employment Densities (2010 & 2040)

	2010 Household Density (HH/Acre)	2040 Household Density (HH/Acre)	2010 Employment Density (Emp/Acre)	2040 Employment Density (Emp/Acre)
Minimum	0	0	0	0
Maximum	32	45	130	169
Average	4	6	12	17

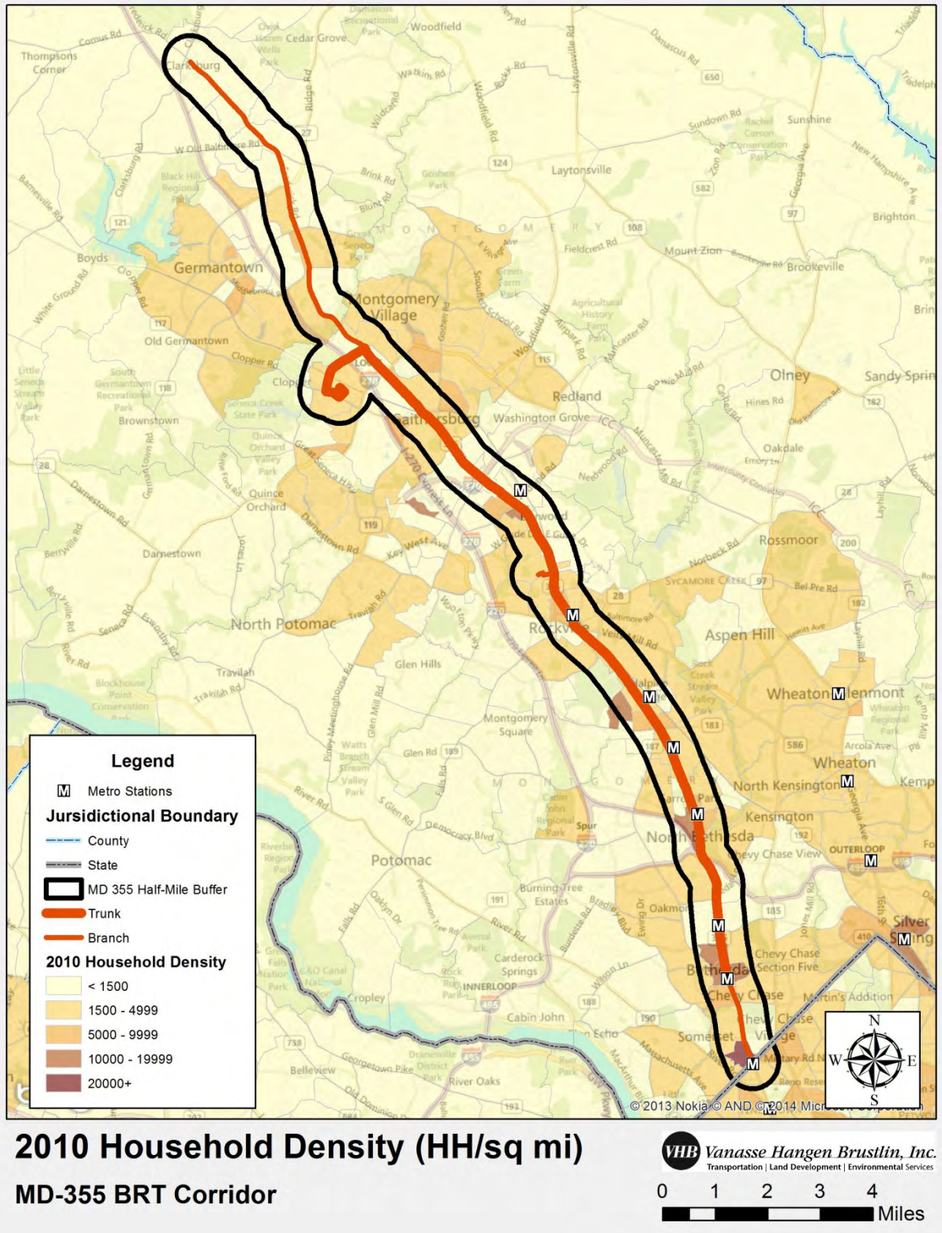
Table 4-3 ITE Residential and Non-residential Densities for Transit Service[9]

	Frequency (20-hour service day)	Dwelling Units per Acre	Employees per Acre
Bus	1 bus/hour	4-5	50-80
Bus	1 bus/30 minutes	7	80-200
Bus	1 bus/10 minutes	15	200-500
Light Rail	Every 10 minutes	35-50	500+

Figures 4-3 and 4-4 on the following pages show the household density (households per square mile) in 2010 and the forecasted density for 2040. Mild growth around Clarksburg, Germantown and Gaithersburg is forecasted. The areas around Rockville, Twinbrook, White Flint and the Bethesda Metrorail stations are forecasted to experience the greatest growth in household and employment densities. The growth in household and employment densities in these areas will have the greatest influence on the number of and growth of transit trips. Figures 4-5 and 4-6, on the following pages, show the employment density for 2010 and the forecasted employment density for 2040. Areas showing the greatest growth in employment density are eastern Germantown, Gaithersburg, Twinbrook, and White Flint. Figures 4-7 and 4-8 show the actual percent change between 2010 and 2040 for households and employment, respectively. Figures 4-9 and 4-10 show the absolute change between 2010 and 2040 for households and employment, respectively.

[9] Institute of Transportation Engineers, A Toolbox for Alleviating Traffic Congestion, 1989.

Figure 4-3 MD 355 Household Densities (2010)

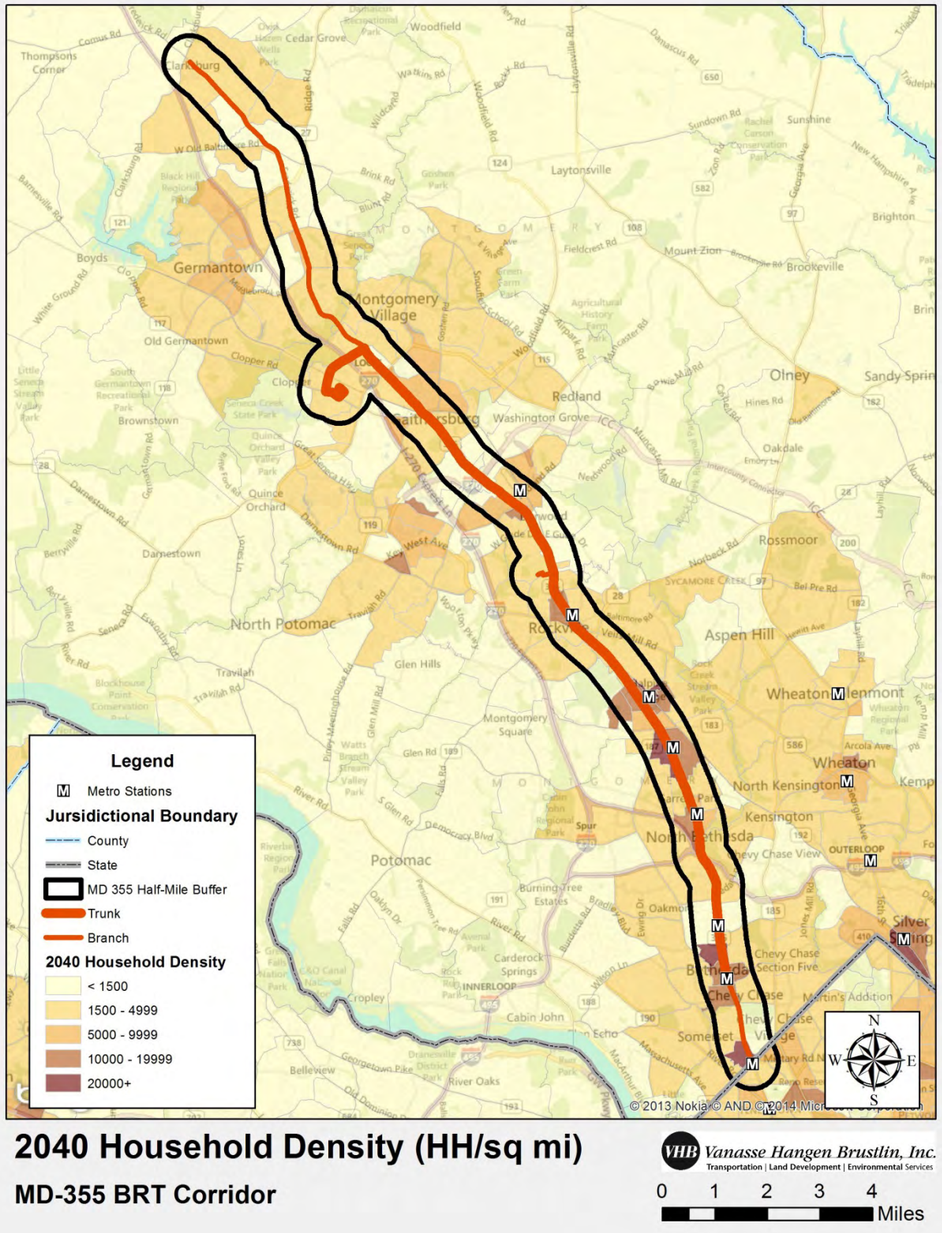


2010 Household Density (HH/sq mi)

MD-355 BRT Corridor

VHB Vanasse Hangen Brustlin, Inc.
Transportation | Land Development | Environmental Services

Figure 4-4 MD 355 Household Densities (2040)



2040 Household Density (HH/sq mi)

MD-355 BRT Corridor

VHB Vanasse Hangen Brustlin, Inc.
Transportation | Land Development | Environmental Services

Figure 4-5 MD 355 Employment Densities (2010)

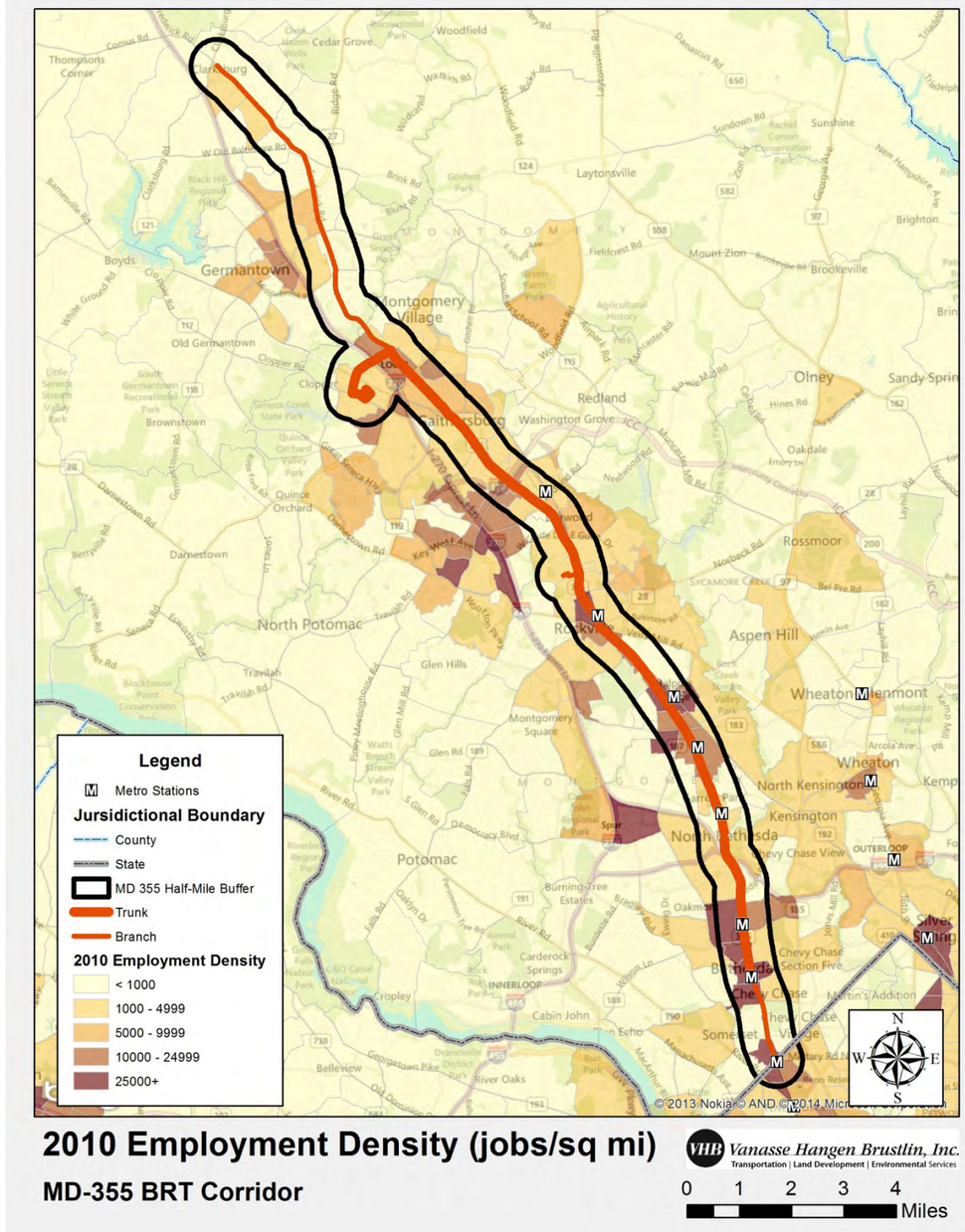


Figure 4-6 MD 355 Employment Densities (2040)

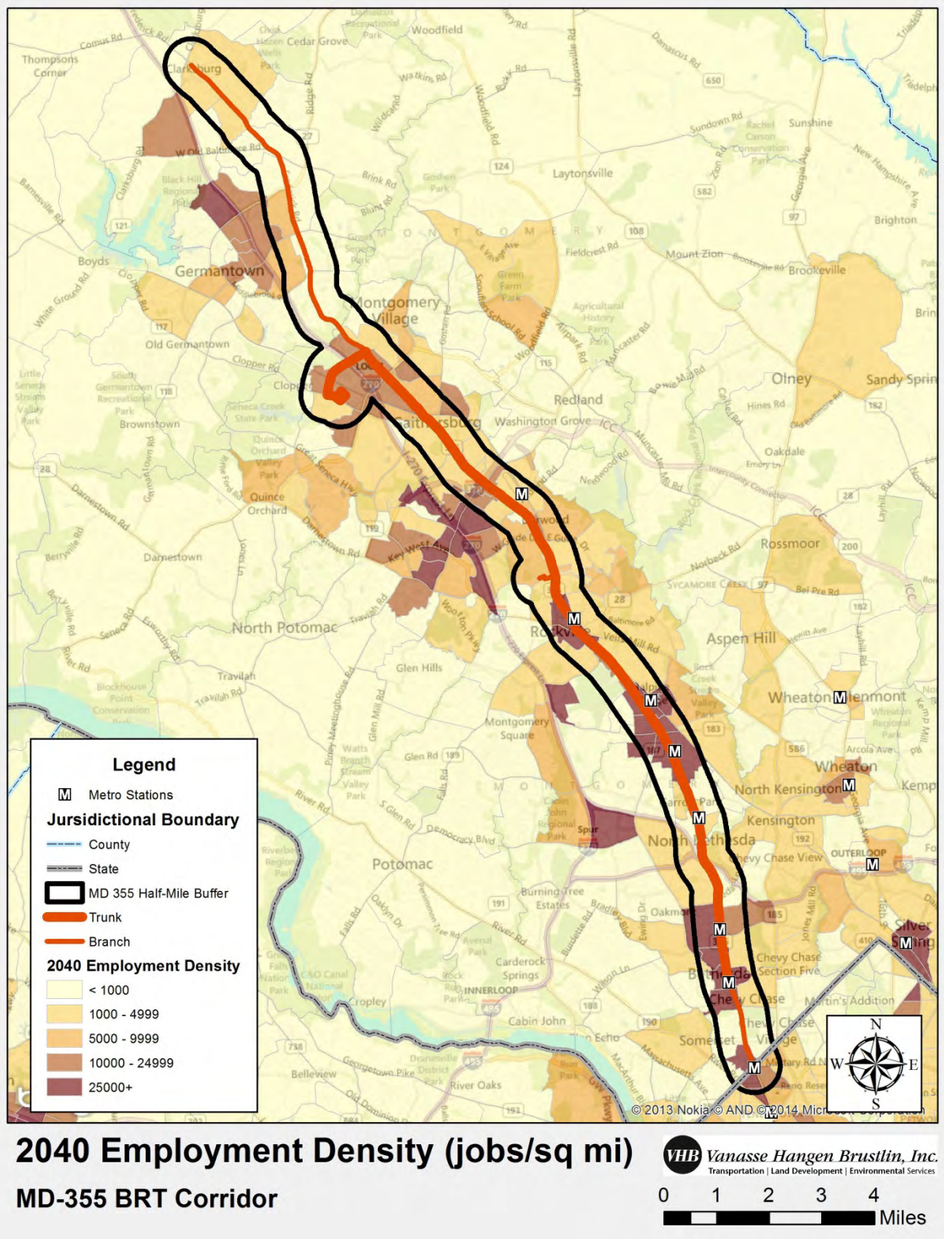


Figure 4-7 MD 355 Change in Household Densities - Percent (2010-2040)

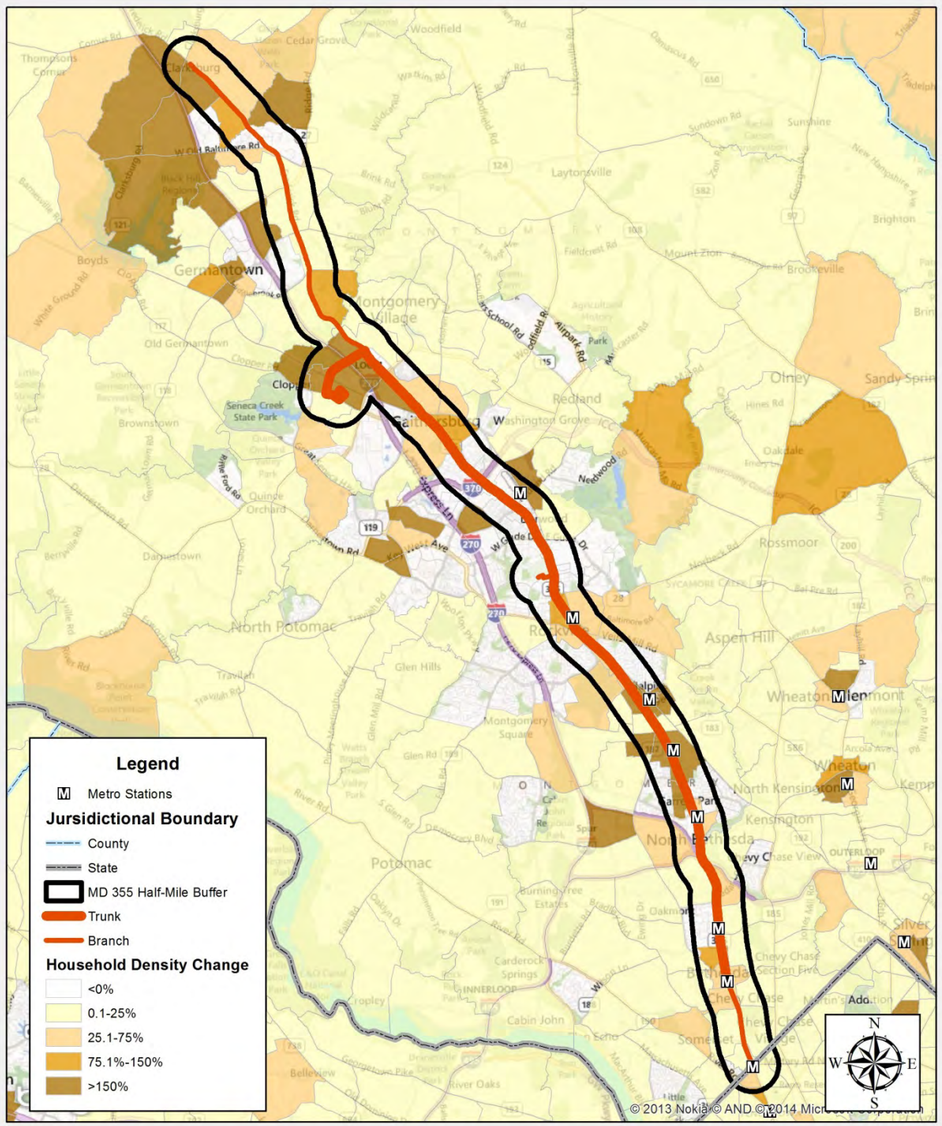


Figure 4-8 MD 355 Change in Employment Densities - Percent (2010-2040)

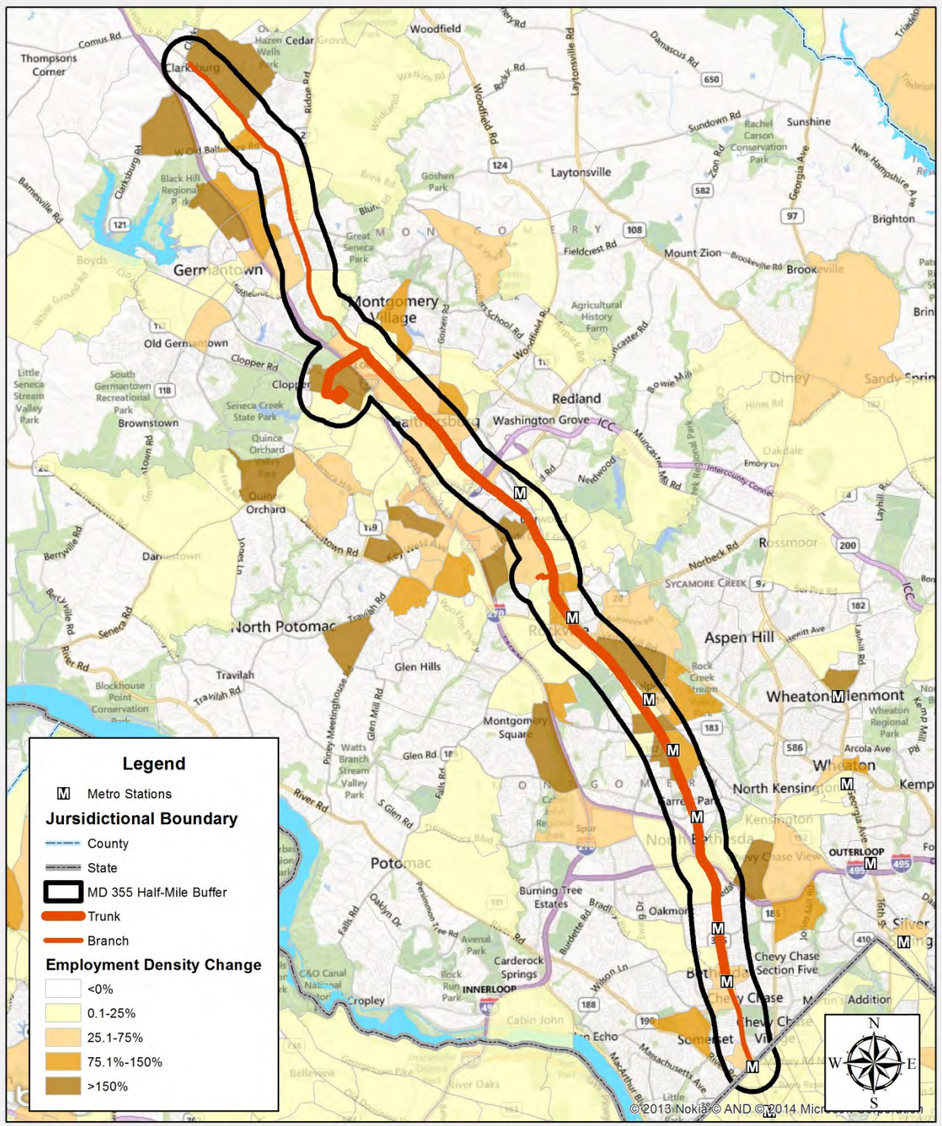


Figure 4-9 MD 355 Change in Household Densities - Absolute (2010-2040)

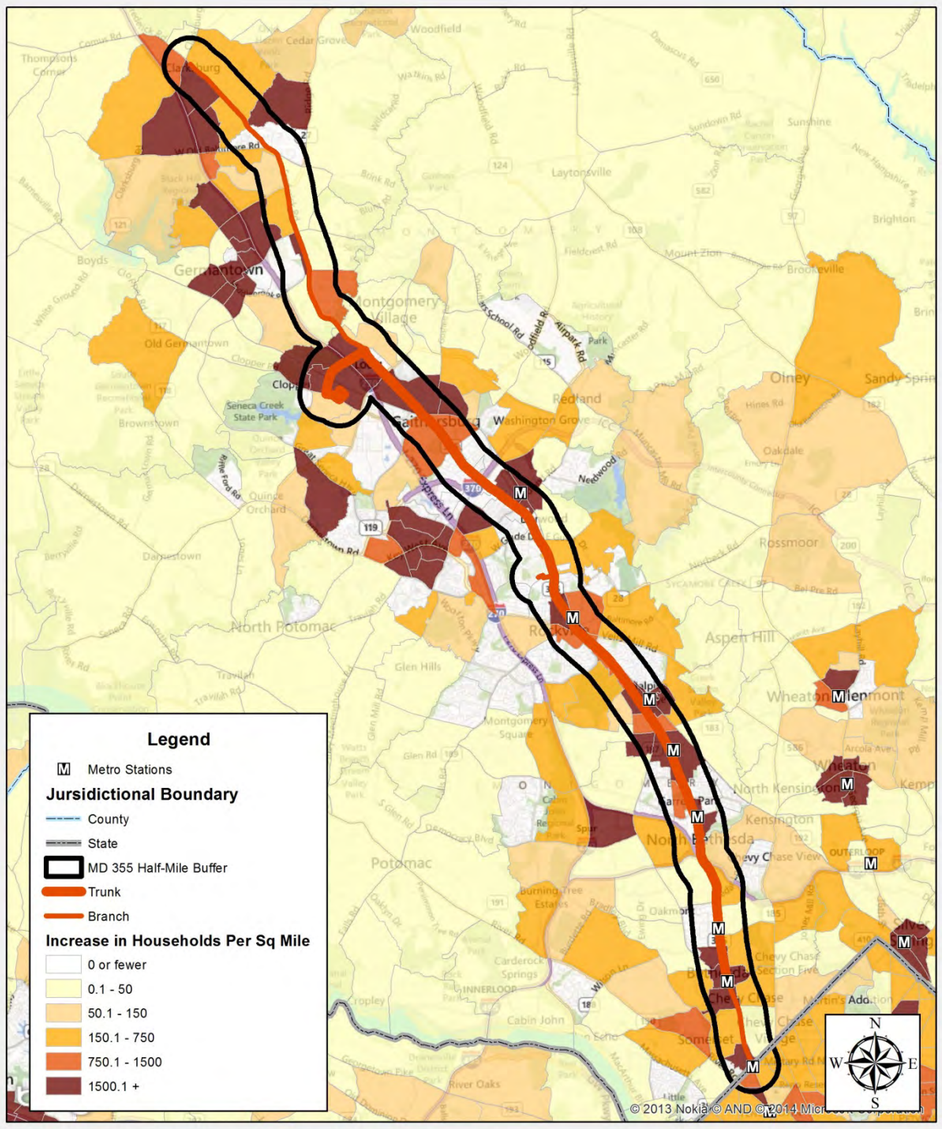
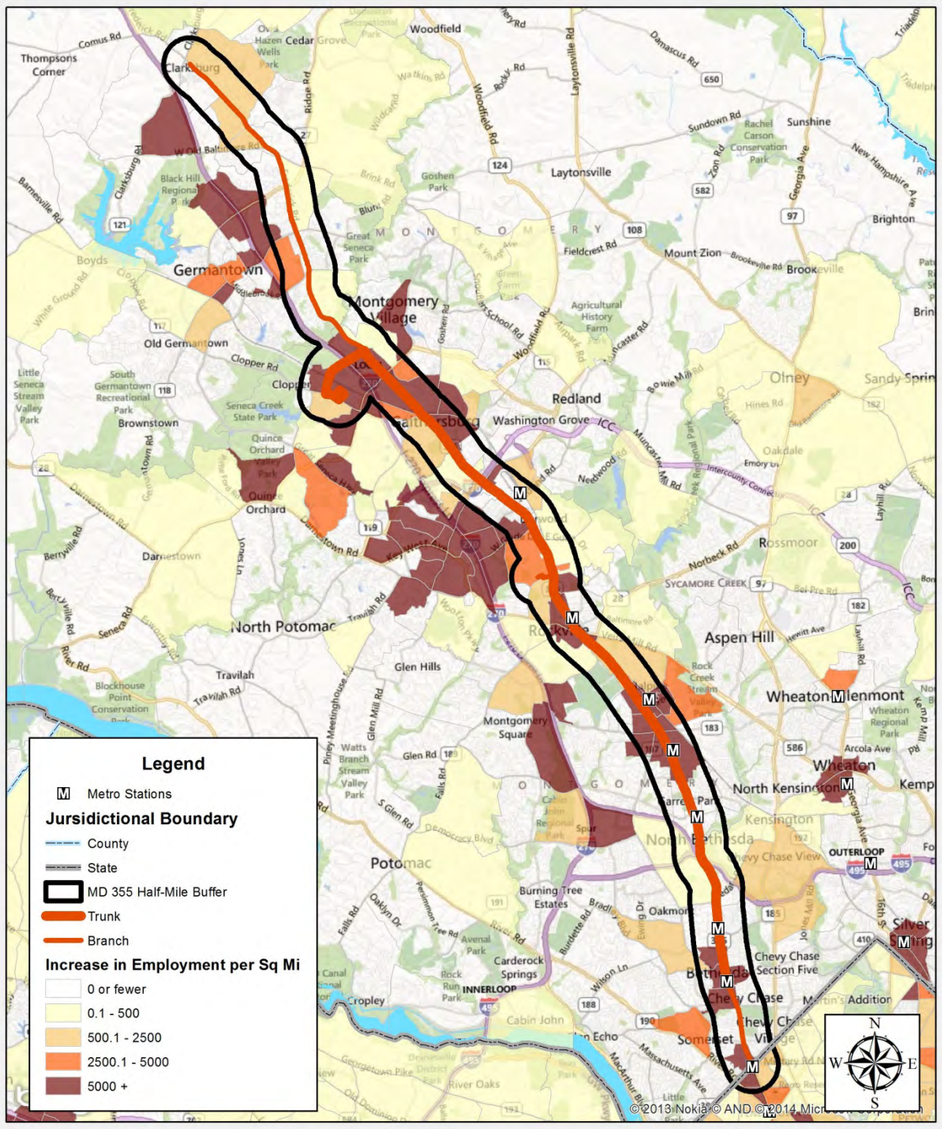


Figure 4-10 MD 355 Change in Employment Densities - Absolute (2010-2040)



Transportation Network

Existing Transit Characteristics

While serving origin and destination locations are important elements of the RTS, it is also important to facilitate transfers between the RTS, other buses and modes that operate along the corridor. There are a number of Ride On, Metrobus and MTA Commuter services that operate either along or intersect with MD 355. Figure 4-11 details which of these services interact with the MD 355 RTS.

Service Characteristics for Primary Routes

There are Metrobus and Ride On bus routes operating on the corridor. Their general routes and service characteristics are described below. Average weekday ridership for each route was examined for the calendar year spanning September 2011 to August 2012[10].

Metrobus:

- There are no Metrobus routes that run the length of the MD 355 corridor. The majority of the Metrobus routes only travel for brief stretches of MD 355. The buses that travel the northern portion of the corridor collect commuters and then connect to Metrorail via I-270. Those that use the southern portions of the corridor connect area neighborhoods with nearby Metrorail stations.

Montgomery County Ride On:

- Route 46 – Operates along MD 355 from the Medical Center Metrorail station in North Bethesda up to the Montgomery College Campus north of Rockville along Campus Drive. The route operates with 15-minute peak headways based on 51 minute runtimes. Route 46 averaged approximately 4,000 weekday riders.

- Route 55 – This route runs from the Germantown Transit Center, past the Montgomery College (Germantown Campus), then down MD 355 to the Rockville Metrorail station. The route operates with 15-minute peak headways with 70-minute runtimes. Route 55 averaged approximately 8,000 weekday riders and has the highest ridership route in the system.

Major Feeder Routes and Connections

The Friendship Heights and Shady Grove Metrorail stations are the termini for the major feeder routes in this corridor. Both are multimodal hubs providing heavy rail service into the urban centers and core. Additionally, the Rockville station serves the Red Line, the MARC commuter rail service and Amtrak. Table 4-4 shows the routes that currently terminate at points along the MD 355 corridor or cross the corridor.

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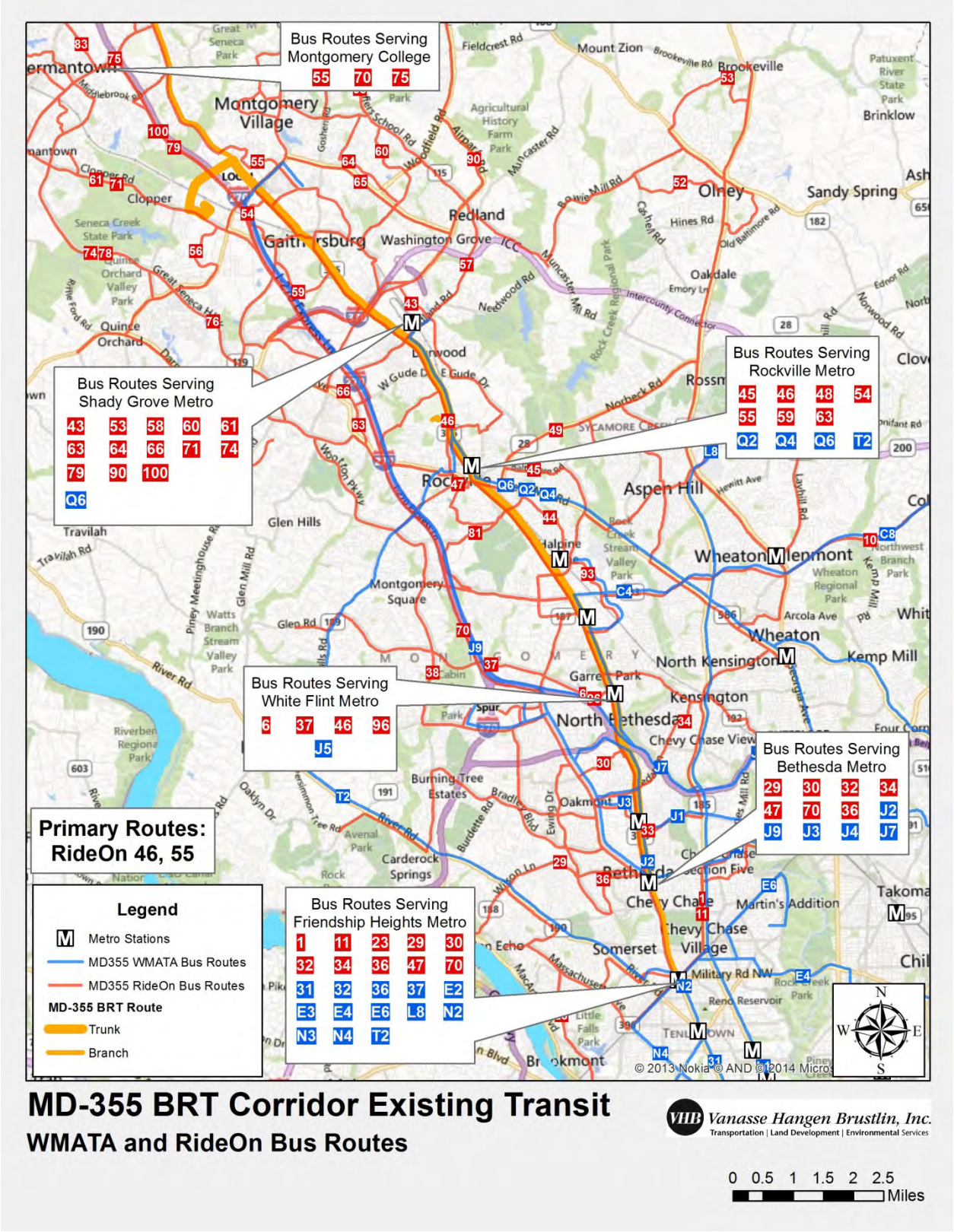
Table 4-4 Bus Service MD 355 Corridor

Operator	Route Name	From	To
WMATA	31I	Friendship Heights Station	Nw Virginia Ave & Nw 21st St
WMATA	32I	Southern Ave Station	Friendship Heights Sta
WMATA	36I	Naylor Rd Station	Friendship Heights Sta
WMATA	37I	Friendship Heights Station	7th St Nw & Pennsylvania Ave Nw
WMATA	C04	Pg Plaza Station	Twinbrook Station
WMATA	C08	College Park UMD Station	White Flint Station & Rockville Pk
WMATA	E02#	Ft Totten Station	Friendship Heights Station
WMATA	E02	New York Ave Ne & Fenwick St	Friendship Heights Station
WMATA	E03	New York Ave NE & Fenwick St	Friendship Heights Station
WMATA	E04	Terminal;Ne Eastern Ave & Ne Jamaica St	Friendship Heights Station
WMATA	E06	Greene Cir Nw & Knollwood Retiremen	Friendship Heights Station
WMATA	J01	Silver Spring Station	Medical Ctr Station
WMATA	J02	Silver Spring Station	Montgomery Mall Transit Ctr
WMATA	J03	Silver Spring Station	Montgomery Mall Transit Ctr
WMATA	J04	College Park Umd Station	Bethesda Station
WMATA	J05	Twinbrook Station	Silver Spring Station
WMATA	J07	Bethesda Station	Lakeforest Mall
WMATA	J09	Lakeforest Mall	Bethesda
WMATA	L01	Chevy Chase Term Rdwy & Connecticut	18th St Nw & E St Nw
WMATA	L02	Chevy Chase Term Rdwy & Connecticut	15th St (W) & Bet I & K Sts
WMATA	L04	Chevy Chase Term Rdwy & Connecticut	Connecticut Ave Nw & 20th St Nw
WMATA	L08	Friendship Heights Station	Bel Pre Rd & Grand Pre Rd
WMATA	N02	Friendship Heights Station	17th St Nw (East) & I St Nw
WMATA	N03	Jenifer St Nw & 44th St Nw	10th St & Constitution Ave (63 & 64)
WMATA	N04	Friendship Heights Station	17th St Nw (East) & I St Nw
WMATA	Q02#	Silver Spring Station	Mannakee St & South Campus Dr
WMATA	Q02	Montgomery College & West Campus Dr	Silver Spring Station
WMATA	Q04	Rockville Station West	Silver Spring Station
WMATA	Q06	Shady Grove Station (W)	Wheaton Station
WMATA	T02	Rockville Station East	Friendship Heights Station
Ride On	01	Friendship Heights Station	Bonifant St
Ride On	05	Twinbrook Station	Bonifant St
Ride On	06	Montrose Ave	Montgomery Mall

Operator	Route Name	From	To
Ride On	10	Powder Mill Rd & New Hampshire Ave	Twinbrook Station
Ride On	11	Bonifant St	Friendship Heights Station
Ride On	23	Friendship Heights Station	Sibley Hospital
Ride On	26	Glenmont Station	Westfield Montgomery Mall
Ride On	29	Friendship Heights Station	Bethesda Station
Ride On	30	Bethesda Station	Medical Center Station
Ride On	32	Bethesda Station	Mac Arthur Blv & Clara Barton Pkwy
Ride On	33	Glenmont Station	Medical Center Station
Ride On	34#	Grand Pre Rd & Grand Bel Manor	Friendship Heights Station
Ride On	34	Wheaton Station	Friendship Heights Station
Ride On	36	Bethesda Station	Bradley Blvd & Congressional Ct
Ride On	37	Falls Rd	Grosvenor Station
Ride On	38	Wheaton Station	Westfield Montgomery Mall
Ride On	43	Shady Grove Station	Traville Gateway Dr
Ride On	44	Twinbrook Station	Rockville Station
Ride On	45	Fallsgrove Dr & Rock Regional Transit Center	Twinbrook Station
Ride On	47	Bethesda Station	Rockville Station
Ride On	48	Rockville Station	Wheaton Station
Ride On	49	Rockville Station	Glenmont Station
Ride On	52	Rockville Station	Hospital Cut Thru Cut & Prince Philip Dr
Ride On	53	Shady Grove Station	Glenmont Station
Ride On	54	Rockville Station	Lakeforest Transit
Ride On	56	Rockville Station	Lakeforest Transit Center
Ride On	57	Lakeforest Transit Center	Shady Grove Station
Ride On	58	Lakeforest Transit Center	Shady Grove Station
Ride On	59	Club House Rd & Montgomery Village Ave	Rockville Station
Ride On	60	Stedwick Rd & Montgomery Village Ave	Shady Grove Station
Ride On	61	Germantown Transit Center	Shady Grove Station
Ride On	63B	Shady Grove Station	Piccard Dr & Gude Dr
Ride On	63	Rockville Station	Shady Grove Station
Ride On	64	Club House Rd & Montgomery Village Ave	Shady Grove Station
Ride On	65	Stedwick Rd & Montgomery Village Ave	Shady Grove Station
Ride On	66	Shady Grove Station	Traville Gateway Dr
Ride On	67	Traville Gateway Dr	Shady Grove Station

Operator	Route Name	From	To
Ride On	70	Bethesda Station	Shakespeare Blv & Milestone Park & Ride
Ride On	71	Clopper Rd & Kingsview Park & Ride	Shady Grove Station
Ride On	74	Germantown Transit Center	Shady Grove Station
Ride On	75	Germantown Transit Center	Whelan La & Mc Correctional Facility
Ride On	76A	Quince Orchard Rd & Darnestown Rd	Shady Grove Station
Ride On	76	W Willard Rd & Wooton Ave	Shady Grove Station
Ride On	78	Clopper Rd & Kingsview Park & Ride	Shady Grove Station
Ride On	79	Md 121 Gateway Center	Shady Grove Station
Ride On	81	Rockville Station	White Flint Station
Ride On	83	Shakespeare Blv & Observation Dr	Germantown Transit Center
Ride On	90A	Shady Grove Station	Woodfield Rd & Pleasant View La
Ride On	90	Shady Grove Station	Sweepstakes Rd & Clubview Rd
Ride On	93	Twinbrook Station	Twinbrook Station
Ride On	96	Grosvenor Station	Westfield Montgomery Mall
Ride On	100	Germantown Transit Center	Shady Grove Station

Figure 4-11 Existing Local Bus Service along MD 355



Corridor Key Stops and Stations

The Shady Grove, Rockville, Twinbrook, White Flint, Grosvenor, Medical Center, Bethesda and Friendship Heights Metrorail stations have the highest boardings and alightings along the MD 355 corridor as indicated below. Most of these stations provide metered parking, daily parking, car sharing, bicycle racks and bicycle lockers. Medical Center and Bethesda do not provide any specific station parking, and Medical Center does not provide car sharing although in the Bethesda CBD there are car sharing locations. All of the Metrorail stations are major multimodal hubs providing connections between various bus routes from Ride On, Metro, MTA, as well as other shuttles. MARC also serves the Rockville Metrorail station.

In addition to the Metrorail stations mentioned above, the following stops were identified because they had more than 200 weekly boardings or alighting. These key stops include:

- Lakeforest Mall
- Montgomery College (Rockville)

Table 4-5 displays the boardings and alightings associated with the stops discussed above. The ridership data that was supplied by Montgomery County.

Table 4-5 Key Bus Stop Ridership

Stop	Boardings	Alightings
Lakeforest Mall	250	325
Montgomery College - Rockville	1,350	1,275
Shady Grove Station	1,475	1,325
Rockville Station	6,750	5,950
Twinbrook Station	1,150	1,125
White Flint Station	1,050	900
Grosvenor & Strathmore Station	450	425
Medical Center Station	1,750	1,350
Bethesda Station	1,575	1,500
Friendship Heights Station	2,350	2,125

Other Transit

There are eight Metrorail stations located on the MD 355 corridor. They are all located on Metrorail's Red Line which provides access to downtown Washington, DC. These stations and the areas around them are key stops along the corridor and provide additional connections to high-capacity transit.

The MD 355 corridor is served by four MARC stations on the Brunswick Line which offer commuter rail service between Martinsburg, WV and Union Station, Washington, DC. Two stations, Rockville and Gaithersburg, are located within 1/3-mile of the corridor. Two more stations, Metropolitan Grove and Washington Grove, are located within 1 1/2- miles of the corridor.

RTS Concept

Summary of CTCFMP Service

In the Planning Board draft of the *Countywide Transit Corridors Functional Master Plan* (CTCFMP[11]), ridership estimates for the MD 355 North and South corridors were calculated under three different scenarios for the year 2040. The first scenario, a two lane median busway, yielded a corridor-wide daily ridership of 34,000 for the northern segment and 49,000 for the southern. The MD 355 South segment produced the highest ridership estimate under this scenario. The second scenario, curb lanes between Ridge Road and Middlebrook Road for MD 355 North, yielded slightly lower ridership, with 32,000 riders. The second scenario for MD 355 South, curb lanes south of Cedar Lane, yielded 46,000 riders. The third scenario for MD 355 north, which removed the portion of the corridor north of Shakespeare Boulevard and tied, it instead into the Corridor Cities Transitway (CCT), yielded a daily ridership of 22,000 riders. The third scenario for the MD 355 South corridor, where curb lanes were evaluated south of the Grosvenor Metrorail station, resulted in a daily ridership of 44,000. The CTCFMP showed that the forecasted ridership on MD 355 Corridor was the highest performing corridor. The Approved CTCFMP does not prescribe the type of busway treatment (i.e., curb vs. median), but instead states the number of lanes and right-of-way required. The approved busway plan treatments will be determined in later studies.

Recommended Service Plan

The recommended service concept is to combine the two corridors described previously as 355 North and 355 South into a single corridor with a trunk (primary) service and branch (secondary) services that connect the endpoints. The trunk service will operate between the Metropolitan Grove MARC station[12] via the Watkins Mill Road interchange and continue to the Grosvenor Metrorail station with additional service to the Bethesda CBD. The trunk can be disaggregated into two sections, the primary from Watkins Mill Road to the Grosvenor Metrorail station. The secondary section is to the Bethesda CBD. A concern for future planning is the effect of general traffic congestion on RTS operations south of Grosvenor. This study did not focus on guideway type, but given the type of development along MD 355 the section from Grosvenor to Bethesda would be expected to have higher levels of traffic congestion and hence slower operations and transit vehicle bunching could be expected.

The overall service plan has two branches. The first branch would operate between Clarksburg and Montgomery College in Rockville and the second branch would operate between Montgomery College and Friendship Heights. The branches would provide complete coverage of the entire corridor while also adding high frequency service along the trunk to provide the highest level of service on the portions with the greatest demand and

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[11] The Montgomery County Council approved the Countywide Transit Corridors Functional Master Plan in November 2013. As part of the approval the Council proposed some changes to the MD 355 North and South corridors. The MD 355 North corridor would continue to run from Redgrave Place in Clarksburg to Rockville Metro. The corridor would have two branches that connect to the Corridor Cities Transitway in Germantown East. The MD 355 South corridor would no longer terminate at Friendship Heights, but would instead terminate at the Bethesda Metro station. These proposals were not considered in the analysis contained in this report due to the timing of their release. Future study of the individual corridors will need to contain a review of the Council recommendations as part of a detailed analysis. In addition, the County Council approved plan does not specify RTS treatments, only the number of lanes and right-of-way, leaving the RTS corridor design details to the engineering studies.

[12] There is an overpass over I-270 at Watkins Mill that would connect MD 355 with the Metropolitan Grove MARC station slated for completion in 2016. Connecting to MARC would provide a connection between commuter rail and RTS.

need. The branches would operate at a high-quality service level providing easy, accessible transit service along the entire corridor.

Table 4-6 presents some key corridor characteristics that were used to define the trunk and branch service concepts. The trunk segment serves the portion of the corridor with the greatest growth in households and employment. The growth in households is almost double that of the other segments in the corridor. The growth in employment along the trunk portion of the corridor is approximately 25 percent greater than in the southern segment.

Table 4-6 also shows the level of high quality transit service in each segment. The current Constrained Long Range Plan (CLRP) shows that the trunk segment of the corridor is planned to have approximately only two thirds of the peak revenue miles of high quality transit service as compared to the southern segment. These figures do not include the RTS; only transit service that is in the CLRP. Therefore, the section from Metropolitan Grove to Grosvenor, which is forecasted to have the greatest growth, is lacking in high-capacity transit service. High capacity transit would be light rail, heavy rail, or bus rapid transit. By defining a trunk segment and prescribing greater levels of high-quality transit service, the proposed service concept will help meet the need for high-capacity transit. The branches will provide high-capacity transit to areas that don't warrant the same level of service as the trunk due to development patterns or existing high-capacity levels of transit service.

Table 4-6 Key Corridor Characteristics

	Clarksburg to Metropolitan Grove	Metropolitan Grove to Grosvenor	Grosvenor to Friendship Heights
Change in Total Households per SqMi (2010-2040)[1]	1,407	2,699	1,440
Change in Total Employment per SqMi (2010-2040)[1]	1,076	5,245	4,162
Year 2040 Peak Weekday Revenue Miles of High Quality Transit[2]	0	2,757	4,589

1. Source: MWCOG Land Use Forecast Round 8.2

2. Source: TPB Version 2.3 Model

The proposed service concept is representative of the fact that the majority of transit trips in the corridor are made by commuters. This pattern will likely continue into the future given the current and planned development. This is a function of many factors including the longer distance traveled to work versus other trip purposes such as shopping or recreation, traveling alone on commuting trips, and the nondiscretionary nature of commuting trips. Commuters take transit because there is congestion as well as the cost and availability of parking near employment centers, which often makes transit a viable option. Additionally, shopping or recreation trips, as opposed to work trips, typically involve multiple travelers and often a need for carrying packages. These needs are often accomplished easier through the use of a personal vehicle. The majority of trips on the RTS can be expected to be commuter trips and the service plan concept reflects that aspect. This service plan concept allows for multimodal transfer to modes which provide faster service to the downtown core

and business districts. The service plan also recognizes the need to serve all trips including the non-commuting trips. The plan provides high service levels outside of the peak periods.

Based on the TPB Version 2.3 Travel Demand Forecast Model, the areas within the corridor that are forecasted to have high-transit mode shares for commuting to work (i.e., attraction end) are at the southern end of the corridor. The Bethesda CBD is forecasted to have approximately a 40 percent transit mode share for commuter trips traveling to and from work. North Bethesda is forecast to have an approximately 20 percent transit mode share for commuter trips to work; Bethesda outside of the CBD is forecast to have an approximately 24 percent transit mode share. Washington, DC remains the highest area for transit commuting with over a 50 percent mode share.

For the home (i.e., production end) to work trip, the areas further north in the corridor have high transit mode shares for trips going to the urban core. This would include the Germantown and Gaithersburg areas which both have an approximately 25 percent transit mode share, Rockville with an approximately 30 percent mode share and North Bethesda with a 35 percent model share. The Bethesda CBD shows over a 50 percent mode share for commuters that live in the Bethesda CBD area. The Bethesda CBD high transit mode share is representative of the land use densities, access to existing transit and the cost of parking.

In reviewing the transit travel times from the TPB Version 2.3 Travel Demand Forecast Model (i.e., transit skims) in the corridor, for trips destined for areas inside the Beltway, the RTS will most likely serve to connect riders to other modes. The Metrorail and MARC services provide faster transit options than the RTS. The combination of a completely separate running way and greater station spacing contribute to this competitive advantage over RTS. The longer the trip, the higher probability that RTS will serve as a feeder into Metrorail or MARC. The RTS service concept plan presented here accommodates that need as well as providing connections to important activity generators that are between Metrorail stations, such as Montgomery College, and the development along Rockville Pike (MD 355) from Rockville Town Center to White Flint. Grosvenor Metrorail station was selected as the termini for the trunk service because of the greater frequency of Metrorail service there and the ability to easily service the station. The branches, both north and south, serve to provide connectivity through the corridor as envisioned in the CTCFMP.

Key Locations

The location of RTS stops is an important factor in the success of the RTS system. Stops that are located at, or within a reasonable proximity to, activity generators (in terms of residential origins and commercial, medical, government or other destinations), will assist the initial marketing of the service and with ongoing ridership growth. It is important to note that exact stop locations have not been selected. This step should occur when more detailed planning for the individual corridors takes place.

For this service concept plan, general stop locations have been delineated by the County's plan. The plan presented 20 locations for the MD 355 North corridor alignment and 14 locations for the MD 355 South alignment. Stop locations range in distance from 0.20 to 1.51 miles, with an average stop distance of 0.72 miles along both corridors. This falls within a desired stop distance range for BRT service of 0.50 and 0.75 miles. Tables 7 and 8 display the stop locations along the MD 355 North and South corridors and the distances between each of these stops.

Table 4-7 Stop Locations and Distances for MD 355 North

From	To	Segment Distance (miles)
Redgrave Place	Shawnee Lane	0.84
Shawnee Lane	Foreman Boulevard	0.20
Foreman Boulevard	Little Seneca Parkway	0.46
Little Seneca Parkway	West Old Baltimore Road	0.70
West Old Baltimore Road	Ridge Road	0.86
Ridge Road	Shakespeare Boulevard	0.44
Shakespeare Boulevard	MD 118	0.41
MD 118	Middlebrook Road/Montgomery College – Germantown Campus	0.78
Middlebrook Road/Montgomery College – Germantown Campus	Professional Drive	1.51
Professional Drive	Watkins Mill Road	0.51
Watkins Mill Road	MD 124	0.59
MD 124	Odendhal Avenue	0.34
Odendhal Avenue	Brookes Avenue	0.61
Brookes Avenue	Education Boulevard	0.66
Education Boulevard	Shady Grove Road	1.21
Shady Grove Road	King Farm Boulevard	0.60
King Farm Boulevard	Gude Drive	1.30
Gude Drive	Mannakee Street/Montgomery College – Rockville Campus	0.67
Mannakee Street/Montgomery College – Rockville Campus	Rockville Metro Station	0.93
	Total Trip Distance	13.60
	Average Stop Distance	0.72

Table 4-8 Stop Locations and Distances for MD 355 South

From	To	Segment Distance (miles)
Rockville Metro Station	Edmonston Drive	0.97
Edmonston Drive	Halpine Road	1.06
Halpine Road	Hubbard Drive	0.55
Hubbard Drive	White Flint Metro Station	0.60
White Flint Metro Station	Security Lane	0.40
Security Lane	Grosvenor Metro Station	0.90
Grosvenor Metro Station	Pooks Hill Road	1.09
Pooks Hill Road	Cedar Lane	0.65
Cedar Lane	Medical Center Metro Station	0.55
Medical Center Metro Station	Cordell Avenue	0.52
Cordell Avenue	Bethesda Metro Station	0.44
Bethesda Metro Station	Bradley Boulevard	0.53
Bradley Boulevard	Friendship Heights Metro	1.15
	Total Trip Distance	9.42
	Average Stop Distance	0.72

Service Span and Frequency

The levels of service, in terms of span of service and headways, for RTS service have to be at a premium level in order to meet passenger demand and high ridership levels. Ideally, the RTS service concept would operate from the early morning until late at night, with 10 minute headways or less. Ten minute headways provide a level of service that doesn't require the need to check a schedule, the wait times between vehicles is understood to be frequent enough to meet choice rider expectations. This frequency falls in the middle of the range of headways for rapid transit systems in North America, and is a reasonable headway expectation for a new service. As service demand increases along the corridor, headways can be further reduced to accommodate the growing demand. The service span was designed to complement and match Metrorail service spans. The initial MD 355 RTS levels of service for the fully built-out system are displayed in Table 4-9.

Table 4-9 MD 355 Levels of Service

Period	From	To	Span of Service	Headways	
				Peak	Off-Peak
Weekday	Metropolitan Grove	Grosvenor Metro	6AM-12AM	10	10
	Clarksburg	Montgomery College	6AM-12AM	10	30
	Montgomery College	Friendship[13] Heights[14]	6AM-12AM	10	30

Table 4-10 provides a comparison of headway and travel speed savings associated with the MD 355 RTS service. These savings are a comparison between existing local service and the trunk portion of the RTS corridor. The travel speed savings are based on figures for estimated travel speeds from the Federal Transit Administration's *Characteristics of Bus Rapid Transit for Decision Making* report.

Table 4-10 Comparison of Headway and Travel Speeds

Service	Headway (minutes)			Speed (mph)		
	AM	Off-peak	PM	AM	Off-peak	PM
Existing[1]	15	15	15	14.7	15.6	14.4
MD 355 RTS[2,3]	10	10	10	18	20	18
Difference	5	5	5	3.3	4.4	3.6
Percent Travel Time Savings				22%	28%	25%

1. Based on Montgomery County Ride On timeTable 4-for Route 46

2. Headway is for the trunk portion of the corridor

3. Speed estimate is provided for the trunk portion of the corridor based on type of running way, location, and time of day

The service concept plan initially would have the MD 355 RTS service offered between the hours of 6:00 AM and midnight from Clarksburg to Friendship Heights with at least ten minute headways in the peak period and 30 minutes during the off-peak period. Trunk service between Metropolitan Grove and the Grosvenor Metrorail station would be provided at 10 minute frequency all day. The combination of the trunk service and the branch service would result in an effective headway of 5 minutes during the peak period and roughly 7.5 minutes during the off-peak period for the trunk portion of the corridor.

Branches, Overlaps, and Deviations

The service concept plan does not identify any deviations for the MD 355 corridor. The service concept would look to enhance pedestrian connections to provide for better accessibility to places like the Shady Grove Metrorail station. The service plan concept is tied to the service outlined in the CTCFMP. The objective was to remain on MD 355 and limit the

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[13] Every trip will service the Montgomery College Rockville campus. This will effectively create two segments, Clarksburg to Montgomery College-Rockville and Montgomery College-Rockville to Friendships Heights.

[14] Every trip will service the Montgomery College Rockville campus. This will effectively create two segments, Clarksburg to Montgomery College-Rockville and Montgomery College-Rockville to Friendships Heights.

impact of any deviations on travel time. The overall route has been partitioned into segments with a primary segment (trunk) and secondary segments (branches) based on an understanding of demand and overlap with other transit services. Overlaps with other RTS corridors are proposed. These overlaps are proposed to integrate the individual corridors into a larger RTS network and also provide higher levels of service where the overlaps occur.

The MD 355 service concept would overlap with the Veirs Mill Road service concept from the intersection of MD 355 and Veirs Mill Road to the Rockville Campus of Montgomery College. Extending Veirs Mill Road to Montgomery College better serves the travel demand to Montgomery College that comes from the eastern side of the County. This overlap would also provide a strong connection between Rockville and points north with the east side of the County.

While there is no significant overlap between the Randolph Road corridor and the MD 355 corridor, they would intersect at White Flint. This crossing provides a second connection to the eastern side of the County. By connecting to the Veirs Mill and Randolph Road corridors, trips along the MD 355 corridor have high quality transit access across the County and to the other end of the Red Line, Silver Spring, and White Oak. Additionally, these connections would expand the reach of riders along the MD 355 corridor to points outside the County, including Washington, DC and Virginia.

A future potential service deviation for MD 355 RTS service would be to use parallel roadways along the corridor to better serve activity centers. This is of particular note in Gaithersburg near the MARC station and Lakeforest Mall Transit Center. Connecting to these activity and multimodal transfer nodes will provide for a more effective, responsive and comprehensive system. The connection could be on Russell Avenue, which may be able to accommodate improved transit with a much lower impact to through traffic than a similar intervention on MD 355.

Similarly, the RTS may be better suited to use North Washington Street and Middle Lane near the Rockville Town Center to better serve the existing uses and development anticipated to the north of the existing Town Center. This routing may also allow a more exclusive busway with lower impacts to general traffic.

Integration with Local Service

RTS on MD 355 would be complemented by local service along the corridor for passengers to make additional connections as well as access those destinations that fall between RTS stops. There are no Metrobus routes that travel the entirety of the corridor. The Red Line mirrors the corridor from the DC line to Shady Grove. The majority of the Metrobus routes that operate along the 355 corridor connect the surrounding neighborhoods with Metrorail. The Metrobus J and Q routes provide service to various portions of the corridor based on the area they serve, but no Metrobus route travels the entire corridor. These routes are envisioned to provide feeder service from the surrounding areas to the corridor; and where they overlap with the corridor, take advantage of the busway treatments.

Montgomery County's Ride On bus service has many routes that interact with the MD 355 corridor. There are two routes that are primarily focused on the MD 355 corridor. Route 46 travels from the Montgomery College Rockville campus to the Medical Center Metro station. Route 55 travels from Germantown to Rockville. These two routes would not take advantage of the separate busway treatments because this would limit their ability to provide local service. Together they will provide the primary local service. The other Ride On routes will

provide feeder service from the surrounding areas to the RTS corridor. Where it does not impact local operations, the local service could take advantage of the RTS busway.

Fleet Requirement

Based on the recommendation to join the 355 North and South corridors, as well as to create a trunk and two secondary branches, the following vehicle requirements are estimated based on the prescribed headways. During peak service, the requirement would be 35 vehicles, including spares. This would drop to 18 vehicles during the off peak based on increased headways for the branches and improved travel times[15].

Based on the peak segment, peak direction, peak hour figures for ridership discussed in the Functional Master Plan, vehicle requirement would dramatically increase. This exercise used all the assumptions from the July 2013 Draft Functional Master Plan for all RTS operating assumptions. It was assumed that at full build out MD 355 North would carry maximum passengers per segment per direction of 1,920 and MD 355 South would carry 2,225. Assuming that a standard RTS vehicle under maximum loading conditions could carry 85 passengers, this would result in a need for 57 and 47 vehicles respectively, including spares. These estimates are based on meeting the ridership demand and not the headway as was used above. This results in a much lower headway than is recommended above. However, if demand meets the forecast, it would be warranted. It should also be noted that other specialized vehicles could be used which would provide greater capacity. This would result in fewer vehicles required to meet demand and adjustments in frequency accordingly.

Operational Hours

A planning level operating cost was developed based on the assumptions related to the travel speed that could be achieved associated with various BRT treatments. These speeds allowed for a calculation of the number of vehicles that would be required to operate the service using the prescribed headways discussed above. This results in typical weekday service hours totaling 380. This calculates to roughly 127,000 annual service hours. The deadhead hours (i.e., hours to and from the bus garage) have been factored to 15% of the revenue hours, which equates to approximately 147,000 total vehicle hours.

Corridor Outcome and Summary

The implementation of RTS service in this corridor will add frequency and reliable transit service that extends beyond the existing terminus of Metrorail along the MD 355 corridor. This service will provide residents in the Clarksburg and Gaithersburg communities with a higher quality alternative to single occupant vehicle travel. The addition of RTS to the MD 355 corridor will also augment Metrorail by providing a frequency and rapid transit service within a corridor that is transitioning from and outer suburban land use pattern to becoming more transit supportive. The RTS will operate within the corridor and provide more frequent stops compared to the Metrorail service which operates along the side of corridor with greater stop spacing. The MD 355 RTS service will improve travel options for both the suburban commuter as well as the residents of communities from Rockville to Bethesda.

[15] These figures are based on an 11.8 mile long trunk service, and 12.6 and 9.0 mile long branch services. Peak period speeds are assumed to be 17 mph during peak service and 19-21 mph during off-peak service. Spare ratio is 1.2 times the total vehicle requirement.

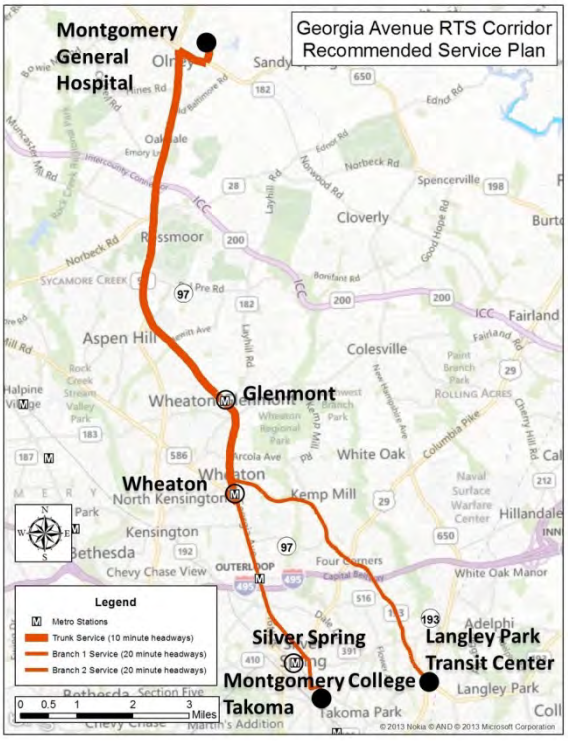
Georgia Avenue Corridor Service Plan

The conceptual service plan for the Georgia Avenue (MD 97) Rapid Transit System (RTS) is based on the draft corridor plans for Georgia Avenue and University Boulevard as outlined in the Montgomery County Planning Department's draft report *Countywide Transit Corridors Functional Master Plan* from July 2013. The concept focuses on providing a faster transit option that connects activity centers and multimodal hubs on the eastern side of Montgomery County. The service integration concept developed as part of this study for the Georgia Avenue RTS proposes for the route to travel between Montgomery General Hospital in Olney to the Wheaton Metrorail station with branch services continuing to the Silver Spring Transit Center and Langley Park Transit Center.

General Corridor Overview

The draft plan proposed two corridors, one between the Olney and the Wheaton Metrorail stations via Georgia Avenue and the second between the Wheaton Metrorail station and the Silver Spring Transit Center. A key focus of this study was service integration across RTS routes. The service integration proposal presented here combines the two corridors along with the University Boulevard RTS corridor. The route would continue from Wheaton with two branches providing connections to Silver Spring via Georgia Avenue and Langley Park via University Boulevard. This RTS route would intersect with all of the eastern county proposed RTS routes. This route concept is shown in Figure 5- 1[1].

Figure 5- 1 Georgia Avenue RTS Corridor



[1] The Montgomery County Council approved the Countywide Transit Corridors Functional Master Plan in November 2013. As part of the approval the Council proposed some changes to the Georgia Avenue and North Bethesda Transitway corridor. The proposals not originally part of the Draft Functional Master Plan from July were not considered in the analysis contained in this report due to the timing of their release. Future study of the individual corridors will need to contain a review of the Council recommendations as part of a detailed analysis.

The trunk portion of the route from Olney to Wheaton is approximately 10 miles in length. The branch from Wheaton to Silver Spring is four miles in length. The branch from Wheaton to Langley Park is six miles in length.

The Georgia Avenue RTS will provide a faster transit option for people traveling along Georgia Avenue. The route will connect major activity and multimodal centers. This includes Montgomery General Hospital, Glenmont, Wheaton, Four Corners, Silver Spring, and Langley Park. The Georgia Avenue RTS will provide a connection between the eastern branch of the Metrorail Red Line with the Purple Line, connect with all of the other RTS routes in the eastern part of the county, and provide feeder service to the Glenmont and Wheaton Metrorail stations.

Existing Sources of Activity

The following sources of activity are located along the Georgia Avenue RTS :

- Montgomery General Hospital
- Olney
- Norbeck Road/Leisure World
- Aspen Hill
- Glenmont (Metrorail)
- Wheaton (Metrorail)
- Forest Glen (Metrorail)/Holy Cross Hospital
- Montgomery Hills
- Downtown Silver Spring
- Northwood High School
- Montgomery Blair High School
- Four Corners
- Langley Park

Existing Demographics

Studies of transit riders show a willingness to walk up to one-half mile to access high quality transit service like the RTS. To provide an understanding of the potential transit market demographic data within one-half mile boundary around the proposed Georgia Avenue RTS was compiled using the 2011 American Community Survey data summarized in Table 5-1. The table also lists the County totals for each item to provide context of how the corridor relates to the County as a whole. Based on these figures, the Georgia Avenue RTS has a higher percentage of commuters using transit compared to the County as a whole. The corridor also has a slightly higher percentage of households below the poverty line. These households might be more dependent on transit as result of limited auto availability. As compared to the other corridors the percent of households that do not own a vehicle is the highest. This would indicate potential for high transit ridership.

Table 5-1 Demograhic Data for Georgia Avenue Corridor

Census Group	Georgia Avenue Corridor	Montgomery County
Population	133,291	959,738
Male (%)	47.8%	48.0%
Female (%)	52.2%	52.0%
Median Age	41.0 years	40.5 years
Workers 16 years and older	71,313	508,645
Public transit is primary means of travel to work (% of workers 16 and older)	16,384 (23.0%)	77,077 (15.2%)
Households	52,264	355,434
Avg. Annual Median HH Income	$89,854	$111,751
Below the poverty line (Households)	3,993 (7.6%)	20,712 (5.8%)
Non-vehicle ownership (Households)	6,556 (12.5%)	29,018 (8.2%)
Source: 2007-2001 American Community Survey 5-Year Estimates		

Existing Land Use

The County's plan shows the Georgia Avenue RTS as two corridors. The first corridor, Georgia Avenue North, travels from Montgomery General Hospital in Olney south to the Wheaton Metrorail station. The second corridor, Georgia Avenue South, travels from the Wheaton Metrorail station to the DC line. The corridor is a major commuter corridor, traveling through diverse land use characteristics.

Starting at the northernmost end of the corridor in Olney, land uses are suburban and designed for auto access. The proposed RTS route begins near Montgomery General Hospital which is surrounded by low-density housing and offices. The building setbacks from the streets are long with parking located between the street and the structures. At the corner of Sandy Spring Road and Georgia Avenue the development is more commercial, with traditional retail and suburban shopping complexes. South of Olney along Georgia Avenue, the land uses transition back to single family residential. The housing pattern along this portion of the corridor is traditional suburban neighborhoods with larger lot single family homes and cul-de-sac street networks. Homes are set away from the corridor and do not face toward Georgia Avenue, often with dense landscaping creating a barrier between the two.

Land use patterns start to change slightly starting south of the ICC. The addition of a frontage road between uses and Georgia Avenue on the western side increases the setback from the corridor edge. The intersection with Norbeck Road has some retail uses and a small townhome complex with more compact residential buildings. Just south of this location there is a large golf course on the western side of Georgia Avenue and more suburban commercial on the eastern side. There is the large age-restricted and gated residential development called Leisure World along the eastern side of Georgia Avenue. This development encompasses 610 acres and is a combination of single family detached, townhome, and apartment dwellings with accessory buildings. A portion of the development falls along the corridor, but does not front to the corridor and is separated from Georgia Avenue by large setbacks and a fence. South of Leisure World is a townhome complex, but the complex is separated from Georgia by trees and the entry points all interact with Bel Pre Road. Low density residential development dominates south of Bel Pre Road on the western side of Georgia Avenue, while slightly higher density mid-rise apartments and townhomes are along the eastern side. Large

retail shopping centers can be found around the intersection with Connecticut Avenue as well as a large cemetery in the southeast quadrant.

South of Connecticut Avenue, land uses transition back to single family residential, but at a slightly higher density. Some of the home front to Georgia Avenue and have shorter setbacks. This pattern dominates, with some interspersed apartment complexes before reaching the Glenmont Metrorail Station. This station has parking and transit facilities, but is predominately a commuter-oriented park and ride station. The land use pattern continues south of Glenmont with single family detached on the western side and higher density apartment and townhomes on the eastern side. There is small retail developments located at key intersections along this segment.

Land use patterns change along Georgia Avenue moving in Wheaton. The land uses become predominately commercial, with shorter setbacks, but still auto-oriented in design. Surface parking is still a dominant feature. The area around the Wheaton Metro station has been to redeveloping for some time as a higher density transit oriented district. The eastern side of Georgia Avenue has some mid-rise apartments with a short setback and oriented to the sidewalk. On the western side is the Wheaton Transit Center and the Westfield Wheaton Mall. This is a suburban mall with the retail buildings surrounded by large surface and structured parking. This concludes the Georgia North corridor and is the beginning of the Georgia South corridor.

South of Wheaton Metro, the land uses transition back to a lower density. The retail uses are replaced by low-rise apartment, townhome, and single family residential. The setbacks on these residential uses are shorter and many are oriented towards with street. In addition to the residential uses there are some churches, schools, and small office buildings. This pattern continues with primarily residential uses, with some larger mid-rise and the occasional high-rise apartment complex until reaching the Beltway.

South of the Beltway the uses transition back to auto-oriented retail before transitioning back to residential around 16th Street. The residential is a mix of single family detached homes and low-rise apartments and townhomes. The residential density increases slightly until reaching Spring Street where high rise buildings dominate the corridor. These buildings are a mix of office and residential with some retail uses on the ground floor. Buildings front to the sidewalk and the setbacks are minimal. This more urban pattern continues through Silver Spring, with a more office dominated land use pattern near Downtown Silver Spring. The intensity and height of the buildings taper moving south along Georgia Avenue, exiting Silver Spring and moving towards the District of Columbia. The development remains primarily commercial in nature, but only two- and single- story buildings. The design is a mix of pedestrian- and auto-oriented uses, with small-scale and fast food restaurants.

Planned Land Use Changes

The master plan updates for subareas along the corridor show concentrated areas that are proposed for an increase in employment and household densities. Efforts to maintain the existing character of the established neighborhoods around many of the activity centers is a focus of these sector plans. Some early phases of the RTS, or transitional services, may become operational in the next few years. Research has indicated that bus rapid transit can impact land use along a corridor. The findings of this research indicate that good land use

planning is important for an area to develop into a walkable, mixed-use corridor that can support high-quality transit[2]. The transit oriented development will help ensure that the proposed RTS can have the potential for high ridership both in the peak and the off-peak periods.

The sector plan for Olney is focused on maintaining the existing land use patterns and status of Olney as a "satellite" community for the employment centers in the District of Columbia and along with I-270 and I-95 corridors. Any efforts for future commercial development should be focused on the Town Center. The Town Center, located at the crossroads of Georgia Avenue and Olney – Sand Spring Road, is desired as a community-oriented commercial destination with a pedestrian focus. The concept for the Town Center envisions more compact development with a mix of residential and commercial uses. The plan calls for some structured parking to allow for more compact, pedestrian-oriented development. The plan proposes that an additional 500,000 square feet of commercial and between 400 to 1,300 residential units could be constructed by 2025. The sector plan is also supportive of the Georgia Avenue *Busway*[3]

The *Aspen Hill Master Plan* focuses on protection of much of the existing land uses. The Aspen Hill area has very little land available for development and the existing land uses are well established. There are recommendations for redeveloping the Vitro site as a mixed-use site. There is also discussion of improving the transit-oriented nature of future developments and improving pedestrian connections between stops and commercial centers[4].

The Glenmont Sector Plan, approved by the County Council in November 2013, is focused on maintaining the predominantly residential orientation of the Glenmont area. The plan does recommend concentrating transit-oriented, mixed-use development around the Metrorail station. There is a desire to improve the walkability of the area. Services and amenities will be focused on the local residents, with the Glenmont Shopping Center as the focus of community services, activities, and expanded housing. Non-residential floor area could increase by as much as 200,000 square feet under the plan, and housing units by roughly 2,000 additional units. This growth still retains the existing 0.3 jobs to one housing unit ratio[5].

The County recently completed an update to the Wheaton sector plan that was approved in January 2012. The plan proposes to provide a more pedestrian-oriented development pattern around the Metro station in Wheaton. The plan seeks to focus redevelopment around the Metro station while also preserving older, well-established residential neighborhoods. New development patterns will be mixed use with commercial, retail, and office uses all together in a compact pattern. The plan calls for significant changes to densities along the corridor, particularly south of University Boulevard. Maximum building heights of 250 feet and floor area ratios of 6.0 are proposed closest to the existing Metrorail station, and a gradual tapering of these moving away from the core. The plan, if developed as proposed, would result in only a modest increase in jobs to roughly 13,000 and more housing units, almost 7,000. These changes would transform the jobs-housing ratio from 5.1 to 1 currently, to 2.0 to 1. These

▼

[2] More Development for Your Transit Dollar: An Analysis of 21 North American Transit Corridors, Institute for Transportation & Development Policy,

[3] 2005 Approved and Adopted Olney Master Plan, The Maryland-National Capital Park and Planning Commission – Montgomery County Department of Park and Planning, March 2005.

[4] 1994 Approved and Adopted Aspen Hill Master Plan, The Maryland-National Capital Park and Planning Commission – Montgomery County Department of Park and Planning, April 1994.

[5] Glenmont Section Plan, Montgomery County Planning Department – Maryland National Capital Park and Planning Commission, November 2013.

changes would result in an area that is more compact with mixed uses that is more supportive of transit[6].

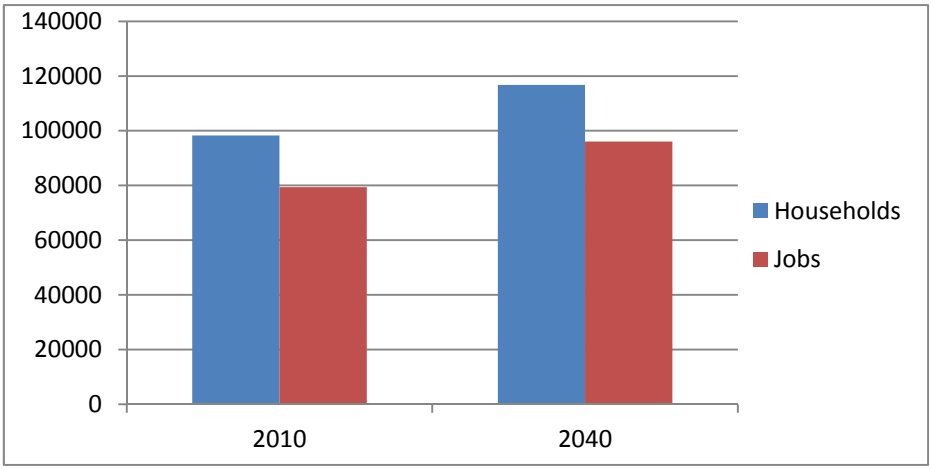
The Forest Glen Sector Plan has not been updated since the late 1990s. The existing plan is focused on preserving the existing neighborhoods of Forest Glen East and West, while allowing Holy Cross Hospital to continue to be a major medical resource to the County and concentrating any major redevelopment around the Metrorail station[7].

The Silver Spring Sector Plan has not been updated since 2000. The current plan advocated for the Silver Spring Transit Center as well as revitalizing the core with transit oriented development[8]. Areas of downtown Silver Spring have revitalized, and it expected that this trend will continue.

The Metropolitan Washington Council of Governments Cooperative Land Use Forecast Round 8.2 shows how the corridor is projected to change between 2010 and 2040. The land use forecast shows development that has been approved. Unlike the proposed updates to the sector plans, the land use forecast represents development that has already been included in the planning process.

Figure 5-2 shows the total corridor change in households and employment from 2010 to 2040. Table 5-2 shows the total corridor household and employment densities along the Georgia Avenue corridor. The table provides details about the lowest and highest observed values as well as the average value for the corridor. These values can be compared against values for residential and non-residential densities as reported in the Institute for Transportation Engineer's (ITE) *A Toolbox for Alleviating Traffic Congestion* shown in Table 5-3.

Figure 5-2 Georgia Avenue Corridor Projected Changes



[6] Wheaton CBD and Vicinity Sector Plan, Montgomery County Planning Department – Maryland National Capital Park and Planning Commission, January 2012.

[7] Forest Glen Sector Plan, Montgomery County Planning Department – Maryland National Capital Park and Planning Commission, July 1996.

[8] Silver Spring Central Business District and Vicinity Sector Plan, Montgomery County Department of Park and Planning, March 2001.

Table 5-2 Georgia Avenue Corridor Projected Changes

	2010 Household Density (HH/Acre)	2040 Household Density (HH/Acre)	2010 Employment Density (Emp/Acre)	2040 Employment Density (Emp/Acre)
Minimum	0	0	0	0
Maximum	25	40	102	153
Average	5	6	6	8

The data in Table 5-3 represents land area that can be developed, versus gross land area in the Transportation Analysis Zone (TAZ) plots. Land that can be developed would exclude parks, and wetlands in the TAZ. Since most of the TAZs along the corridor cover land that can be developed the ITE data in Table 5-3 provides an approximate guide for understanding potential service levels. A land use density threshold for transit supportive areas on gross land area used in local planning studies in the region is three households per gross acre and/or four jobs per gross acre. Based on the maximum values for the corridor, this route could support bus service at 15 to 10-minute frequency.

Table 5-3 ITE Residential and Non-residential Densities for Transit Service[9]

	Frequency (20-hour service day)	Dwelling Units per Acre	Employees per Acre
Bus	1 bus/hour	4-5	50-80
Bus	1 bus/30 minutes	7	80-200
Bus	1 bus/10 minutes	15	200-500
Light Rail	Every 10 minutes	35-50	500+

The figures on the following pages show the household density (households per square mile) and employment density (employees per square mile) in 2010 and the forecasted density for 2040. Figure 5-7 through 5-10 show the changes in density from 2010 to 2040 for both households and employment. The changes are shown both in the percentage change, allowing for the observation of greatest change over the 30-year period; and absolute change, which shows the magnitude in the change.

[9] Institute of Transportation Engineers, A Toolbox for Alleviating Traffic Congestion, 1989.

Figure 5- 3 Georgia Avenue Household Densities (2010)

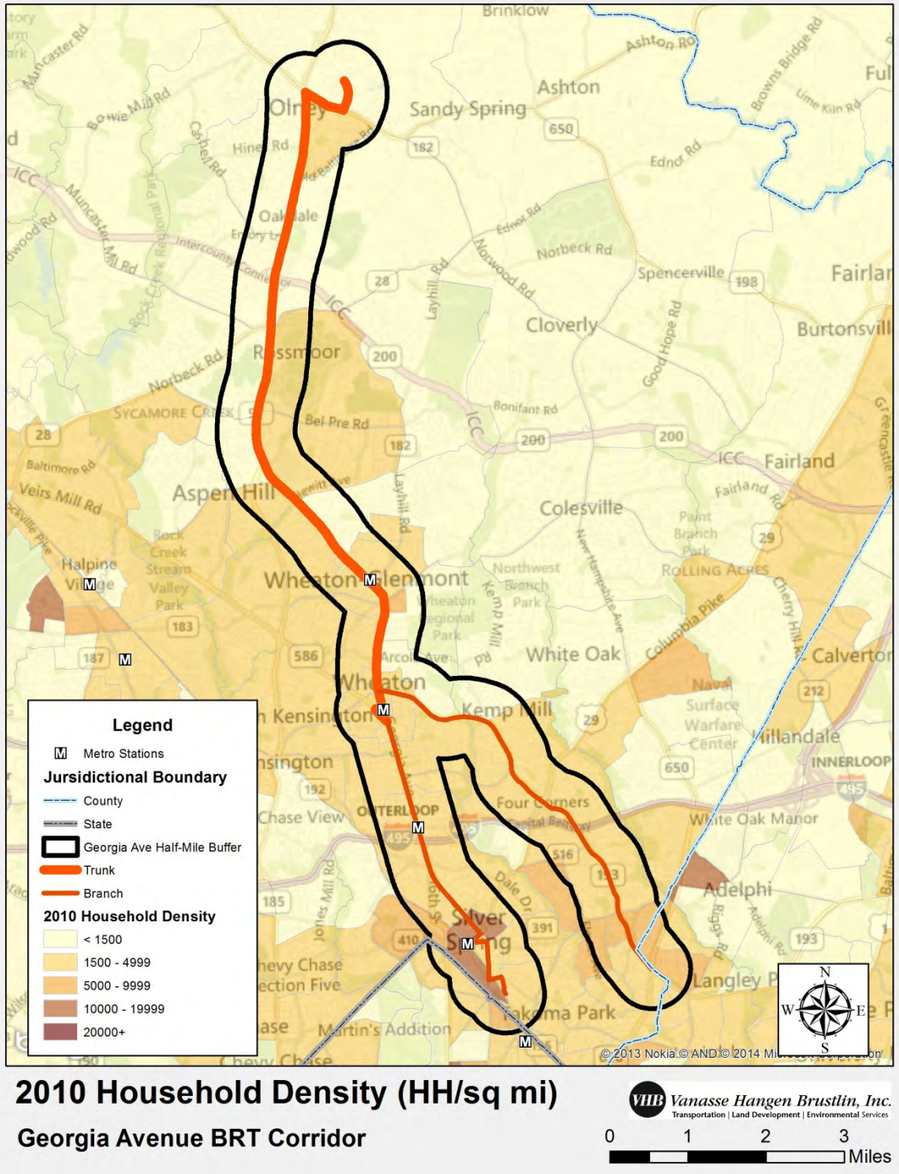


Figure 5- 4 Georgia Avenue Household Densities (2040)

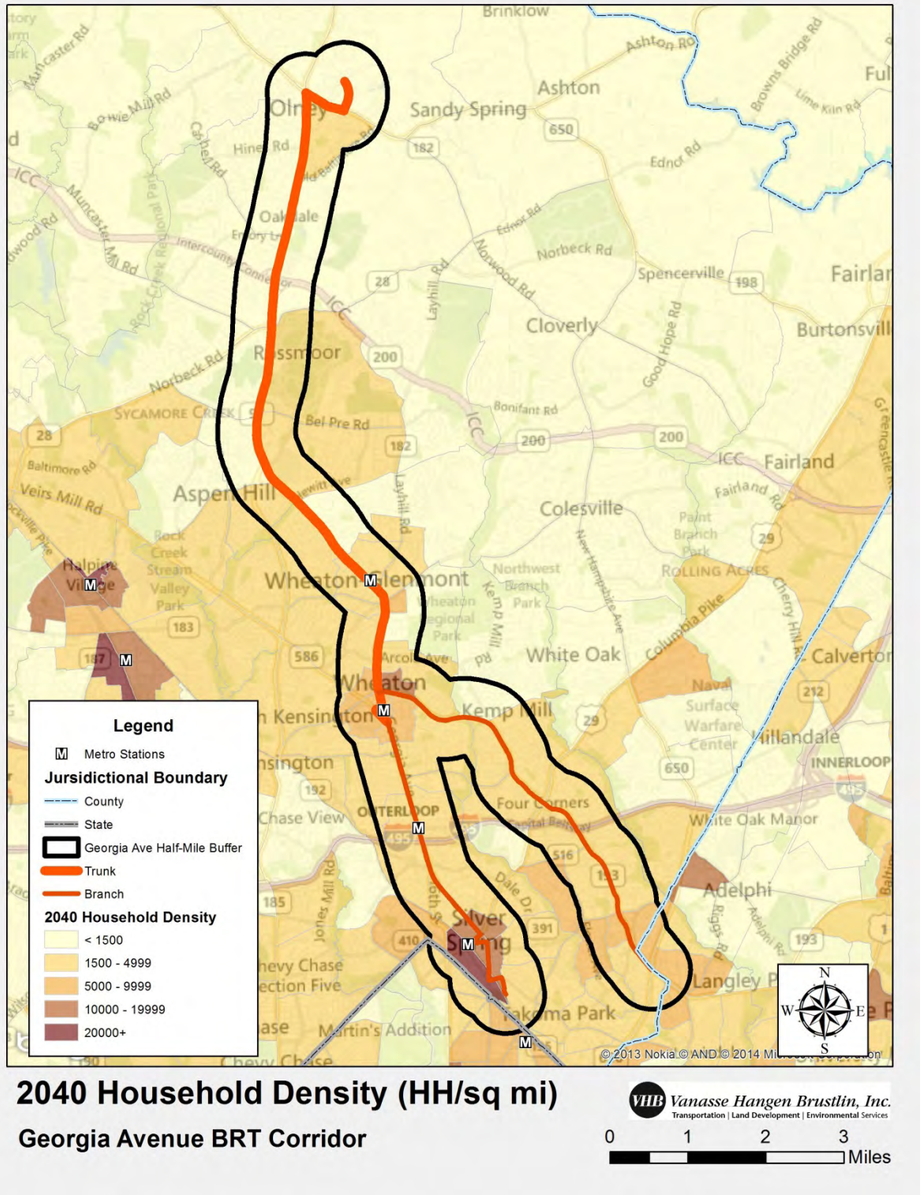
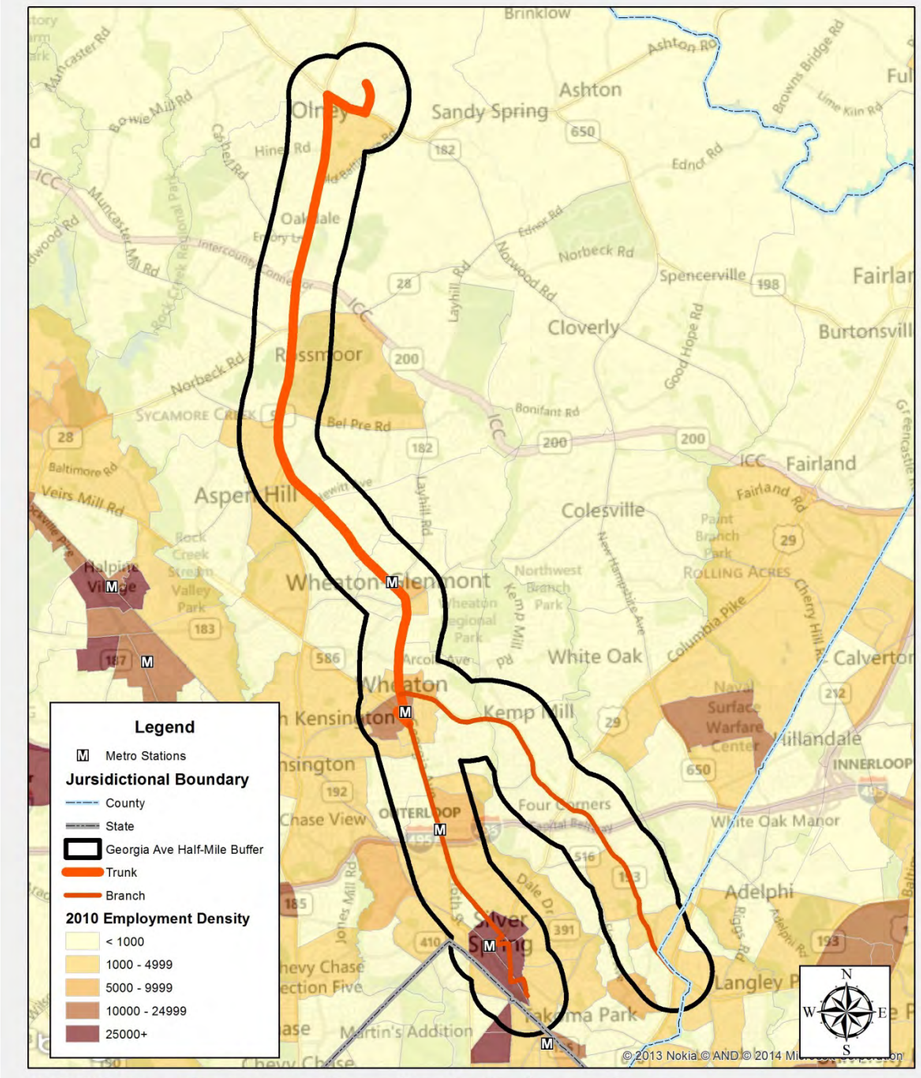


Figure 5- 5 Georgia Avenue Employment Densities (2010)



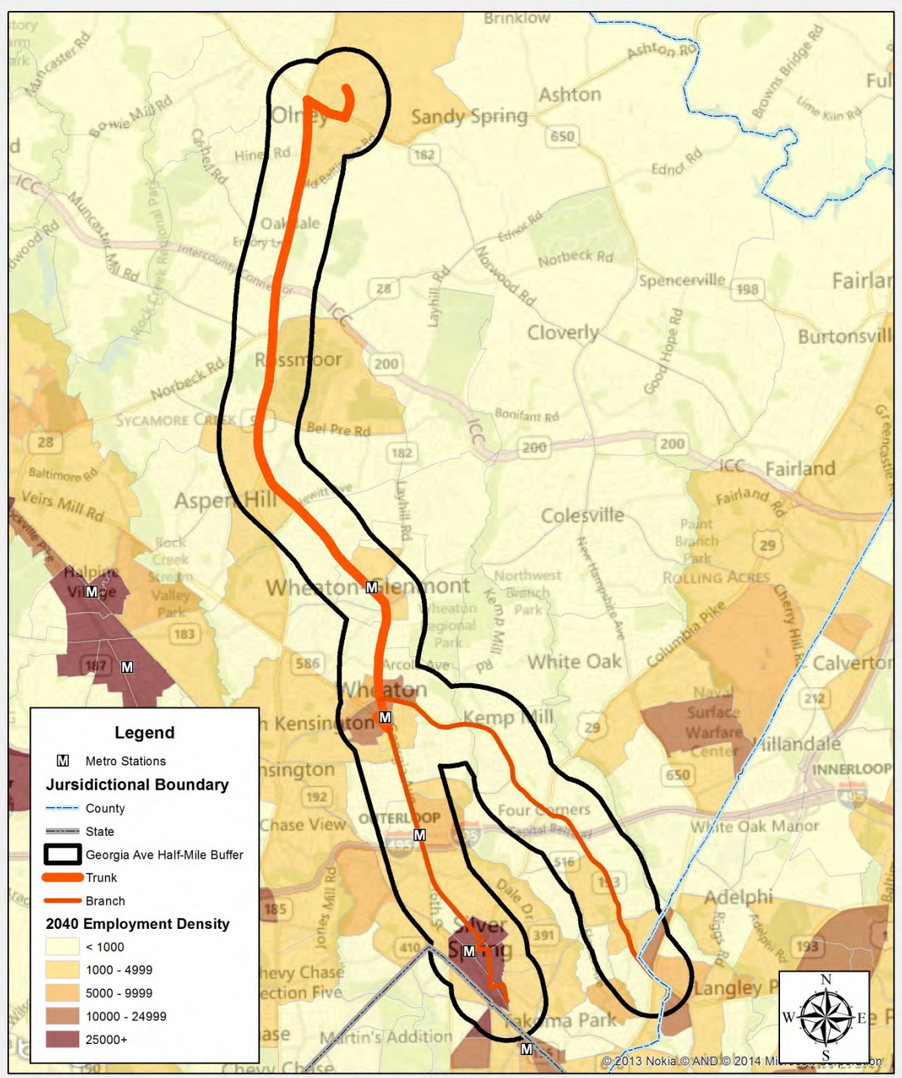
2010 Employment Density (jobs/sq mi)

Georgia Avenue BRT Corridor

Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 1 2 3 Miles

Figure 5- 6 Georgia Avenue Employment Densities (2040)



2040 Employment Density (jobs/sq mi)

Georgia Avenue BRT Corridor

Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 1 2 3 Miles

Figure 5- 7 Georgia Avenue Change in Household Densities - Percent (2010-2040)

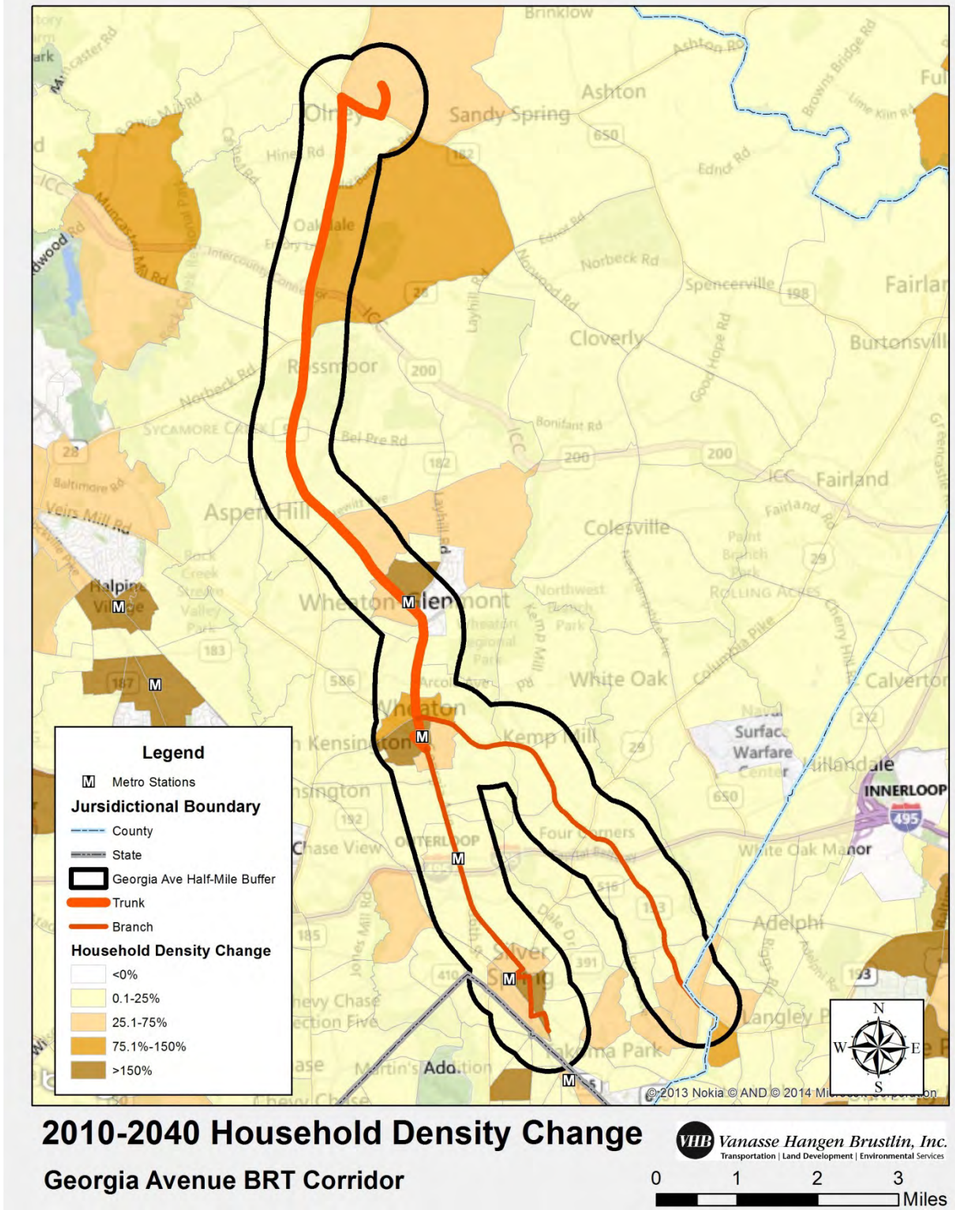


Figure 5- 8 Georgia Avenue Change in Employment Densities - Percent (2010-2040)

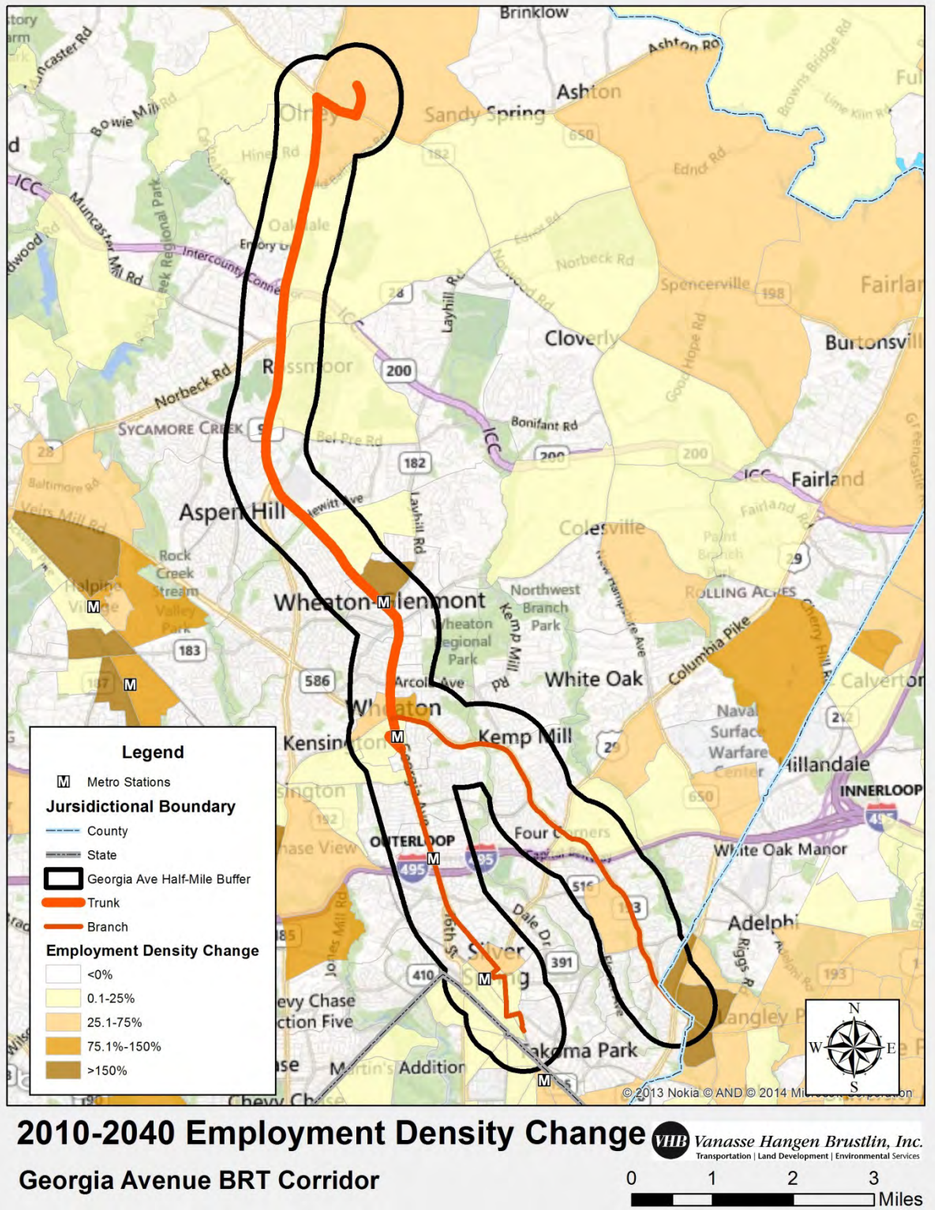


Figure 5- 9 Georgia Avenue Change in Household Densities - Absolute (2010-2040)

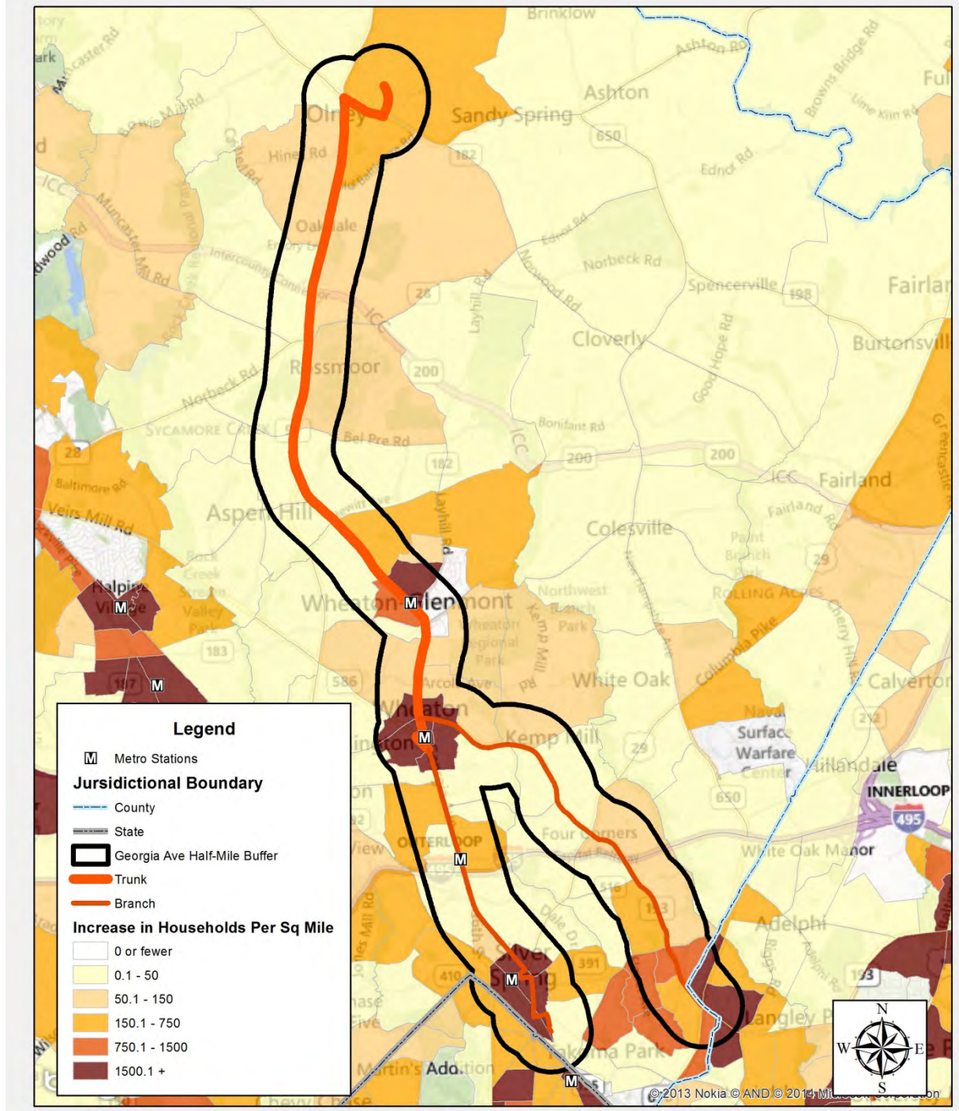
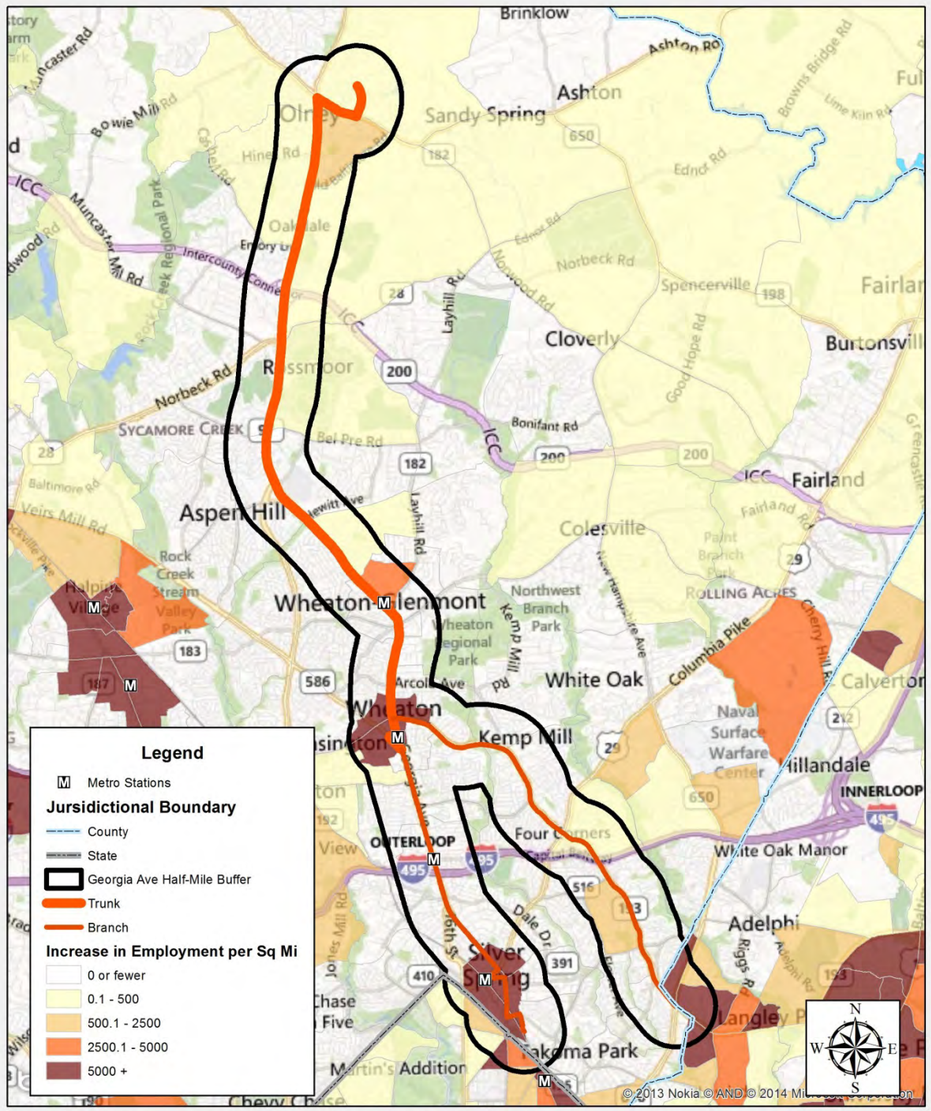


Figure 5- 10 Georgia Avenue Change in Employment Densities - Absolute (2010-2040)



Transportation Network

Existing Transit Characteristics

While serving origin and destination locations are an important element of the RTS, it is also important to facilitate transfers between the RTS and other buses and modes that operate along the corridor. There are a number of Ride On and Metrobus services that operate either along or intersect with the Georgia Avenue corridor. Figure 5-11 details which of these services interact with the Georgia Avenue RTS.

Service Characteristics for Primary Routes

There are Metrobus and Ride On bus routes operating along the Georgia Avenue corridor. Their general routes and service characteristics are described below. Average weekday ridership for each route was examined for the calendar year spanning September 2011 to August 2012.

Metrobus:

- Metrobus routes Y5/7/8/9 – These Metrobus routes are referred together at the Georgia Avenue-Maryland Line, operating between Olney and the Silver Spring Metro station via Georgia Avenue. The different variations serve different areas along the corridor. Together they provide a fairly consistent 15 minute frequency as far north as the Aspen Hill area and a 30 minute frequency north of Aspen Hill. Runtime for the route from Olney to Silver Spring is approximately 65 minutes. Average weekday ridership for the Y-routes is 7,000 riders.

Ride On:

- Ride On Route 53 travels between the Shady Grove Metro station and the Glenmont Metro station with a stop at Montgomery General Hospital. The route travels Georgia Avenue from Prince Phillip Drive to the Glenmont Metro. The route is a peak period service only, with no mid-day or late evening trips. Ride On Route 53 operates with a 35 minute headway and has a 60 minute runtime. Average weekday ridership for the Ride On 53 is 300 riders.

Major Feeder Routes and Connections

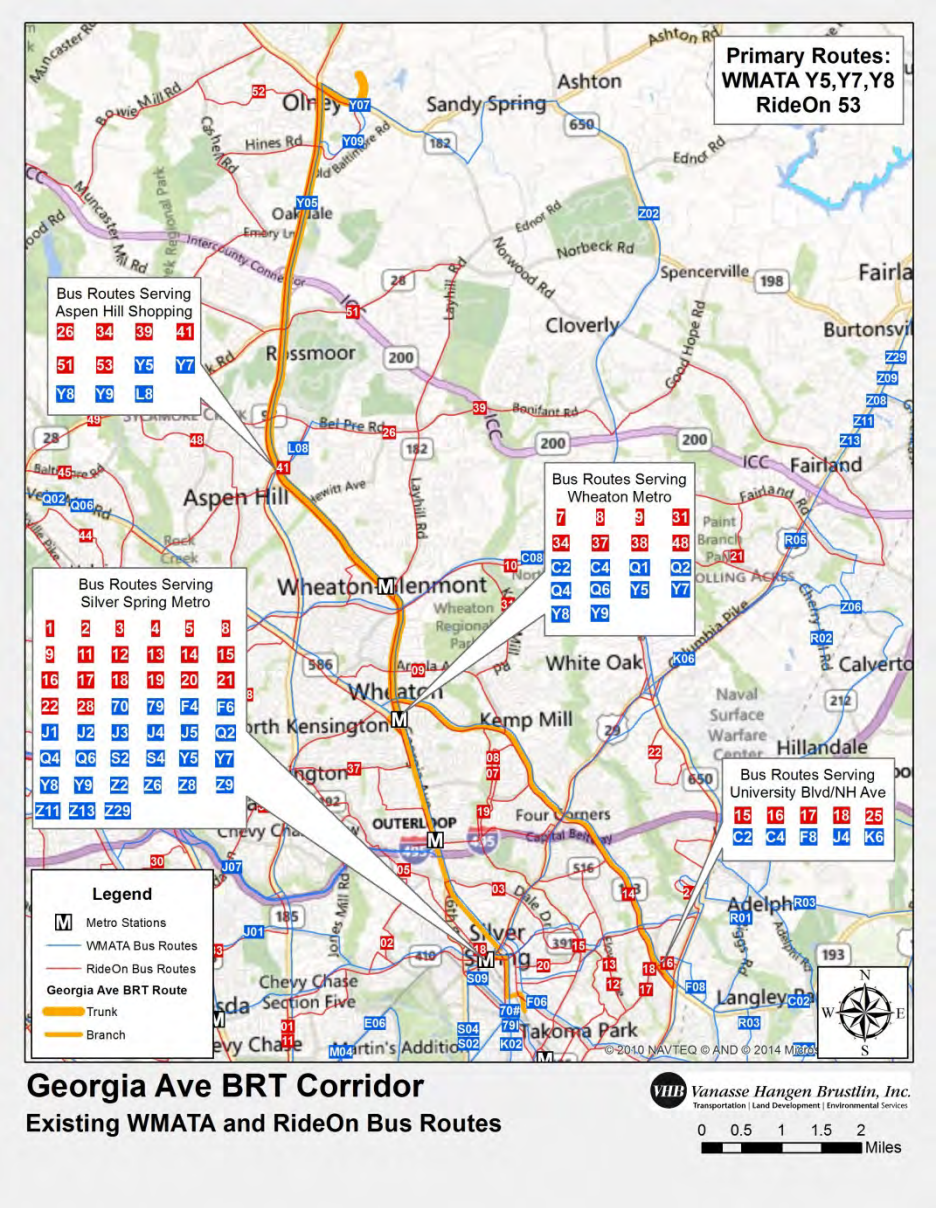
The Silver Spring, Forest Glen, Wheaton, and Glenmont Metrorail stations are the termini for the major feeder routes in this corridor. All are multimodal hubs providing heavy rail service into the urban centers and core. The following routes currently terminate at points along the Georgia Avenue corridor or cross the corridor.

Table 5-4 Bus Service Georgia Avenue Corridor

Operator	Route Name	From	To
WMATA	70	9th/10th & Constitution Av NW	Silver Spring Station
WMATA	79	Silver Spring Station	NW Constitution Av & NW 9th St
WMATA	C2	Greenbelt Station	Wheaton Station
WMATA	C4	Prince Georges Plaza Station	Twinbrook Station
WMATA	F4	New Carrollton Station	Silver Spring Station
WMATA	F6	New Carrollton Station	Silver Spring Station
WMATA	F8	University Blvd & Merrim	Cheverly Station
WMATA	J1	Medical Center Station	Silver Spring Station
WMATA	J2	Westfield Montgomery Mall Transit	Silver Spring Station
WMATA	J3	Westfield Montgomery Mall	Silver Spring Station
WMATA	J4	College Park UMD Station	Bethesda Station
WMATA	J5	Twinbrook Station	Silver Spring Station
WMATA	K6	Lockwood Dr & White Oak S/C	Ft Totten Station
WMATA	L8	Friendship Hgts Sta	Bel Pre Rd & Grand Pre Rd
WMATA	Q1	Shady Grove Station	Silver Spring Station
WMATA	Q2	Montgomery College	Silver Spring Station
WMATA	Q4	Rockville Station West	Silver Spring Station
WMATA	Q6	Shady Grove Station	Wheaton Station
WMATA	S2	Silver Spring Station	10th St & Constitution Ave
WMATA	S4	Silver Spring Station	10th St & Constitution Ave
WMATA	Y5	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y7	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y8	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y9	Montgomery Gen Hospital	Silver Spring Station
WMATA	Z11	Greencastle Park & Ride Lot	Silver Spring Station
WMATA	Z13	Silver Spring Station	Greencastle Park & Ride Lot
WMATA	Z2	Georgia Av & Olney Sandy Spring Rd	Silver Spring Station
WMATA	Z29	South Laurel Park & Ride	Silver Spring Station
WMATA	Z6	Castle Blvd & #14000 Renaissance Pl	Silver Spring Station
WMATA	Z8	Castle Blvd & #14000 Renaissance Pl	Silver Spring Station
WMATA	Z9	Burtonsville S/C & National Dr	Silver Spring Station
Ride On	1	Friendship Heights Station	Bonifant St
Ride On	2	Wayne Ave	Lyttonville Operations Cntr.
Ride On	3	Takoma Station	Bonifant St

Operator	Route Name	From	To
Ride On	4	Armory Ave & Knowles Ave	Bonifant St
Ride On	5	Bonifant St	Twinbrook Station
Ride On	7	Wheaton Station	Forest Glen Station
Ride On	8	Wheaton Station	Dixon Ave
Ride On	9	Wheaton Station	Wayne Ave
Ride On	11	Bonifant St	Friendship Heights Station
Ride On	12	Bonifant St	Takoma Station
Ride On	13	Bonifant St	Takoma Station
Ride On	14	Bonifant St	Takoma Station
Ride On	15	Bonifant St	Lebanon St & University Blvd
Ride On	16	Bonifant St	Takoma Station
Ride On	17	Bonifant St	Lebanon St & University Blvd
Ride On	18	Takoma Station	Lebanon St & University Blvd
Ride On	19	Forest Glen & Brunett Ave	Bonifant St
Ride On	20	Powder Mill Rd & New Hampshire Ave	Bonifant St
Ride On	21	Briggs Chaney Park & Ride	Dixon Ave
Ride On	22	Powder Mill Rd & New Hampshire Ave	Dixon Ave
Ride On	25	Lebanon St & University Blvd	Takoma Station
Ride On	26	Glenmont Station & Bay C	Westfield Montgomery Mall
Ride On	28	Ramsey Ave	Ramsey Ave
Ride On	31	Glenmont Station	Wheaton Station
Ride On	34	Grand Pre Rd & Grand Bel Manor	Friendship Heights Station
Ride On	37	Falls Rd	Grosvenor Station
Ride On	38	Wheaton Station	Westfield Montgomery Mall
Ride On	39	Briggs Chaney Park & Ride	Glenmont Station
Ride On	41	Grand Pre Rd & Grand Bel Manor	Glenmont Station
Ride On	48	Rockville Station	Wheaton Station
Ride On	51	Glenmont Station	Norbeck Rd Park & Ride Lot
Ride On	53	Shady Grove Station	Glenmont Station

Figure 5- 11 Existing Local Bus Service along Georgia Avenue



Corridor Key Stops and Stations

The Silver Spring, Wheaton, and Glenmont Metrorail stations are the heaviest used stops on the Georgia Avenue corridor. All of the Metrorail stations are a multimodal transportation hub with off-street parking, bike racks, bike lockers, and car sharing opportunities on site.

Table 5-5 displays the boardings and alightings associated with the stops discussed above. The ridership data was supplied from Montgomery County.

Table 5-5 Key Bus Stop Ridership

Stop	Boardings	Alightings
Glenmont Station	1,600	1,600
Wheaton Station	3,850	3,600
Georgia Ave. & Cameron St.	220	200
Georgia Ave. & Colesville Rd,	750	650
Silver Spring Transit Center	7,000	7,000
Georgia Ave. & Eastern Ave.	450	450

Other Transit

There are four Metrorail stations located on the Georgia Avenue corridor; all are located on Metrorail's Red Line, which provides access to downtown Washington, DC, includes Glenmont, Wheaton, Forest Glen, and Silver Spring stations are located on eastern end of the Red Line. This segment includes connections to the Metrorail Yellow and Green Lines and the future Purple Line.

RTS Concept

Summary of CTCFMP Service

In the Planning Board draft of the *Countywide Transit Corridors Functional Master Plan* (CTCFMP), ridership estimates for the Georgia Avenue corridors were calculated under different scenarios for the year 2040. The scenarios test different transitway treatments for their impacts on ridership for the draft north and south corridors of the RTS. The extension of the service on University Boulevard and the integration with the other RTS corridors would be expected to increase ridership. Although the mode shift from SOV to transit may not dramatically increase the number of transit riders in the corridor, the high existing ridership may make this RTS line viable.

The approved CTCFMP does not prescribe the type of busway treatment (i.e., curb vs. median), but instead states the number of lanes and right-of-way required. The approved plan busway treatment will be determined in later studies. For the Georgia Avenue RTS the more important characteristic will be the level of service and service integration concept of this RTS route and the connection to Langley Park.

Recommended Service Plan

The recommended service concept for the Georgia Avenue corridor is to connect both the northern and southern corridors outlined in the draft plan. The main trunk line for this route, from Olney to Wheaton will have 10 minute headways. South of Wheaton this route will split into service towards Silver Spring using the Georgia Avenue and service to Langley Park using the University Boulevard. The Veirs Mill Road RTS will also split into two branches south of Wheaton. Both the Georgia Avenue RTS and the Veirs Mill Road RTS will have 10 minute frequencies, so that the effective headways on the branches will remain 10 minutes.

The only major planned highway improvement in the corridor includes the interchange at Randolph Road and Georgia Avenue. There are no proposed improvements on Georgia

Avenue south of Wheaton. The RTS would provide an alternative to single occupancy vehicle travel and a high quality transit connection to serve the planned growth in the corridor. It can be a good supplement to the limited highway improvements in the corridor.

The planned transit improvements in the corridor include BRT between the Wheaton Metrorail station and the Rockville Metrorail station. There is also the construction of the Purple Line which will provide an opportunity to have the segment between Piney Branch Road and the Langley Park Transit Center share guideway if the tracks are embedded in the pavement. This would benefit both the Purple Line and the RTS by allowing for the two high quality transit lines to merge. The overall benefit would be to the transit riders allowing for easy connections to between the RTS and the Purple Line.

Key Locations

The location of RTS stops is an important factor in the success of the RTS system. Stops that are located at, or within a reasonable proximity to, transit generators – in terms of both residential origins and commercial, medical, government or other destinations – will assist the initial marketing of the service and with ongoing ridership growth. For the RTS service, the stops have been preliminarily located by Montgomery County's Functional Master Plan. The stop locations and their distances are displayed in Table 5-7.

Table 5-7 Stop Locations and Distances for Georgia Avenue

	From	To	Segment Distance (miles)
Trunk	Montgomery General Hospital	MD 108 and MD 97	0.744
Trunk	MD 108 & MD 97	MD 97 & Hines Road	0.718
Trunk	MD 97 & Hines Road	ICC park-and-ride	1.955
Trunk	ICC park-and-ride	MD 97 & Norbeck Road park-and-ride	0.384
Trunk	MD 97 & Norbeck Road park-and-ride	MD 97 & Rossmoor Boulevard	0.696
Trunk	MD 97 & Rossmoor Boulevard	MD 97 & Bel Pre Road	0.578
Trunk	MD 97 & Bel Pre Road	MD 97 & MD 185	0.656
Trunk	MD 97 & MD 185	MD 97 & Hewitt Avenue	0.583
Trunk	MD 97 & Hewitt Avenue	Glenmont Metro Station	1.378
Trunk	Glenmont Metro Station	MD 97 & Randolph Road	0.383
Trunk	MD 97 & Randolph Road	MD 97 & Arcola Avenue	0.766
Trunk	MD 97 & Arcola Avenue	Wheaton Metro Station	0.642
Branch 1	Wheaton Metro Station	MD 97 & Dexter Avenue	1.136
Branch 1	MD 97 & Dexter Avenue	Forest Glen Metro Station	0.453
Branch 1	Forest Glen Metro Station	MD 97 & Seminary Road	0.523
Branch 1	MD 97 & Seminary Road	MD 97 & Cameron Street	0.961
Branch 1	MD 97 & Cameron Street	Silver Spring Transit Center	0.377
Branch 1	Silver Spring Transit Center	MD 97 & East West Highway	0.54
Branch 1	MD 97 & East West Highway	MD 97 & Eastern Avenue/Burlington Avenue/Montgomery College	0.39
Branch 2	Wheaton Metro Station	MD 193 & Amherst Avenue	0.47
Branch 2	MD 193 & Amherst Avenue	MD 193 & Inwood Avenue	0.753
Branch 2	MD 193 & Inwood Avenue	MD 193 & Arcola Avenue	0.758
Branch 2	MD 193 & Arcola Avenue	MD 193 & Dennis Avenue	0.574
Branch 2	MD 193 & Dennis Avenue	MD 193 & US 29	0.55
Branch 2	MD 193 & US 29	MD 193 & E Franklin Avenue	0.84
Branch 2	MD 193 & E Franklin Avenue	MD 193 & Gilbert Street	1.102
Branch 2	MD 193 & Gilbert Street	Takoma/Langley Park Transit Center	0.722
		Total Trip Distance Branch 1	13.9
		Total Trip Distance Branch 2	15.3
		Average Stop Distance	0.72

Service Span and Frequency

The level of service including operating hours and headways for the RTS service have to be at a premium level in order to meet passenger demand and obtain high ridership levels. Ideally, the RTS service concept would operate from the early morning until late at night, with 10 minute headways or less. Ten minute headways provide a level of service that does not require the need to check a schedule and the wait times between vehicles is understood to be frequent enough to meet a choice rider's expectations. This frequency falls in the middle of the range of headways for rapid transit systems in North America and is a reasonable headway expectation for a new service. As service demand increases along the corridor, headways can be further reduced to accommodate the growing demand. The service span was designed to complement and match Metrorail service spans. The initial Georgia Avenue RTS levels of service for the fully built-out system are displayed in Table 5-8.

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Table 5-8 Georgia Avenue Levels of Service

Period	From	To	Span of Service	Headways	
				Peak	Off-Peak
Weekday	Onley	Transit Center (Silver Spring, Langley Park)	6AM-12AM	10	10

Table 5-9 provides a comparison of headway and travel speed savings associated with the Georgia Avenue RTS service. These savings are a comparison between existing local service and the trunk portion of the RTS corridor. The travel speed savings are based on guidelines for estimated travel speeds from the *Federal Transit Administration's Characteristics of Bus Rapid Transit for Decision Making*.

Table 5-9 Comparison of Headway and Travel Speeds

Service	Headway (minutes)			Speed (mph)		
	AM	Off-peak	PM	AM	Off-peak	PM
Existing[1]	15	20	15	15.6	14.2	13.1
Georgia Avenue RTS[2,3]	10	10	10	23.0	25.0	23.0
Difference		5		7.4	10.8	9.9
Percent Travel Time Savings				47%	76%	76%

1. Headway and speed based on Metrobus Y-line schedules.

2. Headway is for the trunk portion of the corridor

3. Speed estimate is provided for the trunk portion of the corridor based on type of running way, location, and time of day

The service concept plan initially would have the Georgia Avenue RTS service offered between the hours of 6 AM and midnight from Montgomery Hospital to both Silver Spring and Langley Park with at least 10 minute headways in the peak and off peak periods. As the service develops these hours should be re-evaluated and shifted to respond to the demand.

Branches, Overlaps, and Deviations

The trunk portion of the RTS service will operate between the Montgomery Hospital and the Wheaton Metro station, with additional service provided from Wheaton to both Silver Spring Transit Center and the Takoma Langley Transit Center. As a result the portion of the corridor between Montgomery Hospital and the Wheaton Metrorail station will have the highest level of service.

As described, three buses per hour (20-minute headways) from Montgomery Hospital, continuing on University Boulevard past Wheaton to the Langley Park Transit Center. The other three trips per hour (20-minute headways) will operate from Montgomery Hospital and continue on Georgia Avenue past Wheaton to the Silver Spring Metro station. These two branches, operating every 20 minutes, will provide 10 minute effective headways along the "trunk" of the route, between Montgomery Hospital and Wheaton Metrorail station. The branch service will be supplemented with service from the Veirs Mill Road RTS so that the effective headway on the branches and trunk will be 10 minutes.

Integration with Local Service

RTS along the Georgia Avenue corridor would be complemented by some of the existing service provided by Metrobus and Ride On. The following would be an operational consideration once the Georgia Avenue RTS is implemented:

- Metrobus Routes Y5 and Y7 could be modified.
- Metrobus Routes Y8 and Y9 could be expanded to cover peak periods and would take advantage of the proposed RTS infrastructure curb lanes on Georgia Avenue.
- Ride On Route 53 could be truncated at Olney.
- Ride On Route 52 could connect to Georgia Avenue RTS at ICC park and ride lot and would discontinue service on Georgia Avenue. The ICC park and ride lot provides service to ICC buses to Fort Meade and BWI.

Fleet Requirement

Based on the recommendation to join the University Boulevard and Georgia Avenue corridors, create a trunk and two secondary branches, the following vehicle requirements are estimated based on the prescribed headways. During peak service, the requirement would be 25 vehicles, including spares. This would drop to 15 vehicles during the off-peak based on the improved travel times[10].

Operational Hours

A planning-level estimate of the hours of service that would be required to operate the service concept was developed for the Georgia Avenue RTS. The estimate of operating hours was developed based on the assumptions related to the travel speed that could be achieved associated with various BRT treatments discussed in the draft plan. These assumptions are not being recommended for implementation, but were necessary to produce an estimate of the number of hours that would be required to operate the service.

[10] These Figure 5-s are based on an 11.8 mile long trunk service, and 12.6 and 9.0 mile long branch services. Peak period speeds are assumed to be 17 mph during peak service and 19-21 mph during off-peak service. Spare ratio is 1.2 times the total vehicle requirement.

The assumed speeds allowed for a calculation of the number of vehicles that would be required to operate the service using the prescribed headways discussed above. These assumptions result in typical weekday of 230 service hours. This calculates to roughly 78,000 annual service hours. The deadhead hours (i.e., hours to and from the bus garage) have been factored to 15 percent of the revenue hours, which equates to approximately 90,000 total vehicle hours.

Corridor Outcome and Summary

The implementation of RTS service along the Georgia Avenue will provide a high quality transit link from east-to-west through central Montgomery County. The service will link persons in residential areas with employment, and commercial centers in Olney, Wheaton, Silver Spring, and Langley Park. It will also provide high frequency, high speed connections to Metrorail as well as all of the other RTS corridors, providing access to other regional job centers. The Georgia Avenue corridor will not only support the residents that live along the corridor by providing and improved travel alternative, but it will also support the future growth and redevelopment of areas such as Wheaton and Langley Park. These are areas that are seeking to become more transit oriented and less dependent on single occupancy automobiles.

Veirs Mill Road Corridor Service Plan

The conceptual service plan for the Veirs Mill Road (MD 586) Rapid Transit System (RTS) is based on the draft corridor plans for Veirs Mill Road and University Boulevard as outlined in the Montgomery County Planning Department's draft report *Countywide Transit Corridors Functional Master Plan* from July 2013. The concept focuses on providing a faster transit option that connects activity centers and multimodal hubs on the western side of Montgomery County with the eastern side of the County. The service integration concept developed as part of this study for the Veirs Mill Road RTS proposes for the route to travel between Montgomery College in Rockville to Wheaton with branch services continuing to the Silver Spring Transit Center and Langley Park Transit Center.

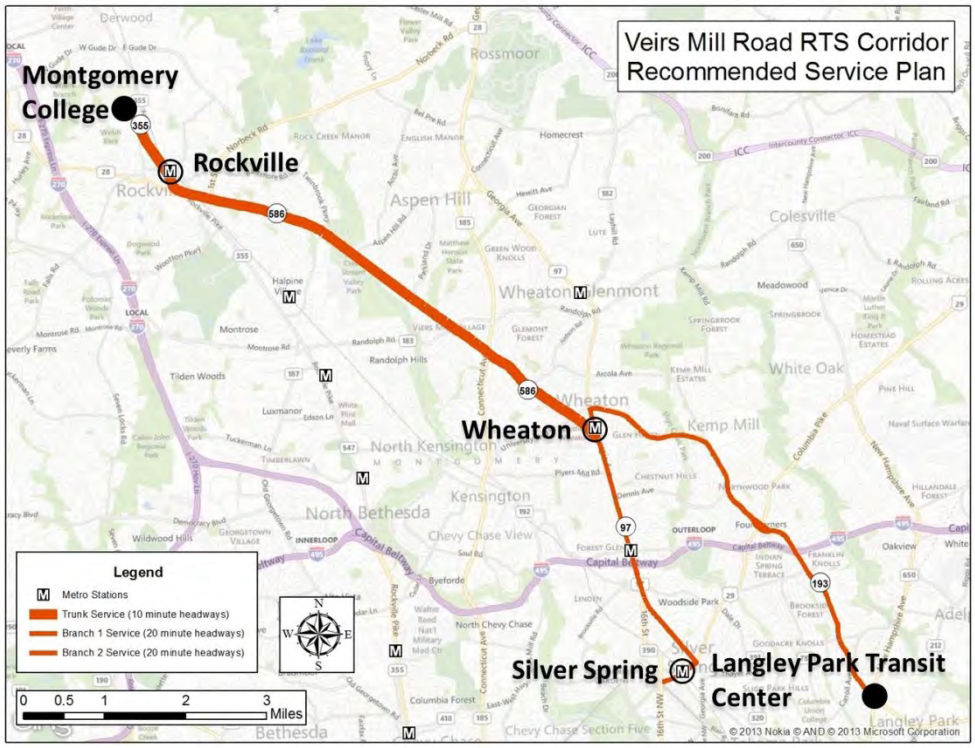
General Corridor Overview

The draft plan proposed a corridor between the Rockville and Wheaton Metrorail stations via Veirs Mill Road. A key focus of this study was service integration across RTS routes. The concept proposed for the Veirs Mill Road RTS creates a seamless route that travels from Montgomery College in Rockville via MD 355 and Veirs Mill Road to the Wheaton Metrorail station. The route would continue from Wheaton with two branches providing connections to Silver Spring via Georgia Avenue and Langley Park via University Boulevard. This RTS route would intersect with all of the other proposed RTS routes. This route concept is shown in Figure 6-1[1]. The trunk portion of the route from Rockville to Wheaton is approximately seven miles in length. The branch from Wheaton to Silver Spring is four miles in length. The branch from Wheaton to Langley Park is six miles in length.

The Veirs Mill Road RTS will provide an improved option for people traveling across the County. The route will connect major activity and multimodal centers. This includes Montgomery College, Rockville, Wheaton, Four Corners, Silver Spring, and Langley Park. The Veirs Mill Road RTS will provide a connection between the two ends of the Metrorail Red Line, connect with all of the other RTS routes, and connect to the Purple Line.

[1] The Montgomery County Council approved the Countywide Transit Corridors Functional Master Plan in November 2013. As part of the approval the Council proposed some changes to the Veirs Mill Road and North Bethesda Transitway corridor. The proposals not originally part of the Draft Functional Master Plan from July were not considered in the analysis contained in this report due to the timing of their release. Future study of the individual corridors will need to contain a review of the Council recommendations as part of a detailed analysis.

Figure 6-1 Veirs Mill Road RTS Corridor



Existing Sources of Activity

The following sources of activity are located along the Veirs Mill Road RTS :

- Montgomery College
- Rockville Town Center (Metrorail)
- Veirs Mill Village/Randolph Hills
- Wheaton (Metrorail)
- Forest Glen (Metrorail)
- Montgomery Hills
- Downtown Silver Spring (Metrorail)
- Northwood High School
- Montgomery Blair High School
- Four Corners
- Langley Park

Existing Demographics

Studies of transit riders show a willingness to walk up to one-half mile to access high quality transit service like the RTS. To provide an understanding of the potential transit market demographic data within 1/2 mile boundary around the proposed Veirs Mill Road RTS was compiled based on the 2011 American Community Survey data as summarized in Table 6-1. The table also lists the County totals for each characteristic to provide context of how the corridor relates to the County as a whole. Based on these figures, the Veirs Mill Road RTS has a much higher percentage of commuters using transit compared to the County as a whole. The corridor also has a slightly higher percentage of households below the poverty line. These households might be more dependent on transit as result of limited auto availability. As compared to the other corridors the percent of households that do not own a vehicle is one of the highest. This would indicate potential for high transit ridership.

Table 6-1 Demograhic Data for Veirs Mill Road Corridor

Census Group	Veirs Mill Road Corridor	Montgomery County
Population	158,363	959,738
Male (%)	51.1%	48.0%
Female (%)	48.9%	52.0%
Median Age	37.3 years	40.5 years
Workers 16 years and older	86,678	508,645
Public transit is primary means of travel to work (% of workers 16 and older)	19,549 (22.6%)	77,077 (15.2%)
Households	53,021	355,434
Avg. Annual Median HH Income	$83,969	$111,751
Below the poverty line (Households)	4,662 (8.8%)	20,712 (5.8%)
Non-vehicle ownership (Households)	6,513 (12.3%)	29,018 (8.2%)
Source: 2007-2001 American Community Survey 5-Year Estimates		

Existing Land Use

The westernmost section of the Veirs Mill Road corridor terminates at a community college. The Rockville campus of Montgomery College is the largest within the system with students utilizing transit and auto modes. Students can ride Ride On for free with a valid student ID. Surrounding the campus are residential neighborhoods, commercial areas and mixed transit oriented developments including the Rockville Town Center. Veirs Mill Road is largely bordered by 1950's exists single family, older residential housing on small lot sizes. There are retail strip shopping centers and the development is typical of suburban developments from the 1950's and 1960's.

Wheaton is a commercial center at the corner of two major arterials - Georgia Avenue (MD 97) and University Boulevard (MD 193). There is a large regional shopping mall as well as several shopping centers. There is limited office space and most of the commercial space is retail. South of Wheaton the corridor branches have similar development patterns with housing and shopping centers located at major intersections. The Georgia Avenue branch terminates in Downtown Silver Spring which is a major urban center in the County. The Langley Park branch terminates in a commercial shopping area and ties into the Purple Line as well as the New Hampshire Avenue RTS.

Planned Land Use Changes

The master plan updates for subareas along the corridor show areas increasing in employment and household densities with other areas planned to remain relatively unchanged. There are several significant changes planned for the overall corridor. The Wheaton commercial center and vicinity plan, adopted in 2012, overlaps the corridor between Wheaton Station and Galt Avenue. The plan calls for significant changes to densities along the corridor, particularly south of University Boulevard. Maximum building heights of 250 feet and floor area ratios of 6.0 dramatically increase the transit-supportive potential of the southern end of the Veirs Mill corridor. These urban design characteristics can increase the transit ridership by improving the pedestrian access and connectivity around transit stations.

The City of Rockville has released a draft plan that aims to create a more transit accessibility along Rockville Pike. The plan emphasizes transit-supportive development with mixed uses focusing on multimodal opportunities, and good urban design principals. Maximum building heights will be eight stories in portions of the corridor nearest Veirs Mill Road. This planning area abuts, but does not overlap with, the Veirs Mill Road corridor.

Some early phases of the RTS or transitional services may become operational in the next few years. Bus rapid transit can impact land use along a corridor, and good planning can be a key aspect of ensuring that an area can develop into a walkable, mixed use area that can support high-quality transit[2]. The denser development that provides for easy access to transit will help ridership. This type of development can create not only peak period commuter riders but also attract non-commuting shopping and recreational riders.

The Metropolitan Washington Council of Governments Cooperative Land Use Forecast Round 8.2 shows how the corridor is projected to change between 2010 and 2040. The land use forecast shows development that has been approved. Unlike the proposed updates to the sector plans, the land use forecast represents development that has already been included in the planning process.

Figure 6-2 shows the total corridor change in households and employment from 2010 to 2040. Table 6-2 shows the total corridor household and employment densities along the Veirs Mill Road corridor. The table provides details about the lowest and highest observed values as well as the average value for the corridor. These values can be compared against values for residential and non-residential densities as reported in the Institute for Transportation Engineer's (ITE) *A Toolbox for Alleviating Traffic Congestion* shown in Table 6-3.

The data in Table 6-3 represents land area that can be developed, versus gross land area in the Transportation Analysis Zone (TAZ) plots. Land that can be developed would exclude parks, and wetlands in the TAZ. Since most of the TAZs along the corridor cover land that can be developed the ITE data in Table 6-3 provides an approximate guide for understanding potential service levels. A land use density threshold for transit supportive areas on gross land area used in local planning studies in the region is three households per gross acre and/or four jobs per gross acre. Based on the maximum values the corridor could support bus service at a 10 minute frequency.

▼

[2] More Development for Your Transit Dollar: An Analysis of 21 North American Transit Corridors, Institute for Transportation & Development Policy

The figures on the following pages show the household density (households per square mile) and employment density (employees per square mile) in 2010 and the forecasted density for 2040. Figures 6-7 through 6-10 show the changes in density from 2010 to 2040 for both households and employment. The changes are shown both in the percentage change, allowing for the observation of greatest change over the 30-year period; and absolute change, which shows the magnitude in the change.

Figure 6-2 Veirs Mill Road Corridor Projected Changes

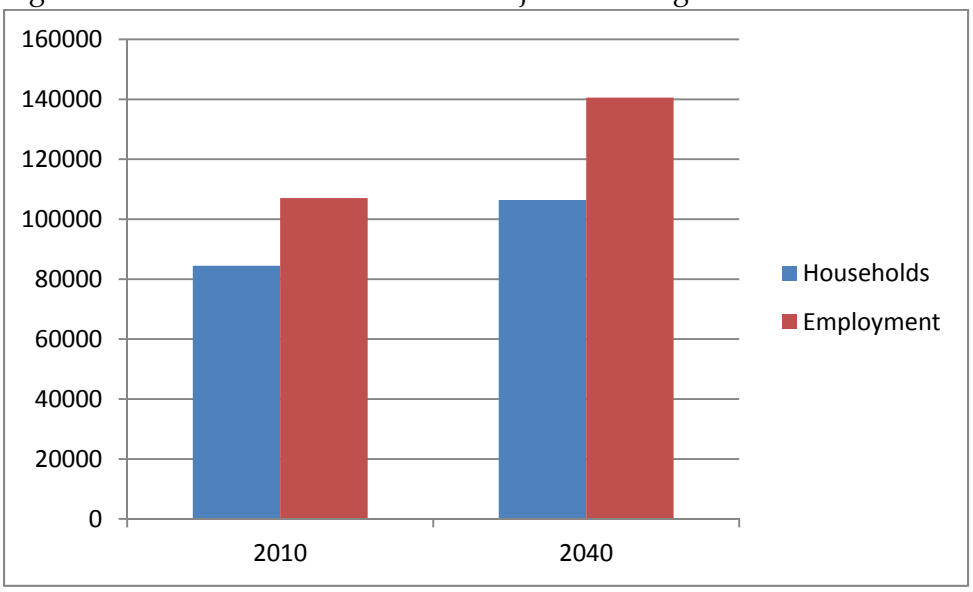


Table 6-2 Veirs Mill Road Corridor Household and Employment Densities (2010 & 2040)

	2010 Household Density (HH/Acre)	2040 Household Density (HH/Acre)	2010 Employment Density (Emp/Acre)	2040 Employment Density (Emp/Acre)
Minimum	0	0	0	0
Maximum	25	40	103	153
Average	4	7	8	12

Table 6-3 ITE Residential and Non-residential Densities for Transit Service[3]

	Frequency (20-hour service day)	Dwelling Units per Acre	Employees per Acre
Bus	1 bus/hour	4-5	50-80
Bus	1 bus/30 minutes	7	80-200
Bus	1 bus/10 minutes	15	200-500
Light Rail	Every 10 minutes	35-50	500+

[3] Institute of Transportation Engineers, A Toolbox for Alleviating Traffic Congestion, 1989.

Figure 6-3 Veirs Mill Road Household Densities (2010)

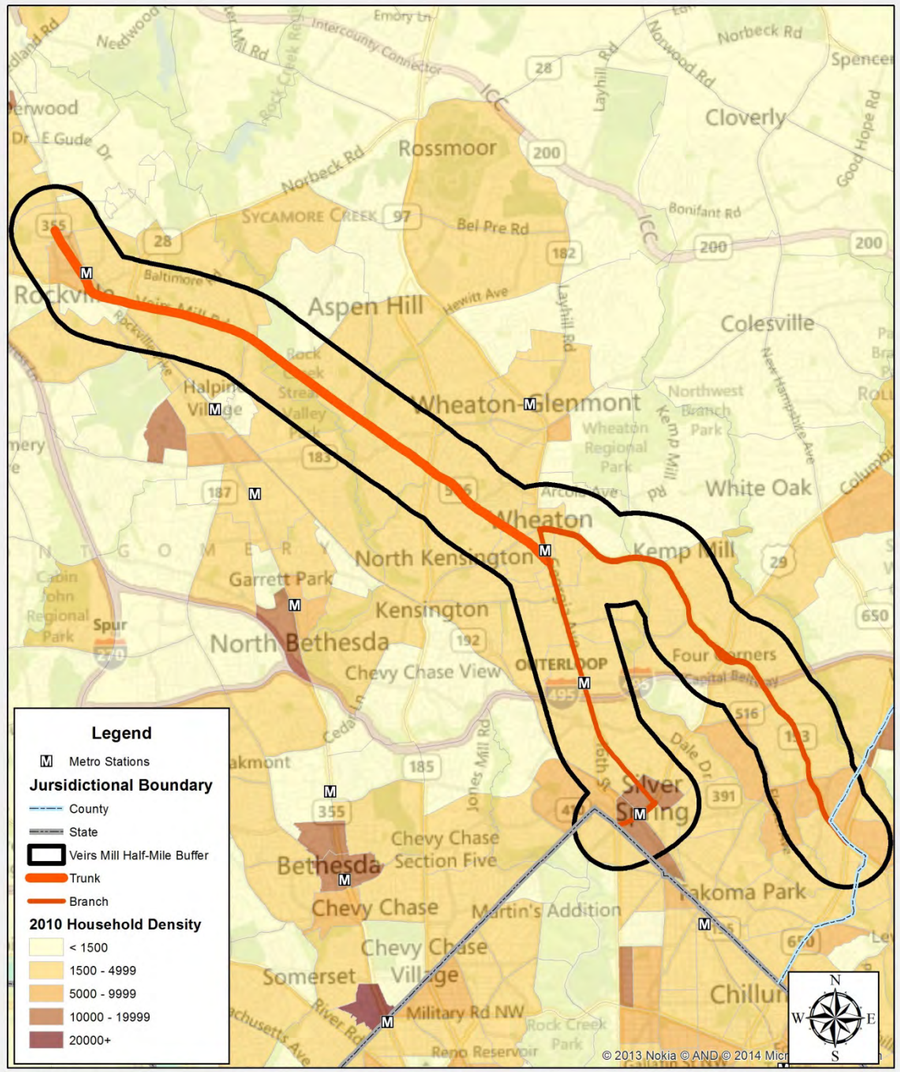


Figure 6-4 Veirs Mill Road Household Densities (2040)

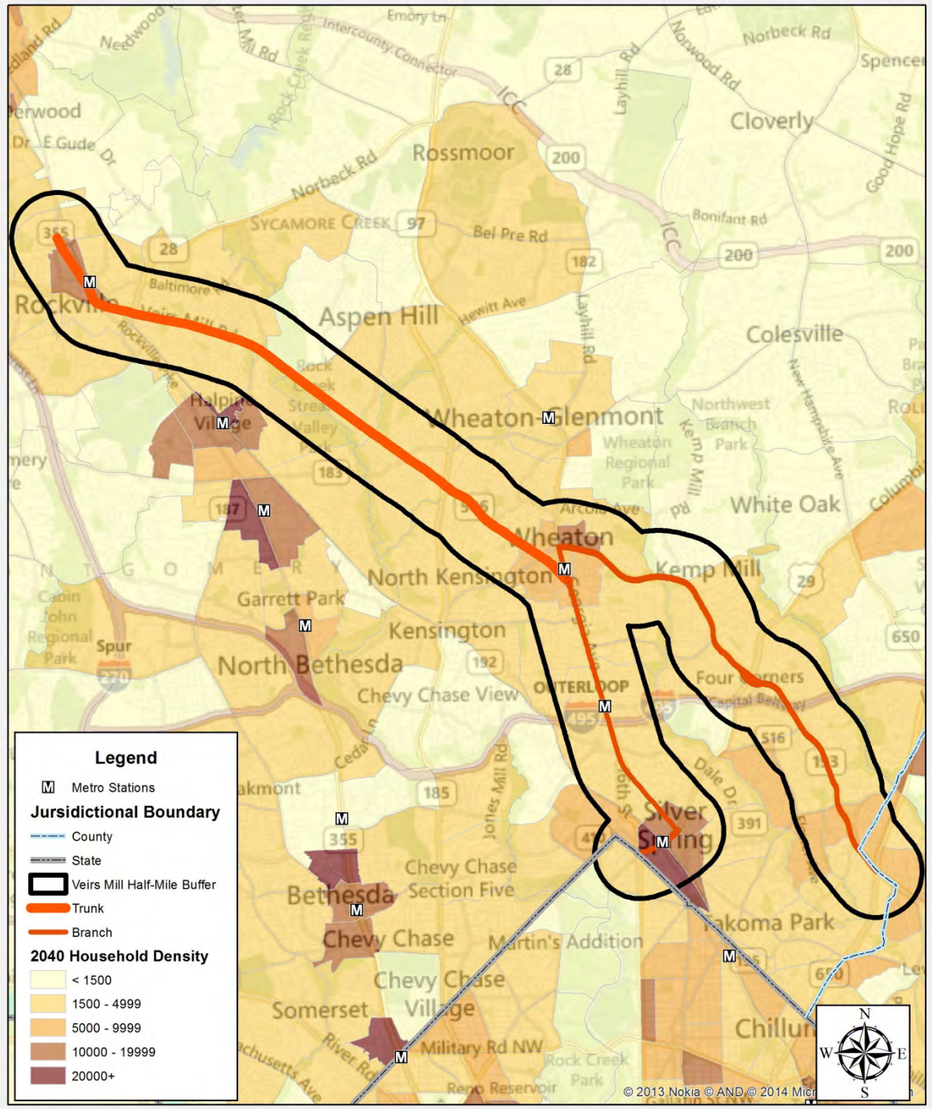


Figure 6-5 Veirs Mill Road Employment Densities (2010)

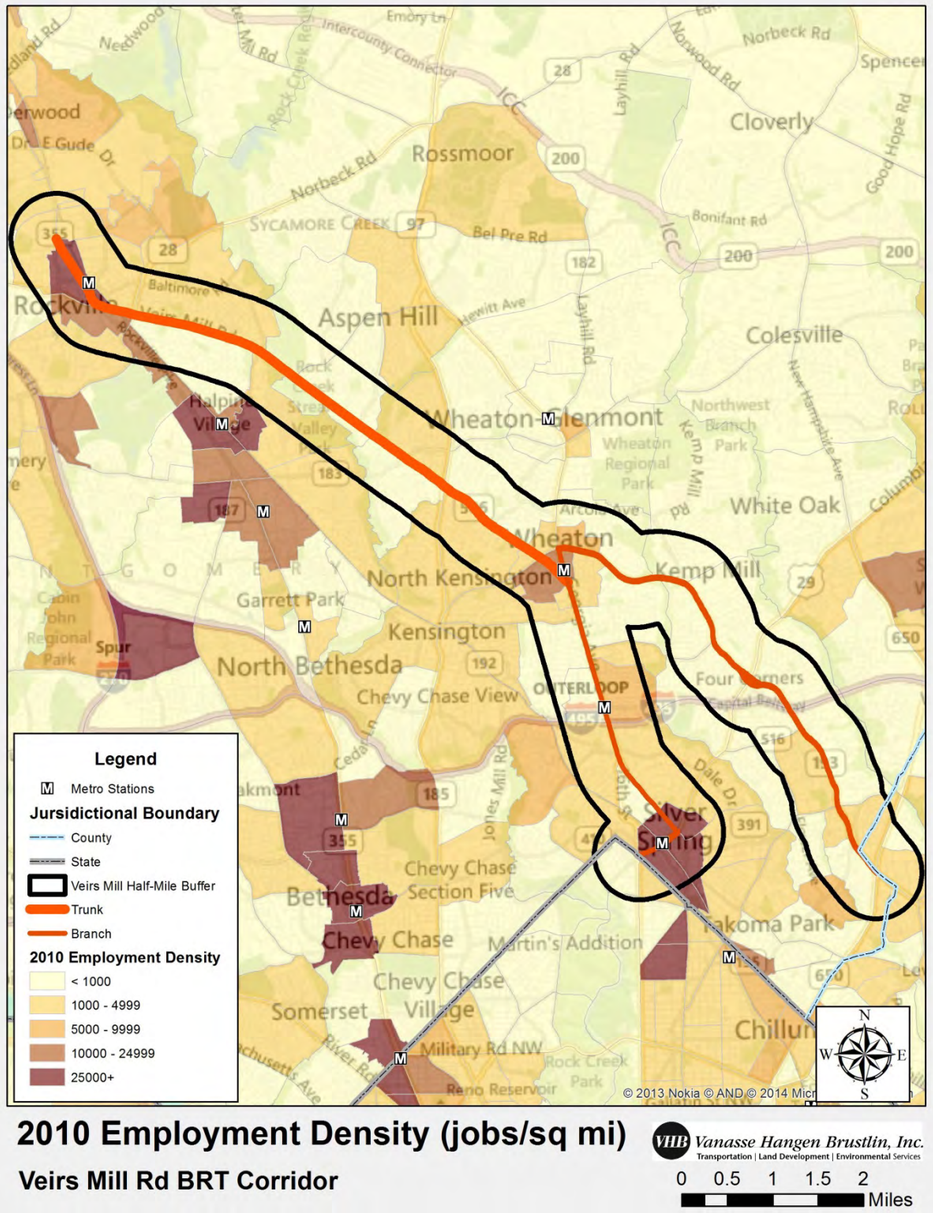


Figure 6-6 Veirs Mill Road Employment Densities (2040)

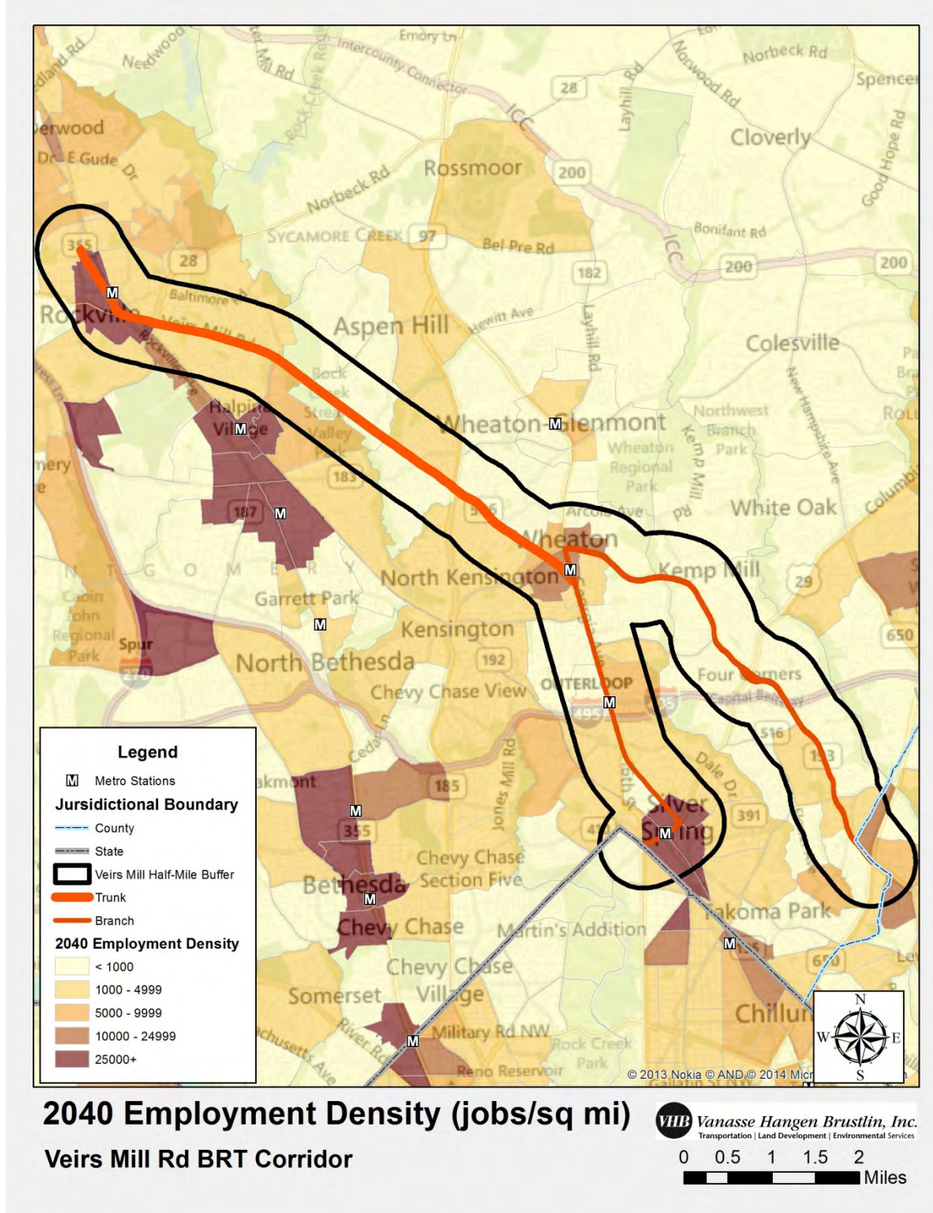


Figure 6-7 Veirs Mill Road Change in Household Densities - Percent (2010-2040)

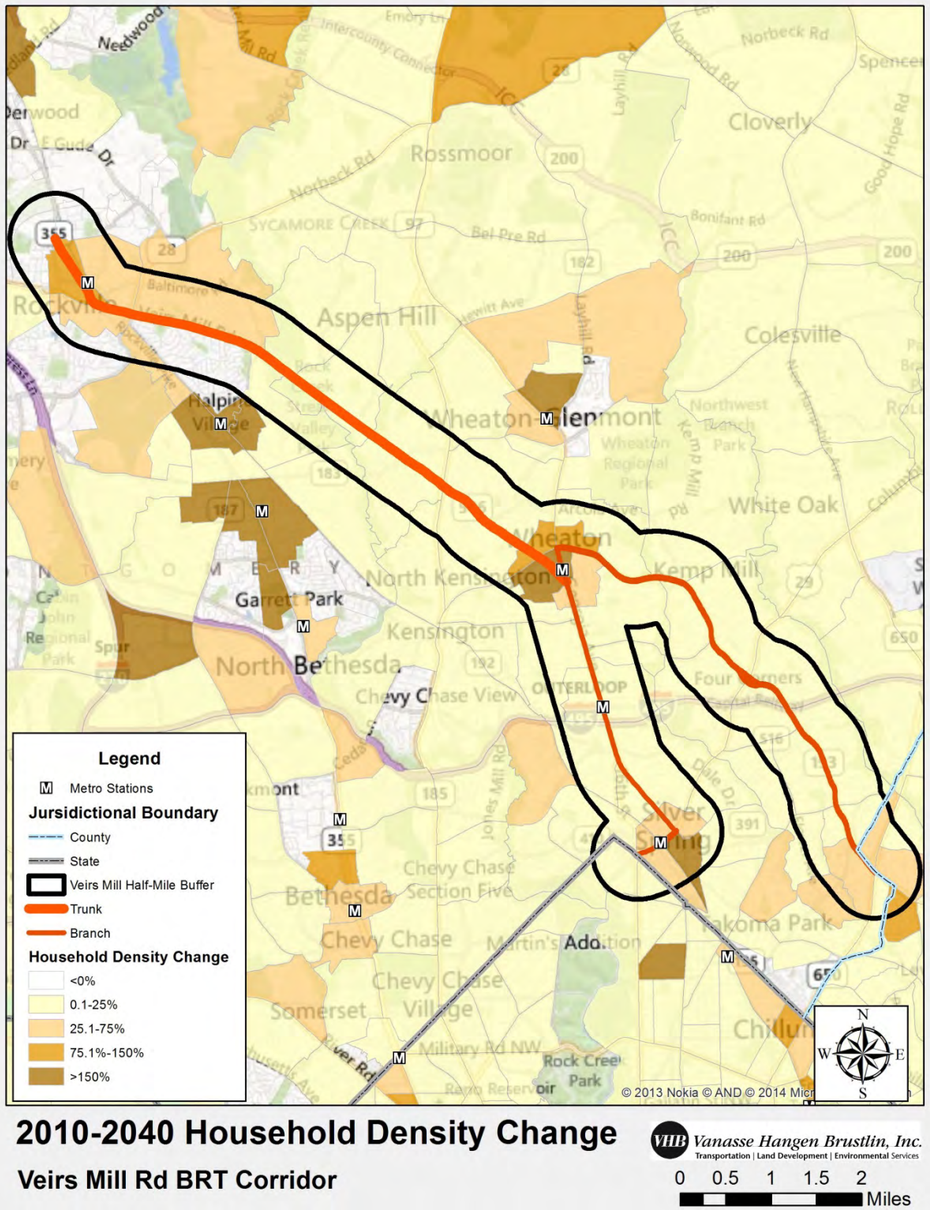


Figure 6-8 Veirs Mill Road Change in Employment Densities - Percent (2010-2040)

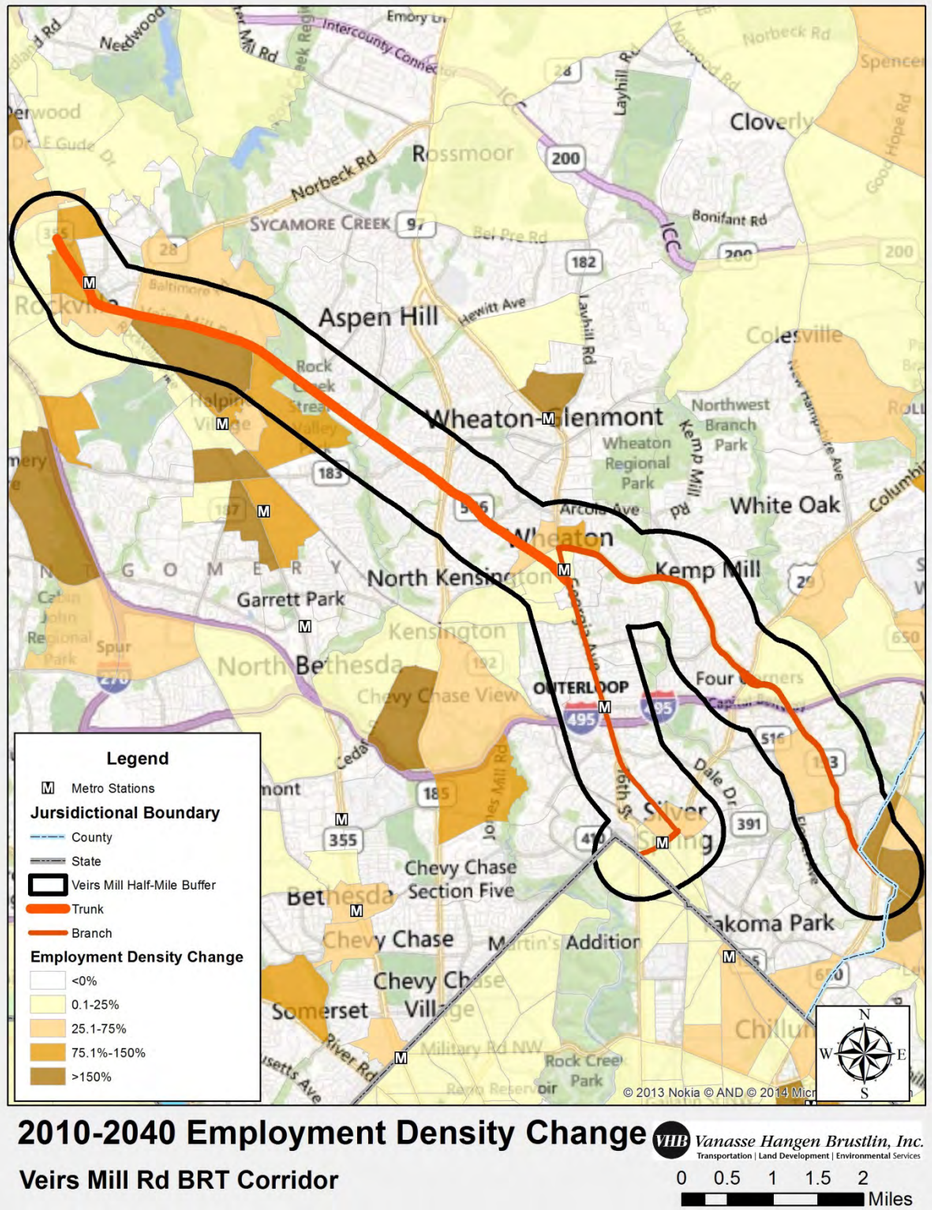


Figure 6-9 Veirs Mill Road Change in Household Densities - Absolute (2010-2040)

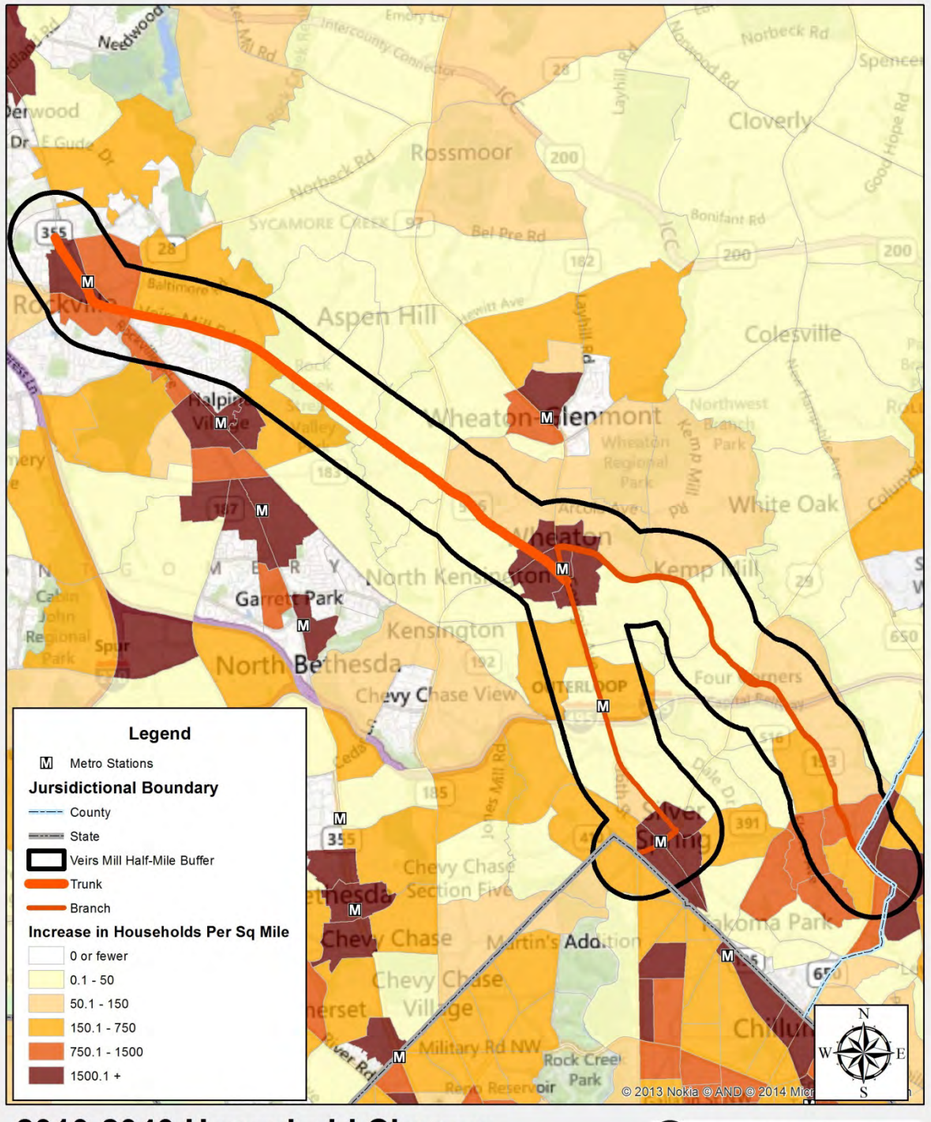
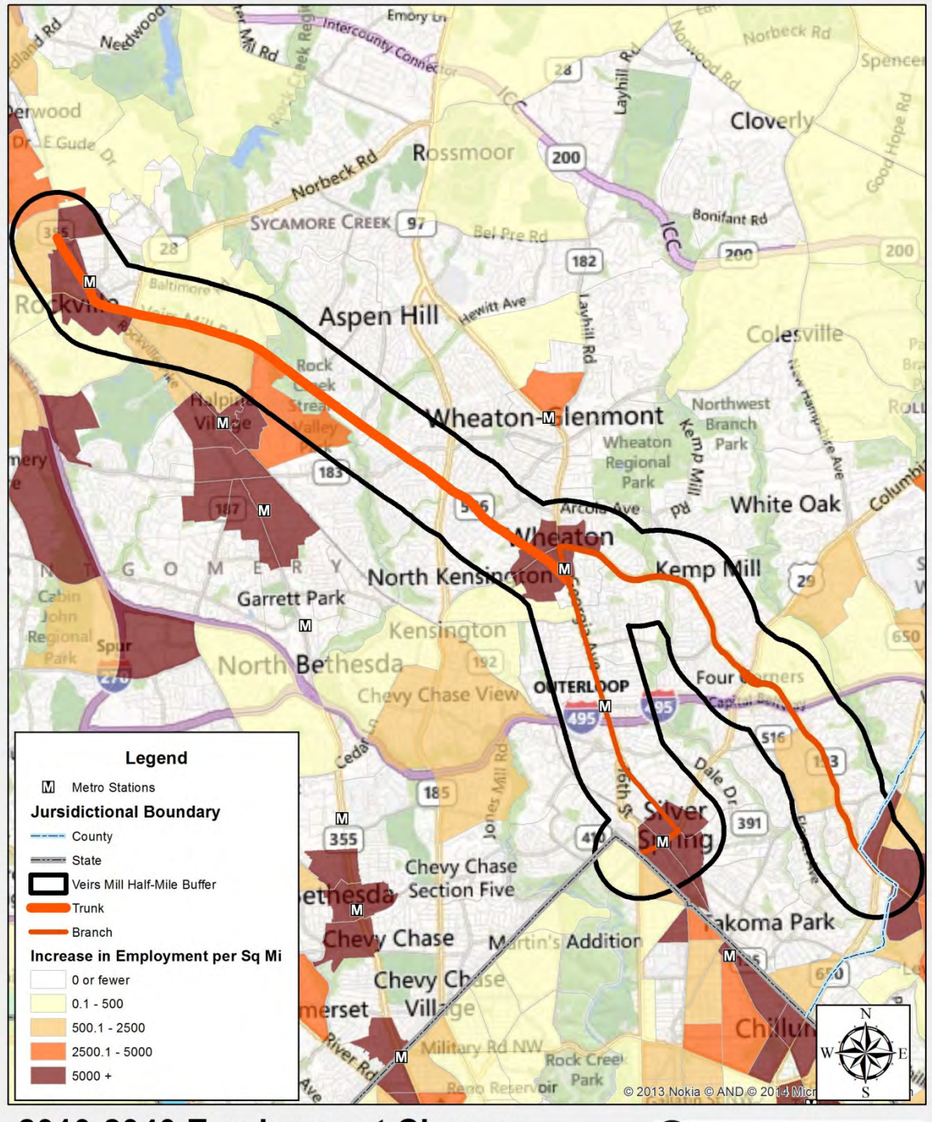


Figure 6-10 Veirs Mill Road Change in Employment Densities - Absolute (2010-2040)



Transportation Network

Existing Transit Characteristics

While serving origin and destination locations are an important element of the RTS, it is also important to facilitate transfers between the RTS and other buses and modes that operate along the corridor. There are a number of Ride On and Metrobus services that will operate either along or intersect with the Veirs Mill Road RTS. Figure 6-11 details which of these services interact with the Veirs Mill Road RTS.

Service Characteristics for Primary Routes

There are Metrobus and Ride On bus routes operating along the Veirs Mill Road corridor. Their general routes and service characteristics are described below. Average weekday ridership for each route was examined for the year spanning September 2011 to August 2012. The Metrobus Q routes and C routes that operate along the corridor have the highest ridership totals in the state. The high ridership on these routes was a key input to the RTS concepts for this corridor.

Metrobus:

- Metrobus routes Q1, Q2, Q4, Q5, Q6 are referred together as the Veirs Mill Road Line, operating between Silver Spring Metrorail station and Shady Grove Metrorail station. The buses travel along Veirs Mill between the Wheaton and Rockville stations. There are 70 bus stops along Veirs Mill Road, 35 in each direction, for an average station spacing of approximately 1,500 feet. Average weekday ridership for the Q-routes is 8,600 riders.
- Metrobus routes C2 and C4, the Greenbelt-Twinbrook MetroBus Line, operate between the Greenbelt and Twinbrook Stations, overlapping the Veirs Mill corridor between Wheaton and Randolph Road. The routes operate approximately 60 westbound trips and eastbound trips per weekday, with peak headways of 15 minutes and off peak headways ranging from 20 to 30 minutes. There are 15-minute headways between 9 AM and 3 PM on Sundays as well, with the total number of trips remaining fairly similar on weekends compared to weekdays. Average weekday ridership for the C2, C4 routes is 11,300 riders.

Major Feeder Routes and Connections

Rockville, Wheaton, and Silver Spring Metrorail stations are the termini for the feeder bus routes in this corridor. All are multimodal hubs providing heavy rail service into the urban centers and core. Table 6-4 shows the routes that currently terminate at points along the Veirs Mill Road RTS or cross the service corridor.

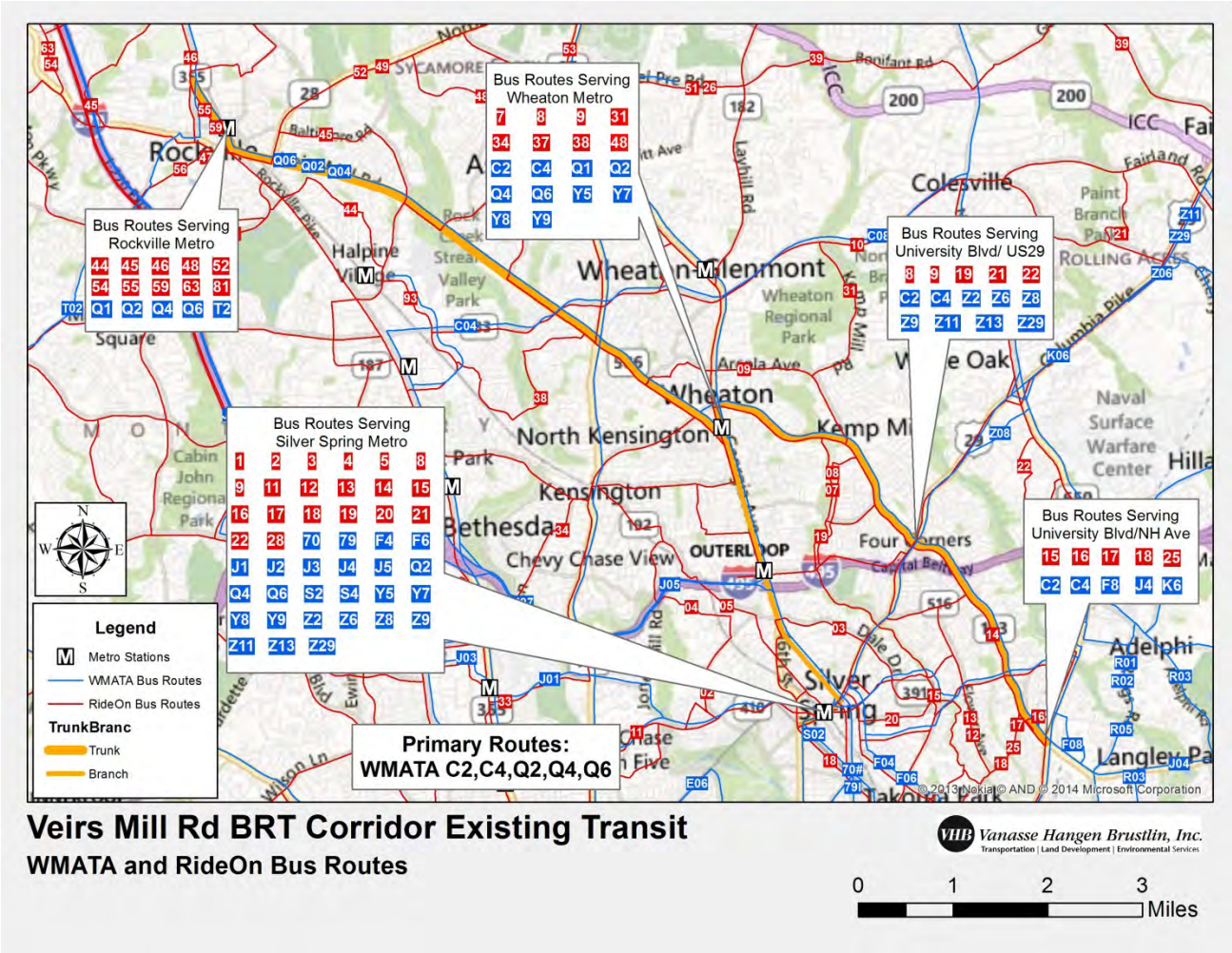
In addition to the Metrorail service, MARC commuter rail service operated peak period and peak directional service connecting Rockville and Silver Spring. There is a high rate of

transfers at the Rockville Metrorail Station between MARC and Metrorail. The Rockville Metrorail service also has Amtrak service.

Table 6-4 Bus Service Veirs Mill Road Corridor

Operator	Route Name	From	To
WMATA	60	Ft Totten Station	Georgia Ave & New Hampshire Ave
WMATA	64	Ft Totten Station	10th St & Constitution Ave
WMATA	C2	Greenbelt Station	Wheaton Station
WMATA	70	9th/10th & Constitution Av NW	Silver Spring Station
WMATA	79	NW Constitution Av & NW 9th St	Silver Spring Station
WMATA	C2	Greenbelt Station	Wheaton Station
WMATA	C4	Prince George's Plaza Station	Twinbrook Station
WMATA	F4	New Carrollton Station	Silver Spring Station
WMATA	F6	New Carrollton Station	Silver Spring Station
WMATA	F8	University Blvd & Merrim	Cheverly Station
WMATA	J1	Medical Ctr Station	Silver Spring Station
WMATA	J2	Westfield Montgomery Mall	Silver Spring Station
WMATA	J3	Westfield Montgomery Mall	Silver Spring Station
WMATA	J4	College Park UMD Station	Bethesda Station
WMATA	J5	Twinbrook Station	Silver Spring Station
WMATA	K6	Lockwood Dr & White Oak S/C	Ft Totten Station
WMATA	Q1	Shady Grove Station	Silver Spring Station
WMATA	Q2	Montgomery College	Silver Spring Station
WMATA	Q4	Rockville Station West	Silver Spring Station
WMATA	Q6	Shady Grove Station	Wheaton Station
WMATA	S2	Silver Spring Station	10th St & Constitution Ave
WMATA	S4	Silver Spring Station	10th St & Constitution Ave
WMATA	T2	Rockville Station	Friendship Heights Station
WMATA	Y5	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y7	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y8	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y9	Montgomery Gen Hospital	Silver Spring Station
WMATA	Z11	Greencastle Park & Ride	Silver Spring Station
WMATA	Z13	Silver Spring Station	Greencastle Park & Ride
WMATA	Z2	Georgia Av & Olney Sandy Spring Rd	Silver Spring Station
WMATA	Z29	South Laurel Park & Ride Lot	Silver Spring Station
WMATA	Z6	Burtonsville S/C & National Dr	Silver Spring Station
WMATA	Z8	Greencastle Park & Ride Lot	Silver Spring Station
WMATA	Z9	Burtonsville S/C & National Dr	Silver Spring Station

Operator	Route Name	From	To
Ride On	1	Friendship Heights Station	Bonifant St
Ride On	2	Lyttonville Operations Cntr.	Wayne Ave
Ride On	3	Takoma Station	Bonifant St
Ride On	4	Bonifant St	Armory -Knowles
Ride On	5	Twinbrook Station	Bonifant St
Ride On	7	Wheaton Station	Forest Glen Station
Ride On	8	Wheaton Station	Dixon Ave
Ride On	9	Wheaton Station	Wayne Ave
Ride On	10	Powder Mill Rd & New Hampshire Ave	Twinbrook Station
Ride On	11	Bonifant St	Friendship Heights Station
Ride On	12	Bonifant St	Takoma Station
Ride On	13	Bonifant St	Takoma Station
Ride On	14	University Blv E & Franklin Ave	Takoma Station
Ride On	15	Lebanon St & University Blvd	Bonifant St
Ride On	16	Bonifant St Z (Ios)	Takoma Station
Ride On	17	Bonifant St	Lebanon St & University Blvd
Ride On	18	Takoma Station	Lebanon St & University Blvd
Ride On	19	Forest Glen & Brunett Ave	Bonifant St
Ride On	20	Powder Mill Rd & New Hampshire Ave	Bonifant St
Ride On	21	Briggs Chaney Park & Ride	Dixon Ave
Ride On	22	Powder Mill Rd & New Hampshire Ave	Dixon Ave
Ride On	25	Lebanon St & University Blvd	Takoma Station
Ride On	26	Glenmont Station	Westfield Shopping Center & Montgomery Mall
Ride On	28	Ramsey Ave	Ramsey Ave
Ride On	31	Glenmont Station	Wheaton Station
Ride On	34	Wheaton Station	Friendship Heights Station
Ride On	37	Falls Rd	Grosvenor Station
Ride On	38	Wheaton Station	Westfield Montgomery Mall
Ride On	44	Rockville Station - West	Twinbrook Station - East
Ride On	45	Fallsgrove Dr	Twinbrook Station East
Ride On	46	S Campus Dr & Campus Dr	Medical Center Station E
Ride On	48	Rockville Station	Wheaton Station
Ride On	52	Montgomery Gen Hospital	Rockville Station
Ride On	54	Lakeforest Transit Center & Odendhal Ave	Rockville Station
Ride On	55	Germantown Transit Center	Rockville Station
Ride On	59	Club House Rd	Rockville Station
Ride On	63	Shady Grove Station	Piccard Dr & Gude Dr



Operator	Route Name	From	To
Ride On	81	Rockville Station t	White Flint Station

Figure 6-11 Existing Local Bus Service along Veirs Mill Road

Corridor Key Stops and Stations

The Silver Spring, Wheaton, and Rockville Metrorail stations are the heaviest used stops on the Veirs Mill Road corridor. All of the Metrorail stations are a multimodal transportation hub with off-street parking, bike racks, bike lockers, and car sharing opportunities on site.

The bus stops at the intersections of Veirs Mill Road with Randolph Road, Connecticut Avenue, US 29 are all key stops and provide access to local and RTS bus routes. The stops provide a shelter, seating, and passenger information. Sidewalks and crosswalks are provided on all sides of the intersections.

In addition to the Metrorail stations, the following high demand stops were identified with greater than 200 boarding or alightings per day. These key stops include:

- Atlantic Avenue
- Randolph Road
- Ferrara Avenue
- Connecticut Avenue
- University Boulevard
- Four Corners
- University Boulevard and Piney Branch Road
- Takoma-Langley Park Transit Center

Table 6-5 displays the boardings and alightings associated with the stops discussed above. The figures for the ridership were pulled from the data that was supplied from Montgomery County.

Table 6-5 Key Bus Stop Ridership

Stop	Boardings	Alightings
Montgomery College	1,350	1,275
Rockville Station	6,750	5,950
Veirs Mill Rd. & Atlantic Ave.	200	200
Veirs Mill Rd. & Randolph Rd.	1,000	800
Veirs Mill Rd. & Ferrara Ave.	200	200
Veirs Mill Rd. & Connecticut Ave.	400	400
Veirs Mill Rd. & University Blvd.	800	1000
Wheaton Station	3,850	3,600
Four Corners.	1,400	1,100
University Blvd. & Piney Branch Rd.	950	700
Takoma-Langley Park Transit Center	2,700	2,250
Georgia Ave. & Colesville Rd,	750	650
Silver Spring Transit Center	7,000	7,000

Other Transit

There are three Metrorail stations located on the Veirs Mill Road corridor; all are located on Metrorail's Red Line, which provides access to downtown Washington, DC. The Rockville station is located along the Red Line segment that travels through the western side of the County and terminates at Shady Grove. The Wheaton and Silver Spring Metrorail stations are located on the eastern end of the Red Line. This segment includes connections to the Metrorail Yellow and Green Lines and the future Purple Line.

RTS Concept

Summary of CTCFMP Service

In the Planning Board draft of the *Countywide Transit Corridors Functional Master Plan* (CTCFMP), ridership estimates for the Veirs Mill Road corridors were calculated under different scenarios for the year 2040. The scenarios test different transitway treatments for their impacts on ridership but only for the draft plan portion of the RTS that travels between the Rockville Metrorail station and the Wheaton Metrorail station. The ridership was approximately 8,000 riders per day. There are current Metrobus routes that serve the corridor and carry more riders. The draft report did not consider route realignments. The extension of the service and integration with the other RTS corridors would be expected to increase ridership. Although the mode shift from SOV to transit may not dramatically increase the number of transit riders in the corridor, the current transit mode share can make this RTS line viable.

The approved CTCFMP does not prescribe the type of busway treatment (i.e., curb vs. median), but instead states the number of lanes and right-of-way required. The approved plan busway treatment will be determined in later studies. For the Viers Mill Road RTS the more important characteristic will be the level of service and service integration concept of this RTS route connecting all of the RTS corridors.

Recommended Service Plan

The recommended service concept for the Veirs Mill Road corridor is to extend the draft plan service from the Rockville Metrorail station to Montgomery College. The Rockville campus for Montgomery College is the main campus and serves the most students. Although the access to the school is not a diversion from MD 355, having it as a termini for the Veirs Mill Road RTS creates a good stopping and starting point while not degrading the RTS concept. The school has heavy transit use and having the RTS termini there allows for serving a population that is often transit dependent. The stop also will serve as a transfer point for the MD 355 RTS. One of the goals of this study was to identify service integration concepts. The Veirs Mill RTS will integrate with both the MD 355 trunk and branch RTS routes.

The main trunk line from Montgomery College to Wheaton will have 10 minute headways. The service will connect the two branches of the Metrorail Red Line. East of Wheaton this route will split into service towards Silver Spring using the Georgia Avenue RTS routing and service to Langley Park using the University Boulevard RTS routing. The Georgia Avenue RTS will also split into two branches south of Wheaton. Both the Veirs Mill Road RTS and the Georgia Avenue RTS will have 10 minute frequencies, so that the effective headways on the branches will remain 10 minutes.

The planned highway improvements in the corridor include the extension of Montrose Parkway from Parklawn Drive to Veirs Mill Road. There are no proposed improvements on Georgia Avenue south of Wheaton. The RTS would provide an alternative to single occupancy vehicle travel and a high quality transit connection to serve the planned growth in the corridor. It can be a good supplement to the limited highway improvements in the corridor.

The planned transit improvements in the corridor include BRT between the Wheaton Metrorail station and the Rockville Metrorail station. There is also the construction of the

Purple Line which will provide an opportunity to have the segment between Piney Branch Road and the Langley Park Transit Center share guideway if the tracks are embedded in the pavement. This would benefit both the Purple Line and the RTS by allowing for the two high quality transit lines to merge. The overall benefit would be to the transit riders allowing for easy connections to between the RTS and the Purple Line.

Key Locations

With the route operating between the Montgomery College, Rockville Campus, and the Wheaton Metro station, the total route length for the Veirs Mill RTS service will be 7.52 miles. This will be the "trunk" portion of the route, as two branches of the Veirs Mills RTS will continue past the Wheaton Metro Station, alternating between the Silver Spring Metro station and the Takoma/Langley Park Transit Center. A subsequent section of the recommended service plan section titled "Branches and Overlaps" will describe the service that will utilize this corridor but continue past Wheaton to both Silver Spring Metro station and the Takoma/Langley Park Transit Center. The stop locations for service beyond the Veirs Mill Road corridor should be similar to those identified in the draft CTCFMP for Georgia Avenue south and University Blvd.

The location of RTS stops is an important factor in the success of the RTS system. Stops that are located at, or within a reasonable proximity to, transit generators – in terms of both residential origins and commercial, medical, government or other destinations – will assist the initial marketing of the service and with ongoing ridership growth. For the Veirs Mill RTS service, the stops have been delineated by Montgomery County's Functional Master Plan. The plan presented 11 stops along the Veirs Mill Road corridor between the Rockville Metro station and the Wheaton Metro station. A 12th stop has been added to the route to provide service to the Montgomery College. The stop locations range in distance between one and another from 0.32 to 1.25 miles, with an average stop distance of 0.68 miles (0.63 miles along the trunk), which falls between the desired stop distance range of 0.50 and 0.75 miles. The stop locations and their distances are displayed in Table 6-7.

Table 6-7 Stop Locations and Distances for Veirs Mill Road

	From	To	Segment Distance (miles)
Trunk	MD 355 and Mannakee Street/Montgomery College – Rockville Campus	Rockville Metro Station	0.929
Trunk	Rockville Metro Station	MD 586 and Norbeck Road	0.64
Trunk	MD 586 and Norbeck Road	MD 586 and Broadwood Drive	0.793
Trunk	MD 586 and Broadwood Drive	MD 586 and Twinbrook Parkway	0.689
Trunk	MD 586 and Twinbrook Parkway	MD 586 and Aspen Hill Road	0.494
Trunk	MD 586 and Aspen Hill Road	MD 586 and Parkland Drive	0.86
Trunk	MD 586 and Parkland Drive	MD 586 and Randolph Road	0.64
Trunk	MD 586 and Randolph Road	MD 586 and MD 185	0.54
Trunk	MD 586 and MD 185	MD 586 and Newport Mill Road	0.69
Trunk	MD 586 and Newport Mill Road	MD 586 and MD 193	0.62
Trunk	MD 586 and MD 193	Wheaton Metro Station	0.36
Branch 1	Wheaton Metro Station	MD 193 and Amherst Avenue	0.47
Branch 1	MD 193 and Amherst Avenue	MD 193 and Inwood Avenue	0.753
Branch 1	MD 193 and Inwood Avenue	MD 193 and Arcola Avenue	0.758
Branch 1	MD 193 and Arcola Avenue	MD 193 and Dennis Avenue	0.574
Branch 1	MD 193 and Dennis Avenue	MD 193 and US 29	0.55
Branch 1	MD 193 and US 29	MD 193 and E Franklin Avenue	0.84
Branch 1	MD 193 and E Franklin Avenue	MD 193 and Piney Branch	1.102
Branch 1	MD 193 and Piney Branch	Takoma/Langley Park Transit Center	0.722
Branch 2	Wheaton Metro Station	MD 97 and Dexter Avenue	1.136
Branch 2	MD 97 and Dexter Avenue	Forest Glen Metro Station	0.453
Branch 2	Forest Glen Metro Station	MD 97 and Seminary Road	0.523
Branch 2	MD 97 and Seminary Road	MD 97 and Cameron Street	0.961
Branch 2	MD 97 and Cameron Street	Silver Spring Transit Center	0.377
		Total Trip Distance Branch 1 Total Trip Distance Branch 2	13.1 10.8
		Average Stop Distance	0.69

Service Span and Frequency

The level of service including operating hours and headways for the RTS service have to be at a premium level in order to meet passenger demand and obtain high ridership levels. Ideally, the RTS service concept would operate from the early morning until late at night, with 10 minute headways or less. Ten-minute headways provide a level of service that does not require the need to check a schedule and the wait times between vehicles is understood to be frequent enough to meet a rider's expectations. This frequency falls in the middle of the range of headways for rapid transit systems in North America and is a reasonable headway expectation for a new service. As service demand increases along the corridor, headways can be further reduced to accommodate the growing demand. The service span was designed to complement and match Metrorail service spans. The initial Veirs Mill Road RTS levels of service for the fully built-out system are displayed in Table 6-8.

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Table 6-8 Veirs Mill Road Levels of Service

Period	From	To	Span of Service	Headways	
				Peak	Off-Peak
Weekday	Montgomery College	Transit Center (Silver Spring, Langley Park)	6AM-12AM	10	10

Table 6-9 provides a comparison of headway and travel speed savings associated with the Veirs Mill Road RTS service. These savings are a comparison between existing local service and the trunk portion of the RTS corridor. The travel speed savings are based on figures for estimated travel speeds from the *Federal Transit Administration's Characteristics of Bus Rapid Transit for Decision Making*.

Table 6-9 Comparison of Headway and Travel Speeds

Service	Headway (minutes)			Speed (mph)		
	AM	Off-peak	PM	AM	Off-peak	PM
Existing[1]	10	15	9	14.0	13.3	12.3
Veirs Mill Road RTS[2,3]	10	10	10	18.0	20.0	18.0
Difference		5		4.0	6.7	5.7
Percent Travel Time Savings				29%	50%	46%

1. Headway and speed based on Metrobus C2, Q2 and Ride On 8 published schedule.

2. Headway is for the trunk portion of the corridor

3. Speed estimate is provided for the trunk portion of the corridor based on type of running way, location, and time of day

The service concept plan initially would have the Veirs Mill Road RTS service offered between the hours of 6 AM and midnight from Montgomery College to both Silver Spring and Langley Park with at least 10 minute headways in the peak and off peak periods. As the service develops these hours should be re-evaluated and shifted to respond to the demand.

Branches, Overlaps, and Deviations

The trunk portion of the Veirs Mill RTS service will operate between the Montgomery College and the Wheaton Metro station, with additional service provided from Wheaton to both Silver Spring Transit Center and the Takoma Langley Transit Center. As a result the portion of the corridor between Montgomery College and the Wheaton Metrorail station will have the highest level of service. The portion of the route from Montgomery College to the Rockville Metrorail station will also overlap with the MD 355 RTS service, providing an additional layer of service between Rockville and Montgomery College.

As described, three buses per hour (20-minute headways) from Montgomery College, using MD 355 and Veirs Mill Road, will continue on University Boulevard past Wheaton to the Langley Park Transit Center. The other three trips per hour (20-minute headways) will operate from Montgomery College, using MD 355 and Veirs Mill Road, and will continue on Georgia Avenue past Wheaton to the Silver Spring Metro station. This service will operate in the infrastructure identified in the CTCFMP Georgia Avenue. These two branches, operating every 20 minutes, will provide 10 minute effective headways along the "trunk" of the route, between Montgomery College and Wheaton Metro station. The branch service will be supplemented with service from the Georgia Avenue RTS so that the effective headway on the branches and trunk will be 10 minutes.

Integration with Local Service

RTS along the Veirs Mill Road corridor would be complemented by some of the existing service provided by Metrobus and Ride On. Currently, the Metrobus C2 and C4 as well as the Q routes and Ride On Route 26 provide service along some portions of the corridor. The following would be an operational consideration once the Veirs Mill Road RTS is implemented:

- Metrobus Route Q2 could serve as the local option between Montgomery College and Silver Spring.
- Metrobus Routes Q4, Q5 and Q6 could be modified in conjunction with MD 355 RTS.
- Metrobus Routes C2 and C4 could continue to operate as they do today and provide local service between Wheaton and Langley Park.
- Metrobus Route C4 and Ride On Route 26 could use the median busway along Veirs Mill Road for the limited segments where they interline.

Fleet Requirement

Based on the recommendation to join the Veirs Mill Road and University of Boulevard corridors, and create the trunk and two secondary branches, the following vehicle requirements are estimated based on the prescribed headways. During peak service, the requirement would be 25 vehicles, including spares. This would drop to 15 vehicles during the off-peak based on the improved travel times[4].

[4] These figures are based on an 11.8 mile long trunk service, and 12.6 and 9.0 mile long branch services. Peak period speeds are assumed to be 17 mph during peak service and 19-21 mph during off-peak service. Spare ratio is 1.2 times the total vehicle requirement.

Operational Hours

A planning-level estimate of the hours of service that would be required to operate the service concept was developed for the Veirs Mill Road RTS. The estimate of operating hours was developed based on the assumptions related to the travel speed that could be achieved associated with various BRT treatments discussed in the draft plan. These assumptions are not being recommended for implementation, but were necessary to produce an estimate of the number of hours that would be required to operate the service.

The assumed speeds allowed for a calculation of the number of vehicles that would be required to operate the service using the prescribed headways discussed above. These assumptions result in typical weekday of 325 service hours. This calculates to roughly 100,000 annual service hours. The deadhead hours (i.e., hours to and from the bus garage) have been factored to 15 percent of the revenue hours, which equates to approximately 115,000 total vehicle hours.

Corridor Outcome and Summary

The implementation of RTS service along the Veirs Mill Road will provide a high quality transit link from east-to-west through central Montgomery County. The service will link persons in residential areas with educational resources, employment, and commercial centers in Rockville, Wheaton, Silver Spring, and Langley Park. It will also provide high frequency, high speed connections to Metrorail as well as all of the other RTS corridors, providing access to other regional job centers. The Veirs Mill Road corridor will not only support the residents that live along the corridor by providing and improved travel alternative, but it will also support the future growth and redevelopment of areas such as Wheaton and Langley Park. These are areas that are seeking to become more transit oriented and less dependent on single occupancy automobiles.

New Hampshire Avenue Corridor Service Plan

The conceptual service plan for the New Hampshire Avenue corridor is based on an earlier RTS draft corridor plan for New Hampshire Avenue as outlined in the Montgomery County Planning Department's *Countywide Transit Corridors Functional Master Plan Planning Board Draft* from July 2013[1]. This concept focuses on connecting the activity centers, multimodal transit nodes, as well as providing transportation opportunities along New Hampshire Avenue from Colesville to Fort Totten.

General Corridor Overview

The Draft Functional Master Plan shows the New Hampshire Ave corridor; running primarily north to south from the Colesville park and ride lot, which is just north of Randolph Road, to the Fort Totten Metrorail station in the District of Columbia. The corridor is 10 miles long and runs through the unincorporated areas of Langley Park, Hillandale, White Oak, and Colesville. This route operates across two counties and into the District of Columbia. Only about 1.5 miles of the route are in the District of Columbia. The route is a regional route connecting the different jurisdictions and will require coordination between them.

Figure 7-1 New Hampshire Avenue RTS Corridor

The purpose of the New Hampshire Avenue RTS is to provide a new, faster transit option connection between Fort

[1] The July 2013 Planning Board Draft of the Countywide Transit Corridors Functional Master Plan was the current plan at the outset of this study. The Draft has been reviewed and adopted with minor changes made by the County Council since the completion of the major planning efforts of this study. These changes have not been reflected because of the schedule of the study, but have been noted where differences occur between the Planning Board Draft and the Adopted Plan.

Totten with Takoma/Langley Park, White Oak, and Colesville. Land uses along the corridor are primarily auto-oriented and low-density, with patterns transitioning between mostly residential and retail-focused commercial moving from Fort Totten north towards White Oak.

The following section will provide an overview of the land use characteristics, key activity centers, existing demographics, and any future land use changes that could have an impact on the proposed RTS service. The existing and future land use patterns play a large role in informing the type of service that could be supported. The connection between land use and transit is strongly documented. If a corridor is currently low-density with no capacity or plans for intensifying land uses, recommending a higher level of transit will likely not be as successful. Conversely, there are currently corridors that display land use patterns that might support higher capacity transit.

Identifying major generators also assist in providing the initial framework for stop spacing and other locational requirements. The type and size of generators along a corridor and the associated existing and future travel patterns provide the basis for the level of transit service suitable for that corridor. Corridors with a high concentration of employment at one end would expect to see a very peaked and directional flow of transit riders, while a corridor with a greater density and mix of uses spread along the entire length of the corridor could expect a more evenly spread out and bi-directional transit ridership pattern.

Lastly, the use of demographic data to identify areas of need and forecast demand for transit, is one of the last pieces in any analysis. There is a strong connection between demand for transit services and higher population and employment density. Similarly, there are particular groups who have a greater propensity for using transit service. Identifying these "transit-supportive" demographic groups can help better frame the type of service needed.

Existing Sources of Activity

The following activity centers are along the New Hampshire Avenue corridor between Fort Totten and Colesville:

- Colesville Park and Ride
- White Oak Shopping Center
- Food and Drug Administration Research Buildings
- National Labor College
- Hillandale Shopping Center
- Langley Park Plaza Shopping Center
- Takoma Park Plaza Shopping Center
- Fort Totten Metrorail Station

Existing Demographics

In order to better understand the potential for the transit use, market demographic data within a half-mile boundary around the proposed New Hampshire Avenue RTS line was compiled using based the 2011 American Community Survey data. The data is summarized in Table 7-1. The table also lists the County totals for each characteristic so as to provide

context of how the corridor relates to the County as a whole. Based on these figures, the New Hampshire Avenue corridor represents roughly 10 percent of the County's population. The corridor earns significantly less per household and has more households below the poverty line than Montgomery County overall. The corridor also has a significantly higher percentage of commuters using transit compared to the County as a whole. The higher commuter transit mode share and high percentage of households with no vehicle available creates an environment where high-quality transit can be successful.

Table 7-1 Demograhic Data for New Hampshire Avenue Corridor

Census Group	New Hampshire Avenue Corridor	Montgomery County
Population	102,243	959,738
Male (%)	51.5%	48.0%
Female (%)	48.5%	52.0%
Median Age	35.6 years	40.5 years
Workers 16 years and older	55,029	508,645
Public transit is primary means of travel to work (% of workers 16 and older)	11,723 (21.3%)	77,077 (15.2%)
Households	32,886	355,434
Avg. Annual Median HH Income	$74,313	$111,751
Below the poverty line (Households)	3,646 (11.1%)	20,712 (5.8%)
Non-vehicle ownership (Households)	4,640 (14.1%)	29,018 (8.2%)
Source: 2007-2001 American Community Survey 5-Year Estimates		

Existing Land Use

The New Hampshire Avenue corridor from Fort Totten to Colesville vacillates between auto-oriented, low-density retail development and low-density residential areas. There are a few commercial parks such as the National Labor College and the Food and Drug Administration campuses, but these are not indicative of the corridor. The majority of residential development is a mix of low-rise apartment buildings, single family homes, and townhouses. The commercial development in this corridor tends to be strip retail centers with ample parking and large distances from store fronts to the arterial roadway. While there are some high-density residential (New Hampshire Avenue and Merwood Drive) and transit-accessible retail (intersection with University Boulevard) are the exceptions along the corridor, on the whole, the corridor's characteristic low-density development does not make it easy for travelers to use transit.

Planned Land Use Changes

There are several sector plans along the New Hampshire Corridor that have land use and transit implications.

Takoma Langley Crossroads Sector Plan

The plan promotes a vision of the area being "a transit-oriented, pedestrian-friendly community that celebrates and builds on the cultural diversity of the Crossroads community." The plan includes accommodations for an eventual connection to the Purple Line, as well as a state-led effort to construct a bus transit center that will consolidate 8 bus

stops. These have been noted as the most significant opportunities to encourage development that emphasizes walking, bicycling, and public transit use.

All commercially zoned and developed properties were approved as Commercial Residential-Town (CRT) Zones. This provides flexible uses with some restrictions on commercial and flexible residential. Density is limited to between 0.5 and 4.0 FAR and 150 feet in height.

Long Branch Sector Plan

Recommendations for this community of older, neighborhood-oriented commercial areas and a mix of single-family and multifamily housing is one in a series of land use plans that set design and development patterns in Purple Line station areas. The plan recommends new mixed-use zoning and varied-housing options. Transit stations at Arliss Street and University Boulevard are expected to spur redevelopment and reinvestment. The plan includes a recommendation to designate the Flower Theater and Shopping Center as a historic site, placing it on the county Master Plan for Historic Preservation.

White Oak Science Gateway Master Plan

The plan area includes several major properties and developments, the largest of which is the 610-acre Federal Research Center. The FDA occupies 130 acres of the FRC and now has 5,500 employees on site. FDA is planning for significant growth on its campus with increase between 10,000 and 15,000 more jobs.

Adventist HealthCare plans to build a new Washington Adventist Hospital and medical campus on nearly 50 acres along Plum Orchard Drive (pending approval of a Certificate of Need from the State).

Approximately 300 acres on two sites near the FRC and Washington Adventist Hospital may provide the possibility of new housing and retail near jobs. The plan also provides recommendations for the National Labor College (located on 46 acres at New Hampshire Avenue and the Beltway), and the White Oak and Hillandale shopping centers.

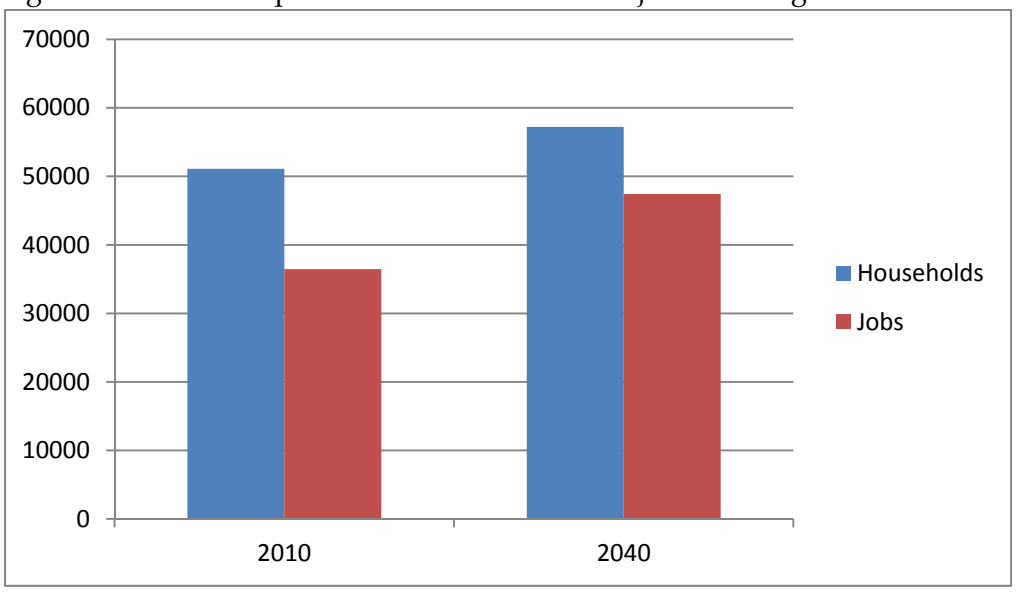
The Metropolitan Washington Council of Governments Cooperative Land Use Forecast Round 8.2 shows how the corridor is projected to change between 2010 and 2040. The land use forecast shows development that has been approved and can be expected to occur. Unlike the proposed updates to master plans, the land use forecast represents a development that is already planned for and in some areas occurring.

Figure 7-2 shows the total corridor change in households and employment from 2010 to 2040. Table 7-2 shows the total corridor household and employment densities along the New Hampshire Avenue corridor. The table provides details about the lowest and highest observed values as well as the average value for the corridor. These values can be compared against values for residential and non-residential densities as reported in the Institute for Transportation Engineers (ITE) article, *A Toolbox for Alleviating Traffic Congestion*, shown in Table 7-3.

The data in Table 7-3 represents land area that can be developed, versus gross land area in the Transportation Analysis Zone (TAZ) plots. Land that can be developed would exclude parks and wetlands in the TAZ. Since most of the TAZs along the corridor cover land that

can be developed, the ITE data in Table 7-3 provides an approximate guide for understanding potential service levels. A land use density threshold for transit supportive areas on gross land area used in other local planning studies in the region is three households per gross acre and/or four jobs per gross acre. Based on the maximum values in the land use forecast, the corridor could support bus service at a 10 minute frequency, although the future Purple line service should also be considered in future corridor and service planning efforts.

Figure 7-2 New Hampshire Avenue Corridor Projected Changes



The figures on the following pages show the household density (households per square mile) and employment density (employees per square mile) in 2010 and the forecasted density for year 2040. Figures 7-7 through 7-10 show the changes in density from 2010 to 2040 for both households and employment. The changes are shown both in the percent change, allowing for the observation of greatest change over the 30-year period; and absolute change, which shows the magnitude in the change.

Table 7-2 New Hampshire Avenue Corridor Household and Employment Densities (2010 & 2040)

	2010 Household Density (HH/Acre)	2040 Household Density (HH/Acre)	2010 Employment Density (Emp/Acre)	2040 Employment Density (Emp/Acre)
Minimum	0	0	0	0
Maximum	19	21	18	19
Average	5	6	3	5

Table 7-3 ITE Residential and Non-residential Densities for Transit Service[2]

	Frequency (20-hour service day)	Dwelling Units per Acre	Employees per Acre
Bus	1 bus/hour	4-5	50-80
Bus	1 bus/30 minutes	7	80-200
Bus	1 bus/10 minutes	15	200-500
Light Rail	Every 10 minutes	35-50	500+

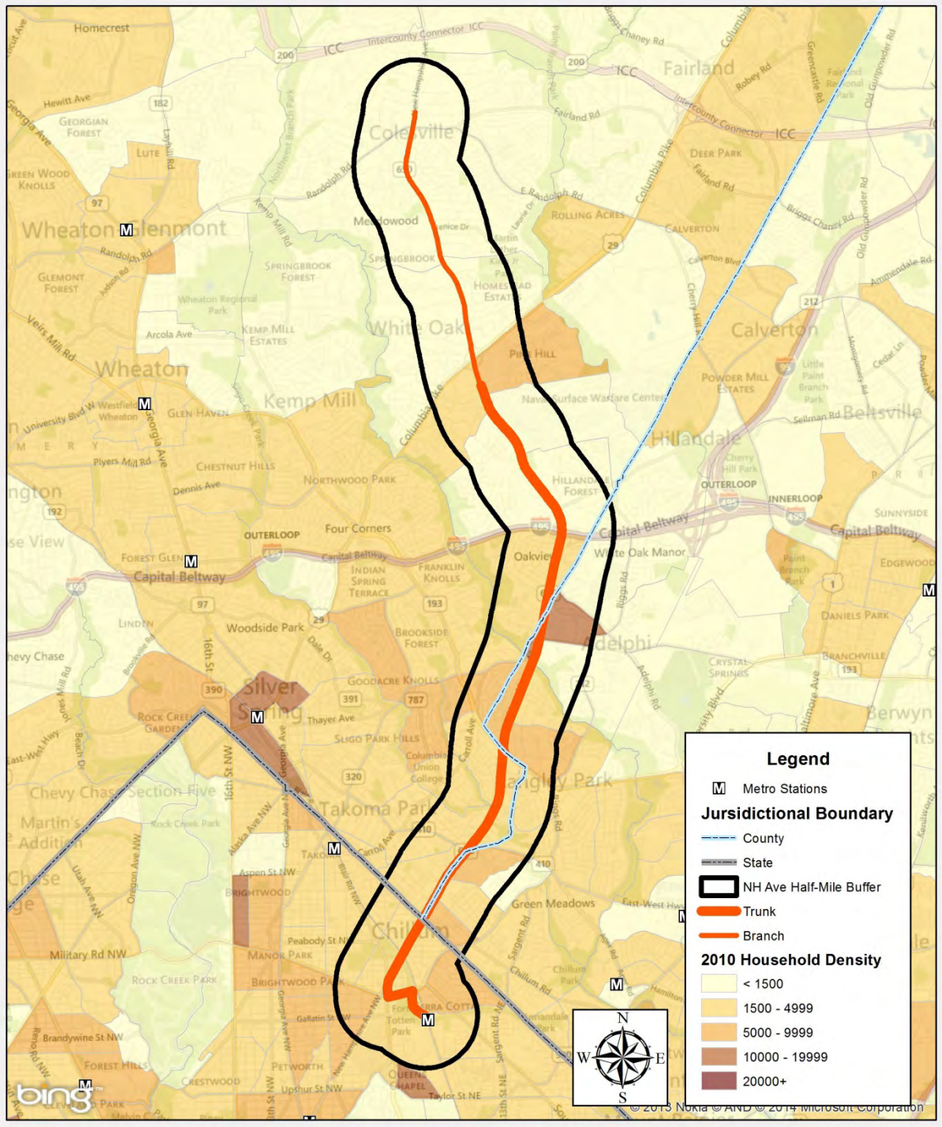
The master plan updates for subareas along the corridor show areas that are increasing in employment and household densities with a focus on sustainable development. While some early phases of the RTS, or transition services, may become operational within the next few years, most of the major infrastructure improvements associated with the RTS will require more than a few years to build. Research has indicated that bus rapid transit can impact land use along a corridor and help development and economic activity. The findings of this research indicate that good land use planning are a key aspect of ensuring that an area will develop into a walkable, mixed-use corridor that can support high-quality transit[3]. The right type of development will help ensure that the proposed RTS along the New Hampshire Avenue corridor can have the potential for high ridership both in the peak and the off-peak periods.

Figures 7-3 and 7-4 on the following pages show the household density (households per square mile) in 2010 and the forecasted density for 2040. Mild growth is projected all along the corridor, but with the most employment and population growth centered in the Langley Park and Tacoma Park areas. Figures 7-5 and 7-6, on the following pages, show the employment density for 2010 and the forecasted employment density for 2040. Figures 7-7 and 7-8 show the actual percent change between 2010 and 2040 for households and employment, respectively. Figures 7-9 and 7-10 show the absolute change between 2010 and 2040 for households and employment, respectively.

[2] Institute of Transportation Engineers, A Toolbox for Alleviating Traffic Congestion, 1989.

[3] More Development for Your Transit Dollar: An Analysis of 21 North American Transit Corridors, Institute for Transportation & Development Policy,

Figure 7-3 New Hampshire Avenue Household Densities (2010)



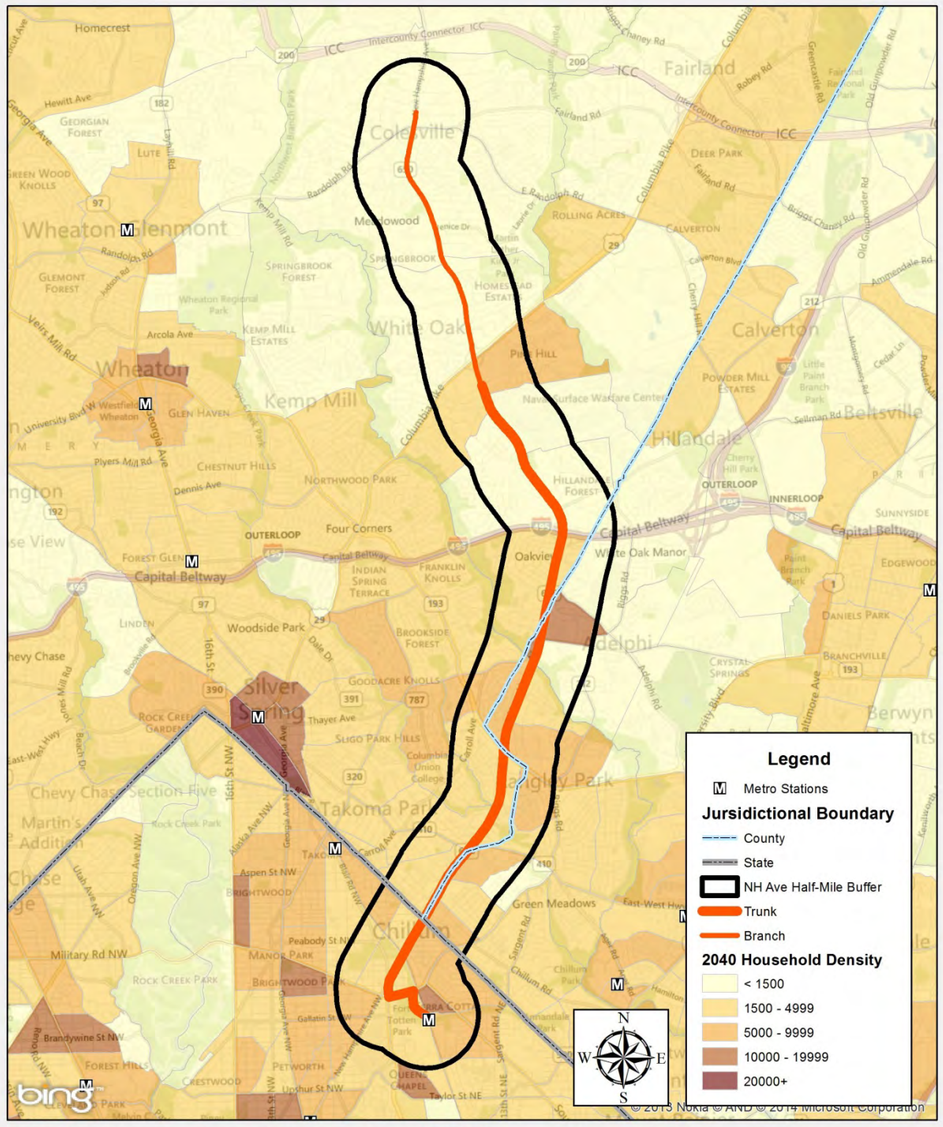
2010 Household Density (HH/sq mi)

New Hampshire Avenue BRT Corridor

VHB Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 7-4 New Hampshire Avenue Household Densities (2040)



2040 Household Density (HH/sq mi)

New Hampshire Avenue BRT Corridor

VHB Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 7-5 New Hampshire Avenue Employment Densities (2010)

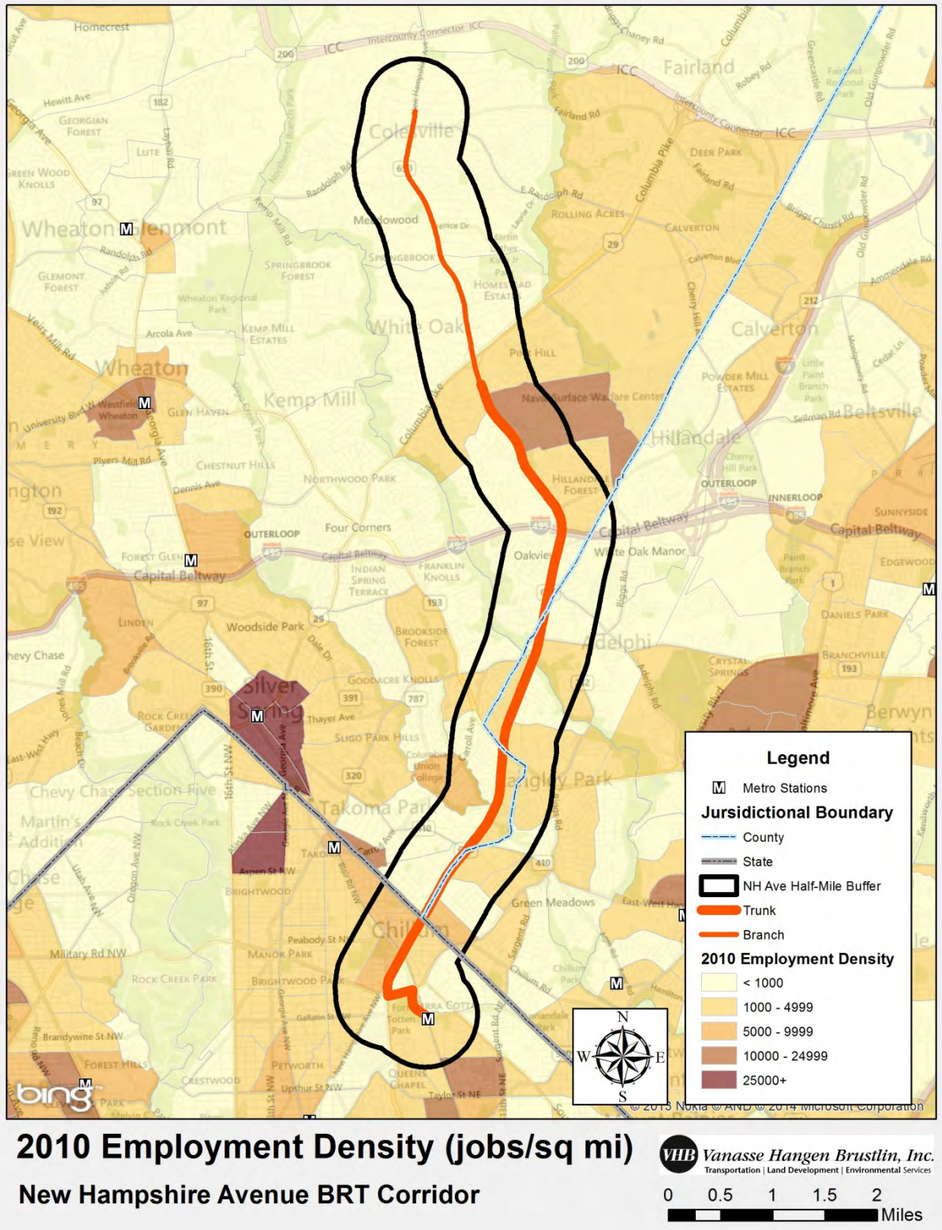


Figure 7-6 New Hampshire Avenue Employment Densities (2040)

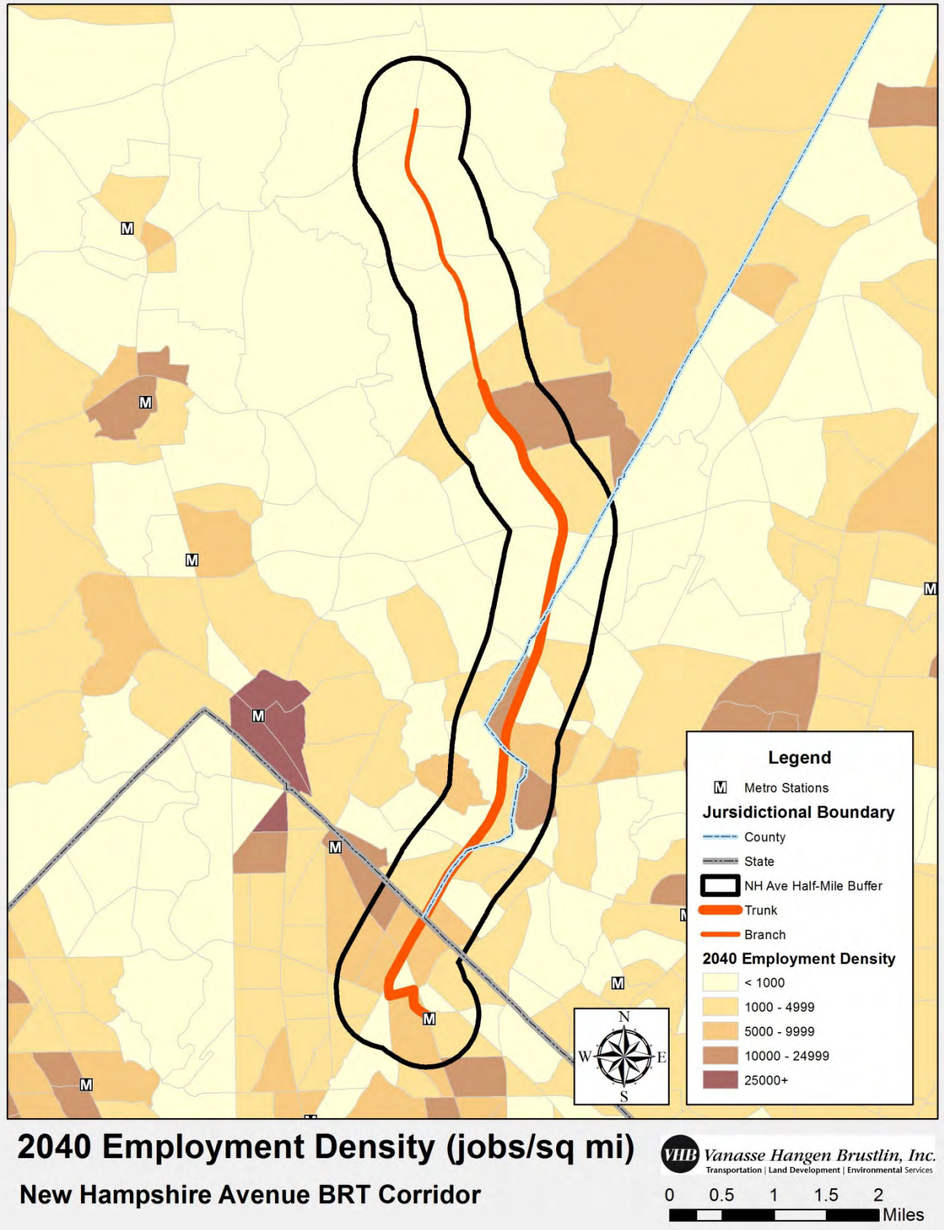
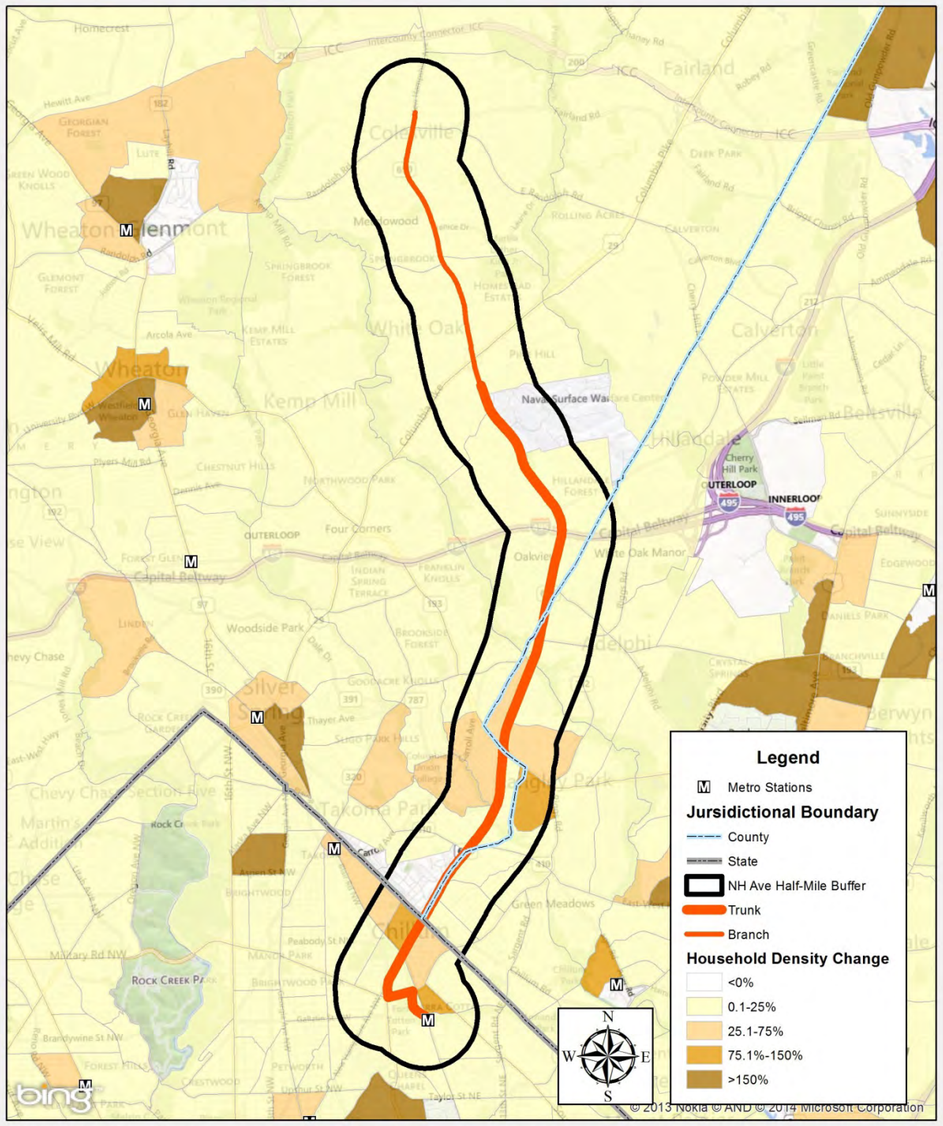


Figure 7-7 New Hampshire Avenue Change in Household Densities - Percent (2010-2040)



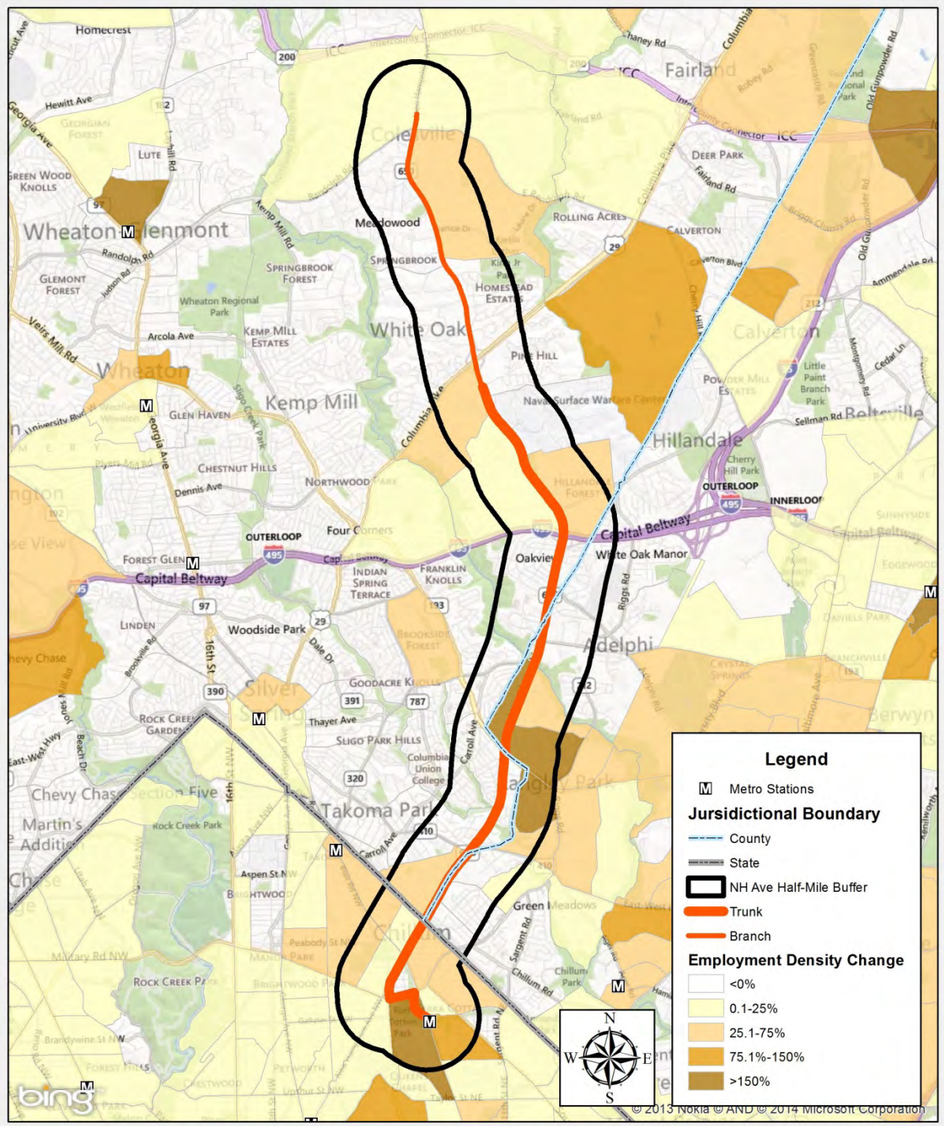
2010-2040 Household Density Change

New Hampshire Avenue BRT Corridor

Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 7-8 New Hampshire Avenue Change in Employment Densities - Percent (2010-2040)



2010-2040 Employment Density Change

New Hampshire Avenue BRT Corridor

Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 7-9 New Hampshire Avenue Change in Household Densities - Absolute (2010-2040)

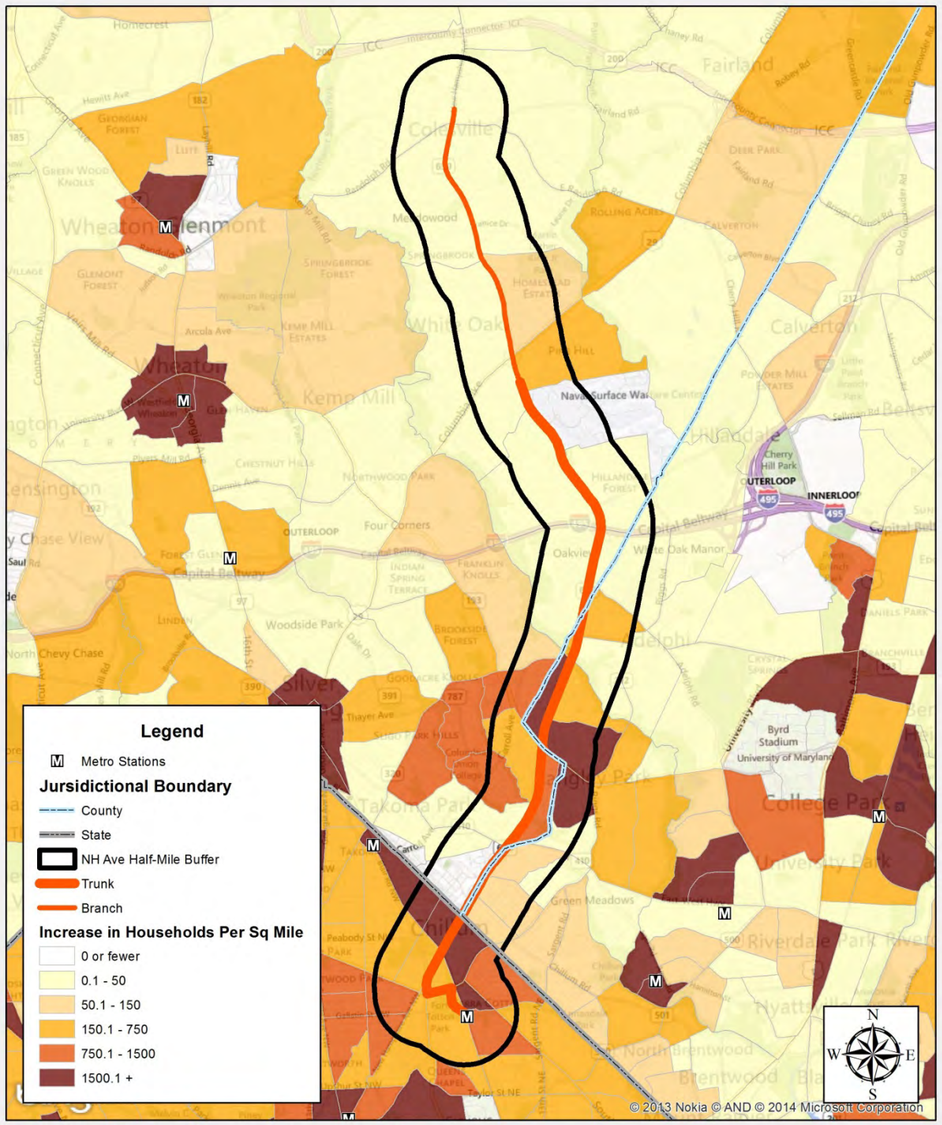
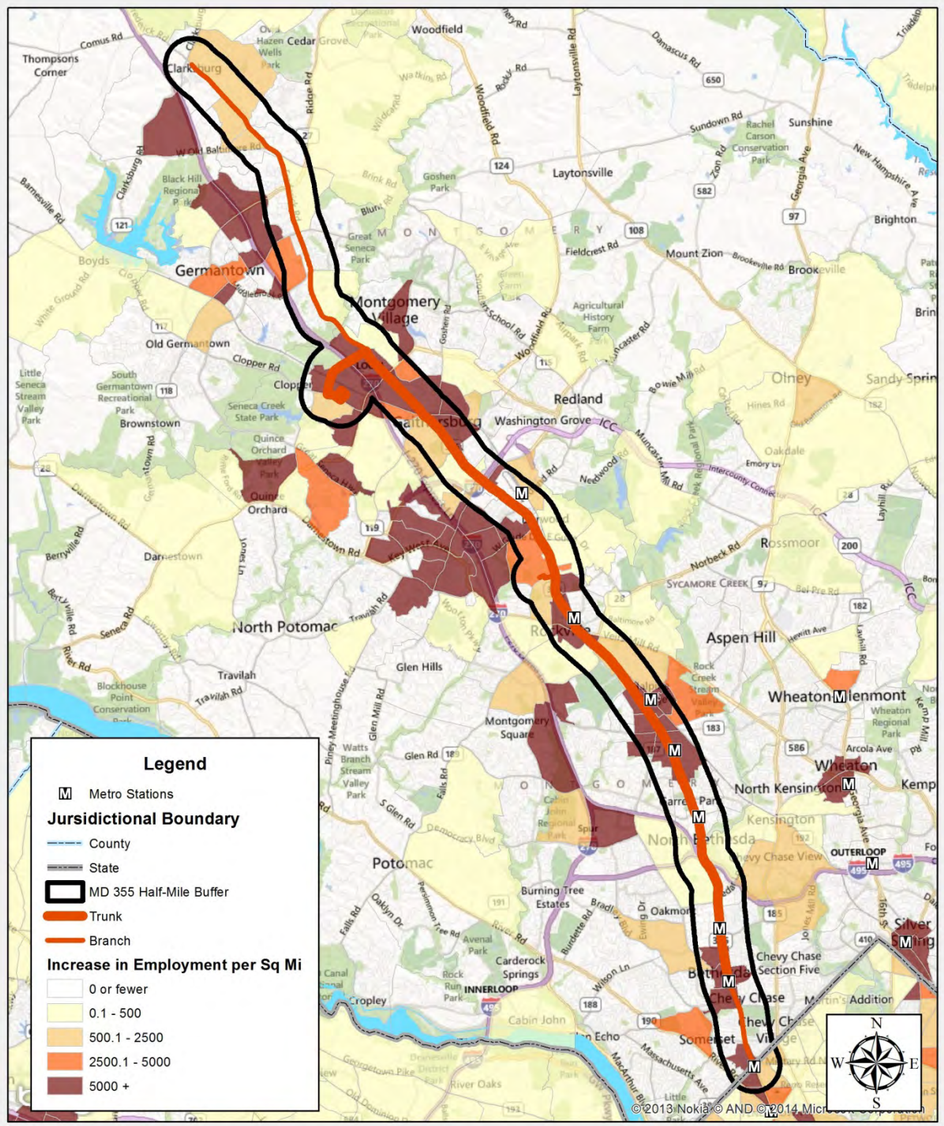


Figure 7-10 New Hampshire Avenue Change in Employment Densities - Absolute (2010-2040)



Transportation Network

Existing Transit Characteristics

While serving origin and destination locations are important elements of the RTS, it is also important to facilitate transfers between the RTS, other buses and modes that operate along the corridor. There are a number of Ride On, Metrobus and MTA commuter services that operate either along or intersect with New Hampshire Avenue. Figure 7-11 details which of these services interact with the New Hampshire Avenue RTS.

Service Characteristics for Primary Routes

There are Metrobus and Ride On bus routes operating on the corridor. Their routes and service characteristics are described below. Average weekday ridership for each route was examined for the calendar year spanning September 2011 to August 2012[4].

Metrobus:

- Metrobus C8 connects the White Flint and College Park Metrotrail stations. The C8 operates along New Hampshire Avenue from US 29 to a half-mile south of the Capital Beltway. It averages almost 3,000 weekly riders both east and west.
- Metrobus K6 operates on almost the entire length of the New Hampshire Avenue Corridor. It runs from the White Oak Shopping Center at US 29 to and from the Fort Totten Metro station.
- The new K9 service provides a skip-stop service that is a faster alternative to the K6 in the peak periods. The service operates between White Oak and Fort Totten. The service has been very successful in its initial operations with close to 1,000 average weekday riders.

Montgomery County Ride On:

- Route 10 – Operates along New Hampshire Avenue from US 29 to the Capital Beltway. The remainder of the route connects to MD 355 via Randolph Road. The 10 has more than 2,200 average weekly riders.

Major Feeder Routes and Connections

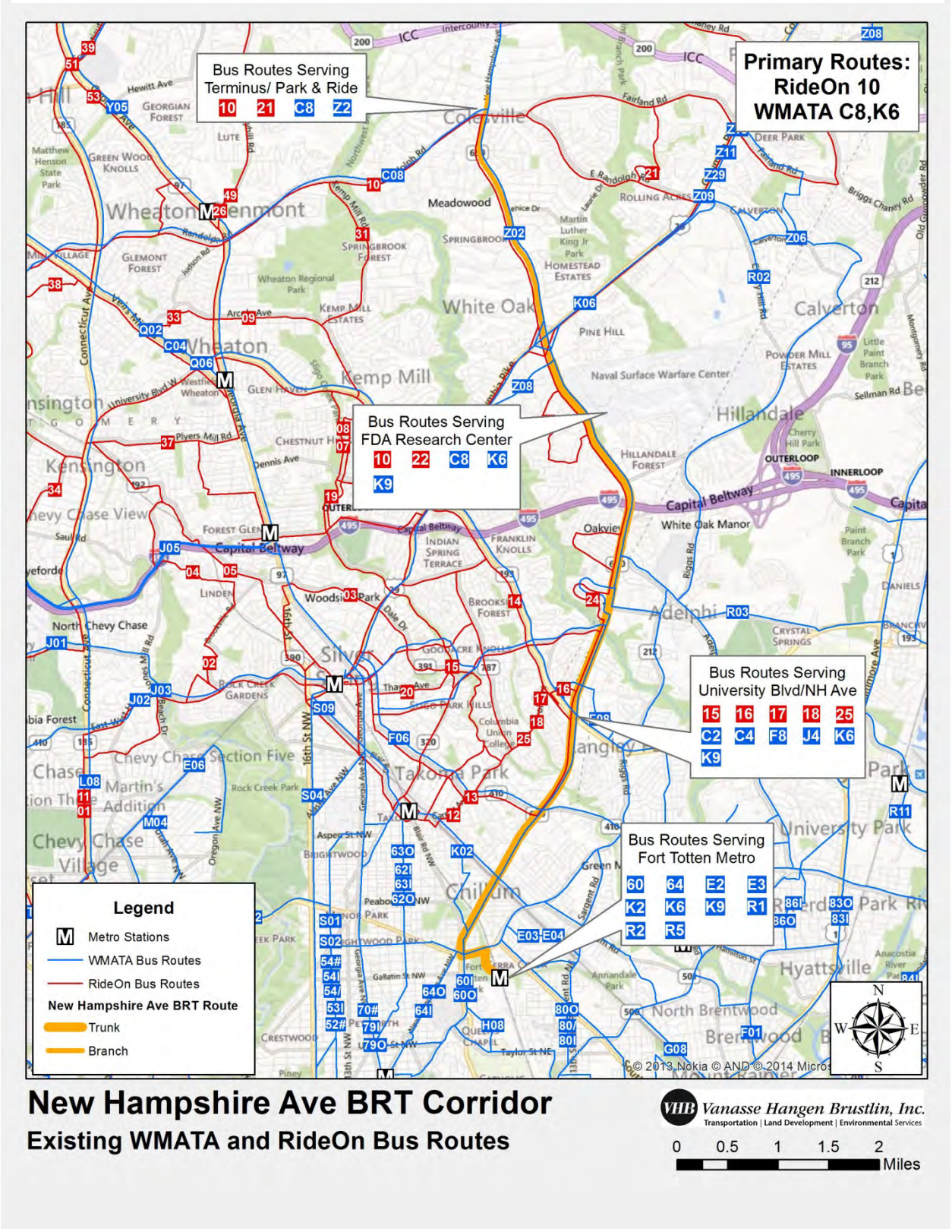
There are rail connections along the New Hampshire Avenue BRT corridor to the proposed Purple Line at Langley Park, and to the Red, Yellow, and Green Lines at Fort Totten. At the intersection of New Hampshire and University Boulevards, riders can connect to Metrobus C2, C4, and J4 lines, at Lockwood Drive, connections can be made to the Z6 and Z8 Metrobus services, and the intersection with East-West Highway provides a connection to the F4 route, though a walk is required from the north side of the intersection to the east. The Fort Totten Metrorail station provides heavy rail service into the urban center. Table 7-4 shows the routes that currently terminate at or cross the New Hampshire Avenue corridor.

▼

Table 7-4 Bus Service New Hampshire Avenue Corridor

Operator	Route Name	From	To
WMATA	60	Ft Totten Station	Georgia Ave & New Hampshire Ave
WMATA	64	Ft Totten Station	10th St & Constitution Ave (63 & 64)
WMATA	C2	Greenbelt Station	Wheaton Station
WMATA	C4	Prince George's Plaza Station	Twinbrook Station
WMATA	C8	College Park Umd Station	White Flint Station & Rockville Pk
WMATA	E2	Ft Totten Station	Friendship Heights Station
WMATA	E3	New York Ave Ne & Bet Fenwick St &	Friendship Heights Station
WMATA	F8	University Blvd & Merrim	Cheverly Station
WMATA	J4	College Park UMD Station	Bethesda
WMATA	K2	Takoma Station	Ft Totten Station
WMATA	K6 & K9	Lockwood Dr & White Oak S/C	Ft Totten Station
WMATA	R1	Metzerott Rd & Greenspire Terr	Ft Totten Station
WMATA	R5	Plum Orchard Dr & Broadbirch Dr	Ft Totten Station
WMATA	Z2	Georgia Av & Olney Sandy Spring Rd	Silver Spring Station
Ride On	10	Powder Mill Rd & New Hampshire Ave	Twinbrook Station
Ride On	15	Lebanon St & University Blvd	Bonifant St
Ride On	16	Bonifant St	Takoma Station
Ride On	17	Bonifant St	Lebanon St & University Blvd
Ride On	18	Dixon Ave	Lebanon St & University Blvd
Ride On	21	Briggs Chaney Park & Ride	Dixon Ave
Ride On	22	Powder Mill Rd & New Hampshire Ave	Dixon Ave
Ride On	25	Lebanon St & University Blvd	Takoma Station

Figure 7-11 Existing Local Bus Service along New Hampshire Avenue



Corridor Key Stops and Stations

The bus stops at White Oak, Fort Totten and Langley Park have the highest boardings and alightings along the New Hampshire Avenue corridor. Hyattsville and Hillandale stops also have significant weekday volume. Table 7-5 displays the boardings and alightings associated with the stops discussed above. The ridership was pulled from the data supplied by Montgomery County.

Table 7-5 Key Bus Stop Ridership

Stop	Boardings	Alightings
White Oak	550	550
Hillandale	200	200
Langley Park	1100	900
Hyattsville	200	200
Fort Totten Metrorail Station	900	800

Other Transit

There is one Metrorail station located on the New Hampshire Avenue corridor. The Fort Totten station is located on Metrorail's Red, Yellow, and Green Lines which provide access to downtown Washington, DC.

RTS Concept

Summary of CTCFMP Service

In the Planning Board draft of the *Countywide Transit Corridors Functional Master Plan* (CTCFMP), ridership estimates for the New Hampshire Avenue RTS were calculated under three different scenarios for the year 2040. The first scenario, a two lane median busway, yielded a daily ridership of 22,000. The second scenario, with a mix of median and curb lanes for New Hampshire Avenue yielded slightly lower ridership, with 21,000 riders. The third scenario for the New Hampshire Avenue RTS, with curb lanes and mixed traffic and no service north of White Oak resulted in a daily ridership of 10,000. The CTCFMP showed that the forecasted ridership on New Hampshire Avenue corridor was a relatively high-performing corridor. The Approved CTCFMP does not prescribe the type of busway treatment (i.e., curb vs. median), but instead states the number of lanes and right-of-way required. The approved busway plan treatments will be determined in later studies.

Recommended Service Plan

The recommended service concept is to take a single corridor with a trunk (primary) service and branch (secondary) services that connect the endpoints. The trunk service will operate between the White Oak and Fort Totten Metrorail stations. The branch will operate north of White Oak. The land use densities north of White Oak do not warrant as frequent of a service therefore in the off-peak periods the frequency would be half of the peak frequency for the branch. The branch of the Randolph Road RTS will supplement this service so that the effective headway is still 10 minutes. The trunk line will have an effective headway of 10 minutes with service starting at White Oak Transit Center at headways of 20 minutes combined with the service from the Colesville park and ride lot at headways equal to 20 minutes. During the peak periods the headway would be 10 minutes starting from the Colesville park and ride lot and continue the whole length of the corridor.

The proposed service concept is representative of the fact that the majority of transit trips in the corridor are made by commuters. This pattern will likely continue into the future given the current and planned development and the off-peak available capacity on New Hampshire Avenue. The commuter base travel is a function of many factors including the longer distance traveled to work versus other trip purposes such as shopping or recreation, travel alone nature of the commuting trip, and the nondiscretionary nature of commuting trips. Commuters take transit because there is congestion as well as the cost and availability of parking near employment centers which often makes transit a viable option. Additionally, shopping or recreation trips, as opposed to work trips, typically involve multiple travelers and often a need for carrying packages. These needs are often accomplished easier through the use of a personal vehicle. The majority of trips on the New Hampshire RTS can be expected to be commuter trips and the service plan concept reflects that aspect. This service plan concept allows for multimodal transfer to modes which provide faster service to the downtown core and business districts including the Red, Yellow, and Green Lines at the Fort Totten Metrorail station.

The service plan also recognizes the need to serve all trips including the non-commuting trips. The plan provides high service levels outside of the peak periods. The shopping and recreational developments on the corridor will be served by high quality transit in the peak and off-peak periods. The Hillandale, Adelphi, and Langley Park shopping areas currently serve a mix of patrons many who are transit dependent. The New Hampshire Avenue RTS will provide a benefit to these riders.

Based on the TPB Version 2.3 Travel Demand Forecast Model, the areas within the corridor that are forecasted to have high-transit mode shares for commuting to work (i.e., attraction end) are at the southern end of the corridor. Takoma Park and Silver Spring are forecasted to have approximately a 30 percent transit mode share for commuter trips traveling to and from work there. Although there are a large number of jobs planned for the White Oak area, the amount of available capacity and the type of development makes high transit mode shares similar to the more urban districts hard to achieve. The New Hampshire RTS and US 29 RTS will be important services in providing viable alternatives to single occupancy vehicle travel.

In reviewing the transit travel times from the TPB Version 2.3 Travel Demand Forecast Model (i.e., transit skims) in the corridor, for trips destined for areas in the regional core, the RTS will most likely serve to connect riders to Metrorail. The longer the trip, the higher probability that RTS will serve as a feeder into Metrorail. The RTS service concept plan presented here accommodates that need as well as providing connections to important activity generators along New Hampshire Avenue.

Based on future needs reviewing the option of continuing the US 29 RTS service from Burtonsville to White Oak and then continuing service on New Hampshire Avenue could be evaluated. Initial review of this concept focused on operations along US 29, but a greater review of travel patterns and travel times could be included in future project planning studies.

Key Locations

The location of RTS stops is an important factor in the success of the RTS system. Stops that are located at, or within a reasonable proximity to, activity generators (in terms of residential origins and commercial, medical, government or other destinations), will assist the initial marketing of the service and with ongoing ridership growth. It is important to note that exact

stop locations have not been selected. This step should occur when more detailed planning for the individual corridors takes place.

For this service concept plan, primary stop locations have been identified by the County's plan. The plan presented 13 locations for the New Hampshire Avenue corridor alignment. Stop locations range in distance from 0.15 to 1.5 miles, with an average stop distance of 0.83 miles. This falls within a reasonable variance from the desired stop distance range for BRT service of 0.50 and 0.75 miles. Table 7-7 displays the stop locations along the New Hampshire Avenue corridor and the distances between each of the stops.

Table 7-7 Stop Locations and Distances for New Hampshire Avenue

From	To	Segment Distance (miles)
Colesville park-and-ride	MD 650 and Randolph Road	0.152
MD 650 and Randolph Road	MD 650 and Valleybrook Drive	1.265
MD 650 and Valleybrook Drive	MD 650 and Jackson Road	0.27
MD 650 and Jackson Road	White Oak Transit Center	1.094
White Oak Transit Center	FDA White Oak Campus	0.504
FDA White Oak Campus	MD 650 and Powder Mill Road	0.926
MD 650 and Powder Mill Road	MD 650 and Oakview Drive	0.499
MD 650 and Oakview Drive	MD 650 and Northampton Drive	0.592
MD 650 and Northampton Drive	Takoma/Langley Park Transit Center	1.281
Takoma/Langley Park Transit Center	MD 650 and MD 410	1.03
MD 650 and MD 410	MD 650 and Eastern Avenue	0.811
MD 650 and Eastern Avenue	Fort Totten Metro	1.5
	Total Trip Distance	**9.92**
	Average Stop Distance	**0.83**

Service Span and Frequency

The levels of service, in terms of span of service and headways for RTS service, have to be at a premium level in order to meet passenger demand and high ridership levels. Ideally, the RTS service concept would operate from the early morning until late at night, with 10 minute headways or less. Ten minute headway will provide a level of service that does not require the need to check a schedule. The wait times between vehicles is understood to be frequent enough to meet rider expectations. This frequency falls in the middle of the range of headways for rapid transit systems in North America and is a reasonable headway expectation for a new service. As service demand increases along the corridor, headways can be further reduced to accommodate the growing demand. The service span was designed to complement and match Metrorail service spans. The initial New Hampshire Avenue RTS levels of service for the fully built-out system are displayed in Table 7-9.

Table 7-9 New Hampshire Avenue Levels of Service

Period	From	To	Span of Service	Headways	
				Peak	Off-Peak
Weekday	Colesville Park and Ride Lot	Fort Totten Metrorail Station	6AM-12AM	10	20
	White Oak	Fort Totten Metrorail Station	6AM-12AM	0	20

Table 7-10 provides a comparison of headway and travel speed savings associated with the New Hampshire Avenue RTS service. These savings are a comparison between existing local service and the trunk portion of the RTS corridor. The travel speed savings are based on figures for estimated travel speeds from the Federal Transit Administration's *Characteristics of Bus Rapid Transit for Decision Making* report.

Table 7-10 Comparison of Headway and Travel Speeds

Service	Headway (minutes)			Speed (mph)		
	AM	Off-peak	PM	AM	Off-peak	PM
Existing[1]	15	18	15	13.8	15.3	13.4
New Hampshire Avenue RTS[2,3]	10	10	10	15.0	18.0	15.0
Difference	5	5	5	1.2	2.7	1.6
Percent Travel Time Savings				9%	18%	12%

1. Based on Metrobus Routes C8, K6, K9, and Z2

2. Headway is for the trunk portion of the corridor

3. Speed estimate is provided for the trunk portion of the corridor based on type of running way, location, and time of day

The service concept plan initially would have the New Hampshire Avenue RTS service offered between the hours of 6:00 AM and midnight from Colesville Park and Ride Lot to Fort Totten with at least ten minute headways in the peak period and 20 minutes during the off peak period. Trunk service between White Oak Transit Center and the Fort Totten Metrorail station would be provided at 20 minute frequency in the off peak. The combination of the trunk service and the branch service would result in an effective headway of 10 minutes during the peak period.

Branches, Overlaps, and Deviations

The service concept plan does not identify any deviations for the New Hampshire Avenue corridor. The service concept would look to enhanced pedestrian connections to provide for better accessibility to places like the White Oak and the FDA campus. The service plan concept is tied to the service outlined in the CTCFMP. The objective was to remain on New Hampshire Avenue and limit the impact of any deviations on travel time. The overall route has been partitioned into segments with a primary segment (trunk) and secondary segments (branches) based on an understanding of demand and overlap with other transit services. Overlaps with other RTS corridors are proposed. These overlaps are proposed to integrate the individual corridors into a larger RTS network and also provide higher levels of service where the overlaps occur.

The New Hampshire Avenue service concept would overlap with the US 29 corridor in White Oak, the Veirs Mill Road service and Purple Line in Langley Park. It would then continue to the Fort Totten Metrorail station which is served by the Red and Green Lines. In the peak periods this station also interlines with Yellow Line service. The New Hampshire Avenue RTS would provide a high capacity and frequency service to feed the Metrorail. The New Hampshire Avenue RTS interlines with the Randolph Road RTS branch service south of the Colesville Park and Ride Lot along New Hampshire Avenue.

A future potential service deviation for the New Hampshire Avenue RTS service would be to access the Life Science development north of White Oak using US 29. This might better service reverse commuting trips and provide a viable transit alternative connecting the Metrorail Green Line with White Oak. It would also serve to better connect the New Hampshire Avenue RTS with the Randolph Road RTS, and the FDA campus.

Integration with Local Service

RTS on New Hampshire Avenue would be complemented by local service along the corridor for passengers to make additional connections as well as access those destinations that fall between RTS stops. The majority of the Metrobus and Ride On routes that operate along the New Hampshire Avenue corridor connect with Metrorail and other multimodal transfer points. The Metro Extra service, Metrobus K9, would be replaced by the RTS.

Fleet Requirement

Based on the recommendation to join the New Hampshire Avenue north and south corridors, as well as to create a trunk and the secondary branch, the following vehicle requirements are estimated based on the prescribed headways. During peak service, the requirement would be approximately 20 vehicles, including spares. This would drop to 12 vehicles during the off-peak based on increased headways for the branches and improved travel times[5].

Operational Hours

A planning level operating cost was developed based on the assumptions related to the travel speed that could be achieved associated with various BRT treatments. These speeds allowed for a calculation of the number of vehicles that would be required to operate the service using the prescribed headways discussed above. This results in typical weekday service hours totaling 300. This Figure 7-calculates to roughly 105,000 annual service hours. The deadhead hours (i.e., hours to and from the bus garage) have been factored to 15 percent of the revenue hours, which equates to approximately 120,000 total vehicle hours.

[5] These figures are based on an 11.8 mile long trunk service, and 12.6 and 9.0 mile long branch services. Peak period speeds are assumed to be 17 mph during peak service and 19-21 mph during off-peak service. Spare ratio is 1.2 times the total vehicle requirement.

Corridor Outcome and Summary

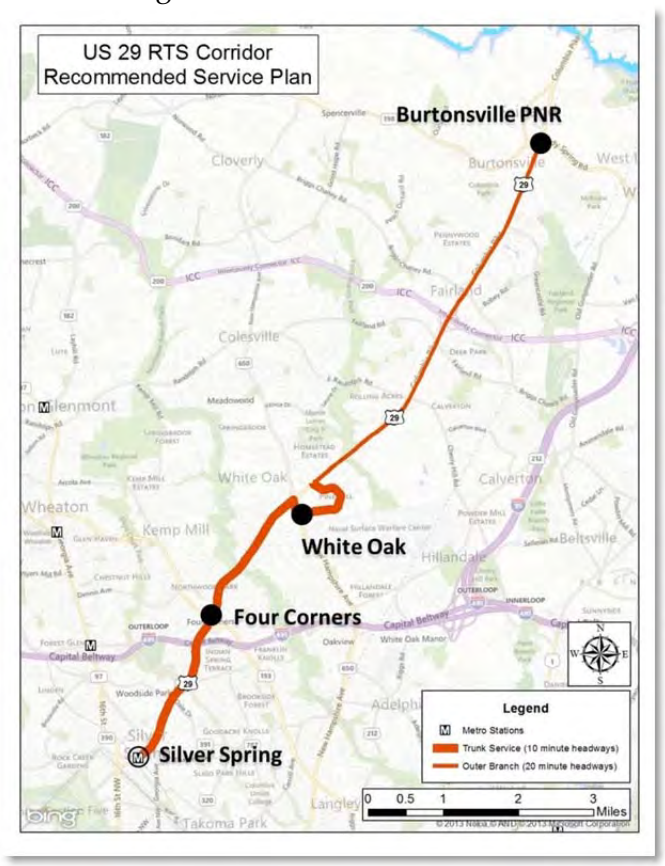
The implementation of RTS service in this corridor will add frequency and reliable transit service that extends from the Metrorail along the New Hampshire Avenue. This service will provide residents on the eastern side of Montgomery County with a higher quality alternative to single occupant vehicle travel. The addition of RTS to the New Hampshire Avenue corridor will also augment Metrorail, and MTA commuter bus service on US 29 by providing a frequency and rapid transit service within a corridor that is transitioning and redeveloping to become more vibrant and transit supportive. The RTS will operate within the corridor and provide more frequent stops compared to the Metrobus service which operates there today. The New Hampshire Avenue RTS service will improve travel options for both the suburban commuter as well as the residents of communities along New Hampshire Avenue.

US 29 Corridor Service Plan

The conceptual service plan for the US 29 RTS service is based on the corridor plan for US 29 as outlined in the draft Montgomery County Planning Department's *Countywide Transit Corridors Functional Master Plan Planning Board* from July 2013[1]. This concept focuses on connecting the activity centers, multimodal transit nodes, as well as providing transportation opportunities along US 29 from Burtonsville to Silver Spring.

General Corridor Overview

Figure 8-1 US 29 RTS Corridor



The draft plan proposes continuous, high quality transit service along US 29, connecting the Burtonsville park and ride lot with White Oak and Downtown Silver Spring. The service passes through White Oak and Four Corners connecting with other RTS routes and local buses. The adopted plan differs from the draft plan in that portions of the RTS routing remains on US 29 versus Lockwood Drive south of White Oak. The proposed service concept outline here proposes to keep the RTS service along US 29 and not use Lockwood Drive. A key focus of this study is service integration and not guideway type, location, or construction sequencing. This concept proposes that the US 29 RTS service focuses on a greater level of service between White Oak and Downtown Silver Spring. In the off-peak hours the RTS service would continue to

[1] The July 2013 Planning Board Draft of the Countywide Transit Corridors Functional Master Plan was the current plan at the outset of this study. The Draft has been reviewed and adopted with minor changes made by the County Council since the completion of the major planning efforts of this study. These changes have not been reflected because of the schedule of the study, but have been noted where differences occur between the Planning Board Draft and the Adopted Plan.

Burtonsville but in the peak existing express transit service north of White Oak would continue using the RTS infrastructure. This service will link key development areas on the corridor together creating a synergy between the neighborhoods, shopping districts, recreational areas, science and technology centers, and educational institutions. The RTS will also complete a high quality transit service connecting to various modes and other multimodal opportunities. The RTS for US 29 is proposed to operate a high capacity transit service from Burtonsville to Downtown Silver Spring as shown in Figure 8-1. The RTS route is approximately 10 miles in length with the primary trunk service being approximately half the corridor's length. The corridor already is served by a series of express bus service in the peak periods. It connects Downtown Silver Spring with the park and ride lots north of New Hampshire Avenue. These routes collect riders at the park and ride lots and then run closed door service to Downtown Silver Spring with some routes stopping at Four Corners. In addition to this service MTA operates commuter buses from points north to Downtown Silver Spring with some routes continuing into the metropolitan urban core.

Existing Sources of Activity

Traveling along the US 29 corridor from Burtonsville to Downtown Silver Spring, the following sources of activity are encountered:

- Burtonsville Park and Ride Lot
- Briggs Chaney Park and Ride Lot
- Randolph Road/Cherry Hill Road/Tech Road Commercial Center
- White Oak Shopping Center/Transit Center/FDA Campus
- Four Corners/Montgomery Blair High School
- Sligo Creek Park
- Downtown Silver Spring
- Silver Spring Transit Center (Metrorail)

Existing Demographics

Studies of transit riders show a willingness to walk up to a one-half mile to access high quality transit service like the RTS. To provide an understanding of the potential transit market, demographic data within a one-half mile boundary around the proposed Randolph Road RTS was compiled using the 2011 American Community Survey data for Census tracts that fall within the one-half mile boundary. The data is summarized in Table 8-1. The table also lists the County totals for each characteristic to provide context of how the corridor relates to the County as a whole. Based on these data, the US 29 RTS has a higher percentage of commuters using transit compared to the County as a whole. The corridor also has a higher percentage of households living below the poverty line as well as a higher percent of households that do not have access to a car. These households might be more dependent on transit as result of limited auto availability and economic conditions.

Table 8-1 Demograhic Data for US 29 Corridor

Census Group	US 29 Corridor	Montgomery County
Population	107,875	959,738
Male (%)	47.2%	48.0%
Female (%)	52.8%	52.0%
Median Age	37.6 years	40.5 years
Workers 16 years and older	59,032	508,645
Public transit is primary means of travel to work (% of workers 16 and older)	12,593 (21.3%)	77,077 (15.2%)
Households	42,524	355,434
Avg. Annual Median HH Income	$86,714	$111,751
Below the poverty line (Households)	3,593 (8.4%)	20,712 (5.8%)
Non-vehicle ownership (Households Households)	5,798 (13.6%)	29,018 (8.2%)
Source: 2007-2001 American Community Survey 5-Year Estimates		

Existing Land Use

The northernmost section of the US 29 corridor from Burtonsville to White Oak includes low-density single family residences, garden style apartment complexes, and townhome communities. The denser developments are located closer to US 29 while the single family housing is farther away. There is commercial development between White Oak and Randolph Road/Cherry Hill Road. Overall, the segment of the corridor north of White Oak is more car-oriented and representative of typical suburban development patterns. The accessibility to US 29 is not very advantageous for walking to transit. However, there are a number of park and ride facilities and current transit service connects these lots to Downtown Silver Spring and the Silver Spring Transit Center.

The section of the US 29 corridor from White Oak to Silver Spring features moderate to high-density development. There are a number of older shopping centers located along US 29 from New Hampshire Avenue to University Boulevard. The neighborhoods in this area feature older homes on smaller lots. There is a complex of high-rise apartments in White Oak, but the development is auto oriented. There are sidewalks to access transit on US 29, but walking distances are typical longer than desirable for access to transit.

South of University Boulevard and inside the Capital Beltway, the area includes single family housing on small lots and Sligo Creek Park. Further south of the park is Downtown Silver Spring; an urban area that is redeveloping. Downtown Silver Spring has a mix of housing including high-rise apartments and townhomes with short setbacks from road, as well as single family housing on grid street networks located farther away from the major arterials.

Planned Land Use Changes

The master plan updates for subareas along the corridor show areas increasing in employment and household densities with other areas planned to remain relatively unchanged. Some early phases of the RTS or transitional services may become operational in the next few years. Bus rapid transit can impact land use along a corridor and good planning

can be a key aspect of ensuring that an area can develop into a walkable, mixed-use area that can support high quality transit[2]. The denser development that provides for easy access to transit will help ridership. This type of development can create not only peak period commuter riders but also attract non-commuting shopping and recreational riders.

The Burtonsville Sector Plan is focused on creating a neighborhood identity for the area where MD 198 and US 29-Business intersect. This plan acknowledges the challenges presented by the creation of the US 29-Bypass, but does not focus on development along this corridor. This is because the US 29-Bypass is extensively a freeway and the development along the highway is focused around the interchanges. The plan does discuss connecting the existing park and ride with regional transit as an opportunity to link local businesses with the region. The park and ride is located behind the Burtonsville Crossing Shopping Center and has 500 spaces[3].

The Fairland Sector Plan was approved and adopted in 1997. The plan is focused on preserving the lower intensity development patterns characteristic of this area of the county. The plan recommended grade separating all of the east-west roads that intersect with US 29 in the study area. These interchanges have further changed this segment of US 29 from an expressway to a freeway making transit accessibility a challenge[4].

A major development change that is currently being planned is the update to the White Oak Sector Plan. The consolidation of the Federal Drug Administration (FDA) on the grounds of the old Naval Surface Weapons Research facility has provided an opportunity to develop the area into a more vibrant and transit friendly community. The vision is to take advantage of the existing major developments of Hillandale, White Oak, and the FDA campus, and promote infill development of a mixed use and transit oriented character that integrates with the existing residential neighborhoods. The master plan covers an area of roughly 3,000 acres on the eastern side of US 29 from Cherry Hill Road to the Northwest Branch Stream and the Capital Beltway. Expansion of the FDA's campus is expected to occur in the near term. The development of a life sciences center, including relocation of the Washington Adventist Hospital along with redevelopment of the White Oak Shopping Center can transform this area, but will increase the demand on the existing transportation network. The US 29 RTS service concept recognizes the importance of providing a high-quality transit service to help mitigate the demand on the existing transportation infrastructure.

The Four Corners Sector Plan was last updated in 1996. The plan produced calls for preservation of the existing residential neighborhoods and commercial corridors currently in place. The plan does recommend improvements to the transportation network that reduces the amount of through traffic on residential streets while improving pedestrian safety along major corridors. The plan also promotes increased use of public transit to connect Four Corners to Metrorail[5]. The proposed RTS for US 29 will provide added connectivity to the Metrorail as well as to key RTS transfer nodes and other multimodal opportunities.

The Metropolitan Washington Council of Governments Cooperative Land Use Forecast Round 8.2 shows how the corridor is projected to change between 2010 and 2040. The 2040

▼

[2] More Development for Your Transit Dollar: An Analysis of 21 North American Transit Corridors, Institute for Transportation & Development Policy

[3] Burtonsville Crossroads Neighborhood Plan, Montgomery County Planning Department, December 2012.

[4] Fairland Master Plan, Montgomery County Department of Park and Planning, August 1996.

[5] Four Corners Master Plan, Montgomery County Department of Park and Planning, December 1996.

regional cooperative land use for the US 29 corridor shows that certain areas are expected to see more growth than others. Overall growth for the corridor is more modest than for some of the other RTS corridors. The change in households from 2010 to 2040 is from approximately 50,350 to 58,450; an increase of 16 percent. The growth in employees between 2010 and 2040 is 63,200 and 83,300, respectively. This is a 32 percent growth in employment. The employment growth supports the goal to more closely balance jobs to housing. Figure 8-2 shows the growth in households and employment.

Figure 8-2 US 29 Corridor Projected Changes

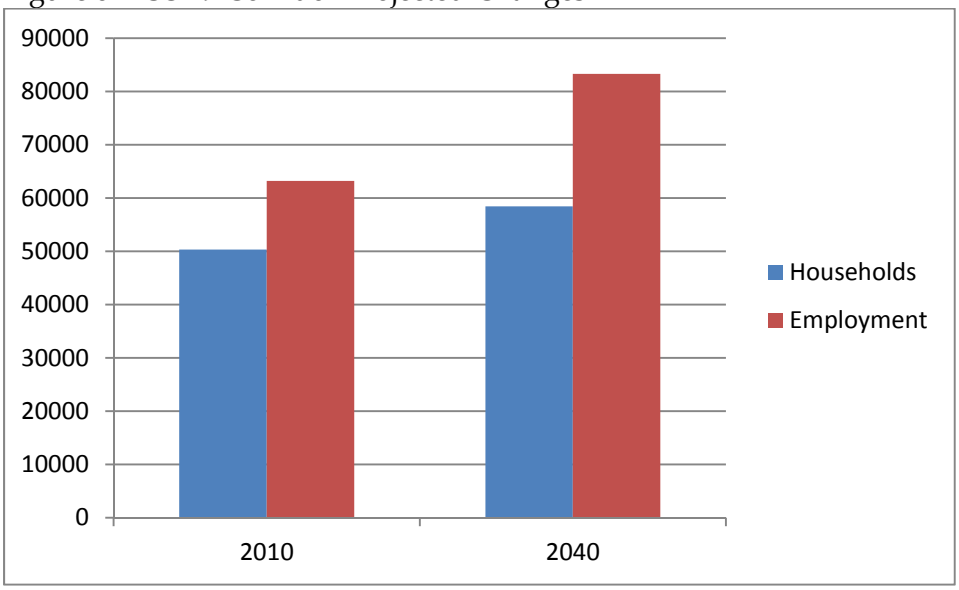


Table 8-2 provides information about the minimum, maximum, and average densities observed (households and employees) for both 2010 and 2040 along the corridor. They provide an indication of the magnitude of the densities along the corridor and how varied the highest and lowest values are, giving an indication of whether the corridor as whole is transit supportive or whether there are areas along the corridor that could support high-quality transit.

The Table 8-2 values can be compared against values for residential and non-residential densities as reported in the Institute for Transportation Engineer's (ITE), *A Toolbox for Alleviating Traffic Congestion,* shown in Table 8-3. The data in Table 8-3 represent land area that can be development, versus gross land area in the Transportation Analysis Zone (TAZ) plots. Land that can be developed would exclude parks and wetlands in the TAZ. Since most of the TAZs along the corridor cover land that can be developed the ITE data in Table 8-3 provides an approximate guide for understanding potential service levels. A land use density threshold for transit supportive areas on gross land area used in local planning studies in the region is three households per gross acre and/or four jobs per gross acre. Based on the maximum values, the corridor could support bus service at a 10-minute frequency.

The areas of highest household density can be found in Downtown Silver Spring. There is consistent household density north of Downtown Silver Spring to White Oak. There is a decrease in density between White Oak and Burtonsville. The household density development pattern is true for both year 2010 and year 2040. Figures 8-3 and 8-4 display the household densities for the entire corridor. The household growth is modest in areas closer to Washington, DC. The greatest change in household density is focused around Downtown

Silver Spring as can be seen in Figure 8-7 and Figure 8-9. This is consistent with the various sector plans for the corridor. The on-going White Oak Sector Plan update has not been incorporated into the Cooperative Land Use Forecast. Greater levels of development have been proposed as part of the update and are still under consideration.

High employment densities along the corridor are located in Downtown Silver Spring and on the FDA campus. The proposed life science development area also shows a high employment concentration by the year 2040. This data can be seen in Figures 8-5 and 8-6. In the other areas along the corridor employment is expected to show modest growth. Growth in employment is planned for the area between Burtonsville and the ICC, south of US 29 and north of White Oak where the Life Sciences/FDA Village Center is planned. Figure 8-8 shows the proposed employment for year 2040. Employment growth in and around Silver Spring is planned to be limited given the goal of more closely balancing households and jobs.

Table 8-2 US 29 Corridor Household and Employment Densities (2010 & 2040)

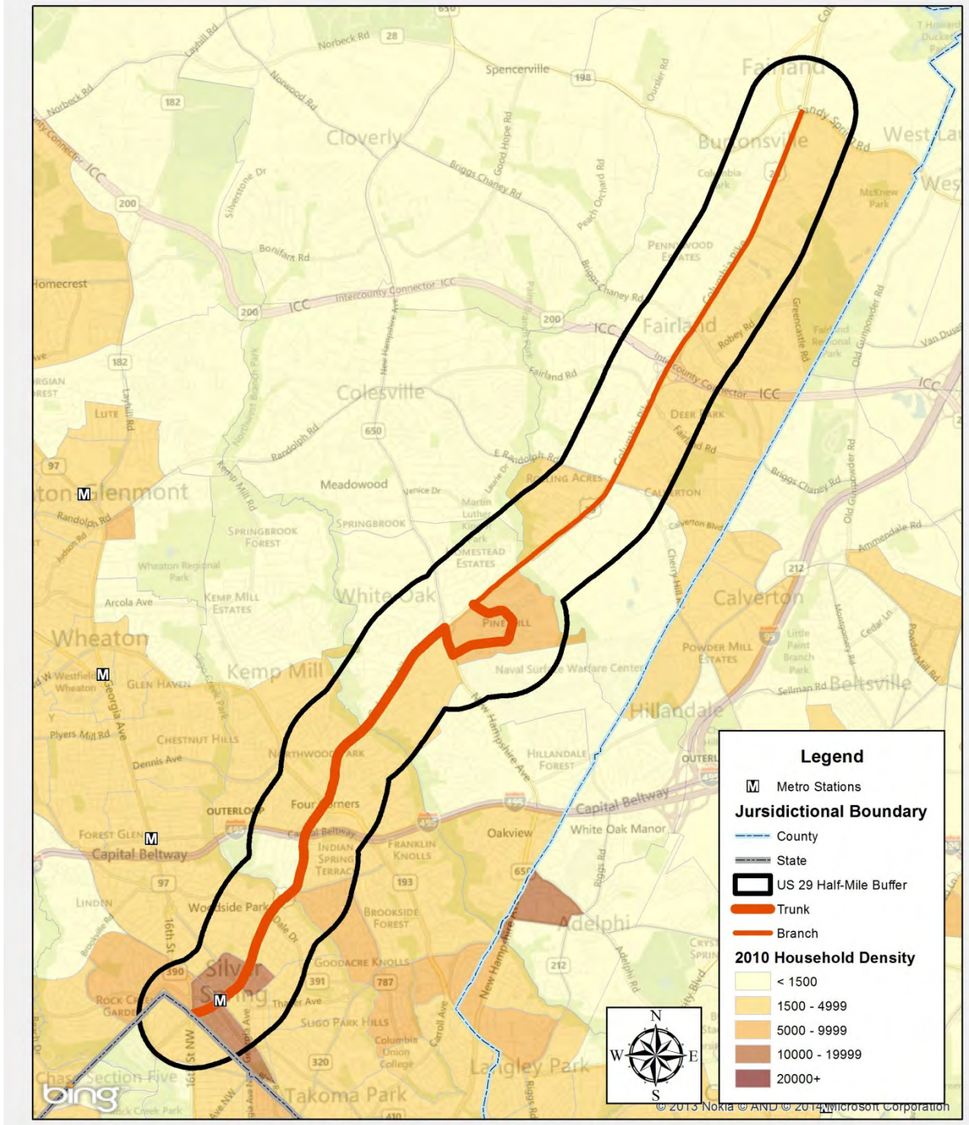
	2010 Household Density (HH/Acre)	2040 Household Density (HH/Acre)	2010 Employment Density (Emp/Acre)	2040 Employment Density (Emp/Acre)
Minimum	0	0	0	0
Maximum	24	102	38	153
Average	4	7	6	9

Table 8-3 ITE Residential and Non-residential Densities for Transit Service[6]

	Frequency (20-hour service day)	Dwelling Units per Acre	Employees per Acre
Bus	1 bus/hour	4-5	50-80
Bus	1 bus/30 minutes	7	80-200
Bus	1 bus/10 minutes	15	200-500
Light Rail	Every 10 minutes	35-50	500+

[6] Institute of Transportation Engineers, A Toolbox for Alleviating Traffic Congestion, 1989.

Figure 8-3 US 29 Household Densities (2010)



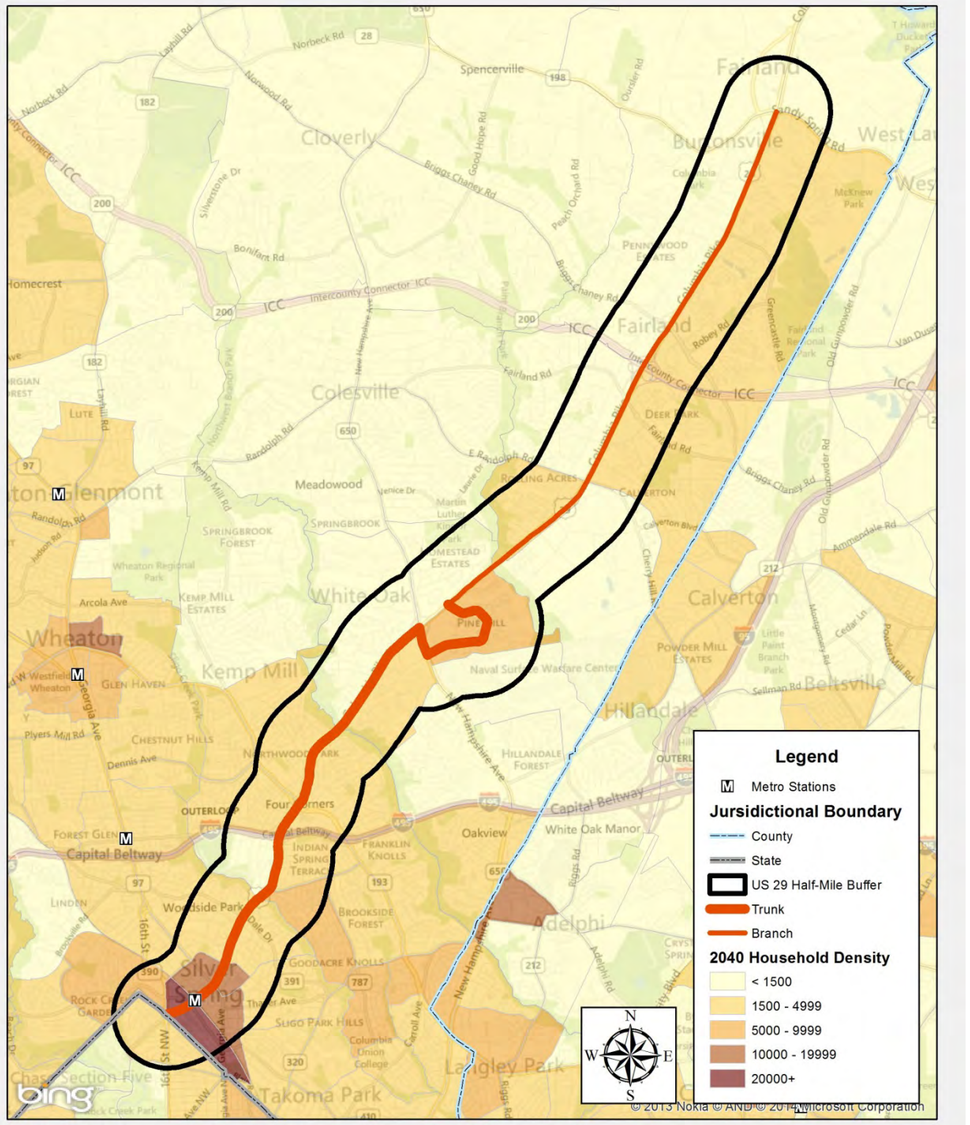
2010 Household Density (HH/sq mi)

US-29 BRT Corridor

VHB Vanasse Hangen Brustlin, Inc.
Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 8-4 US 29 Household Densities (2040)



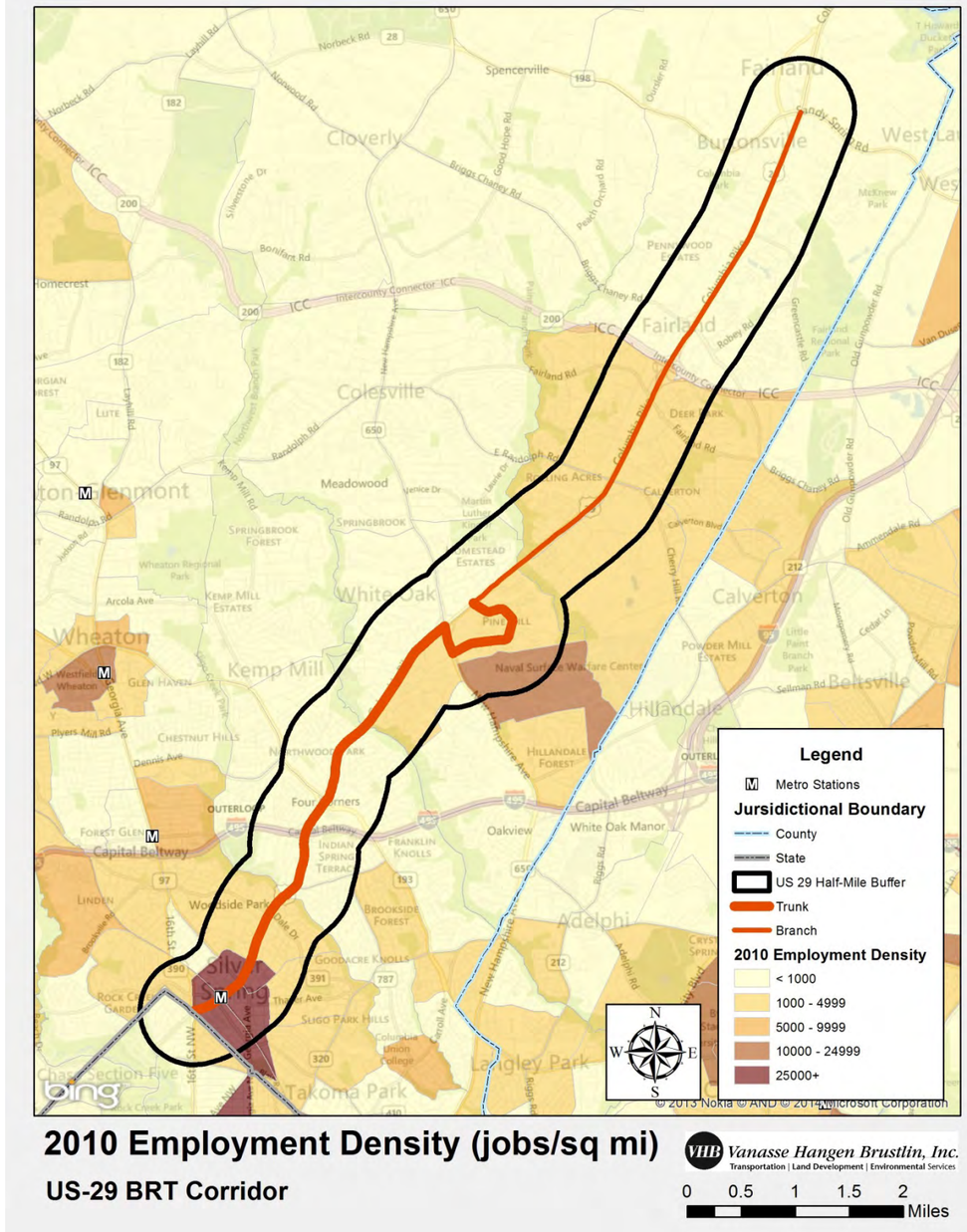
2040 Household Density (HH/sq mi)

US-29 BRT Corridor

VHB Vanasse Hangen Brustlin, Inc.
Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 8-5 US 29 Employment Densities (2010)



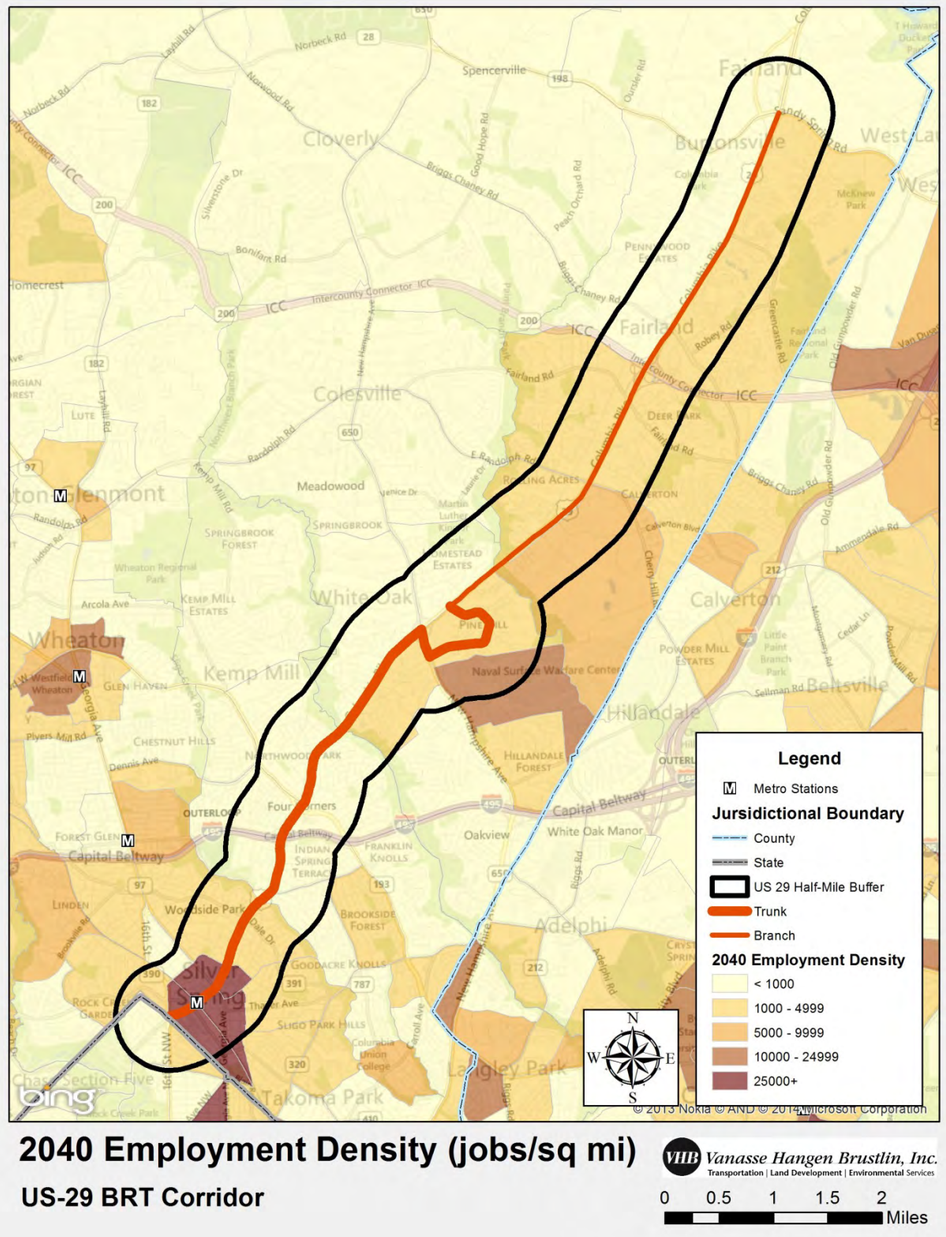
2010 Employment Density (jobs/sq mi)

US-29 BRT Corridor

VHB Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 8-6 US 29 Employment Densities (2040)



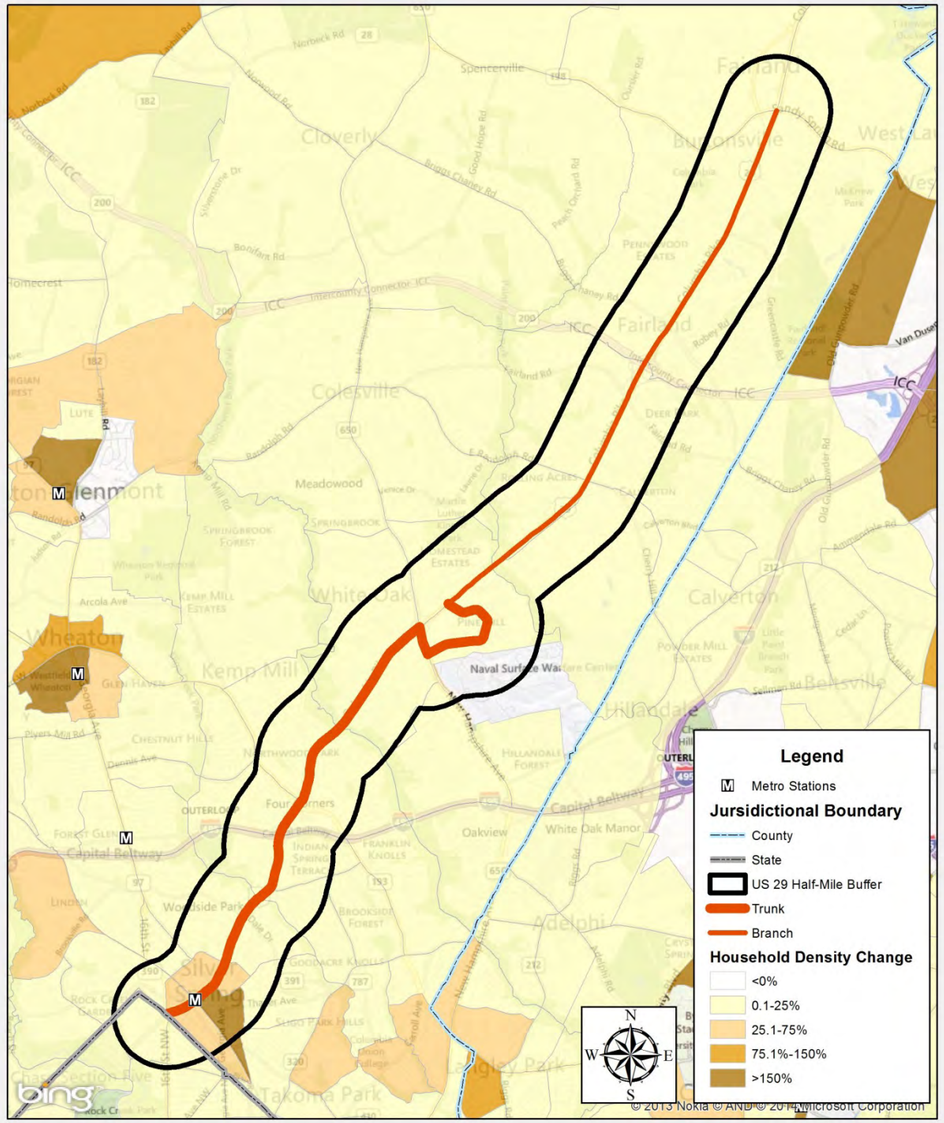
2040 Employment Density (jobs/sq mi)

US-29 BRT Corridor

VHB Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 8-7 US 29 Change in Household Densities - Percent (2010-2040)



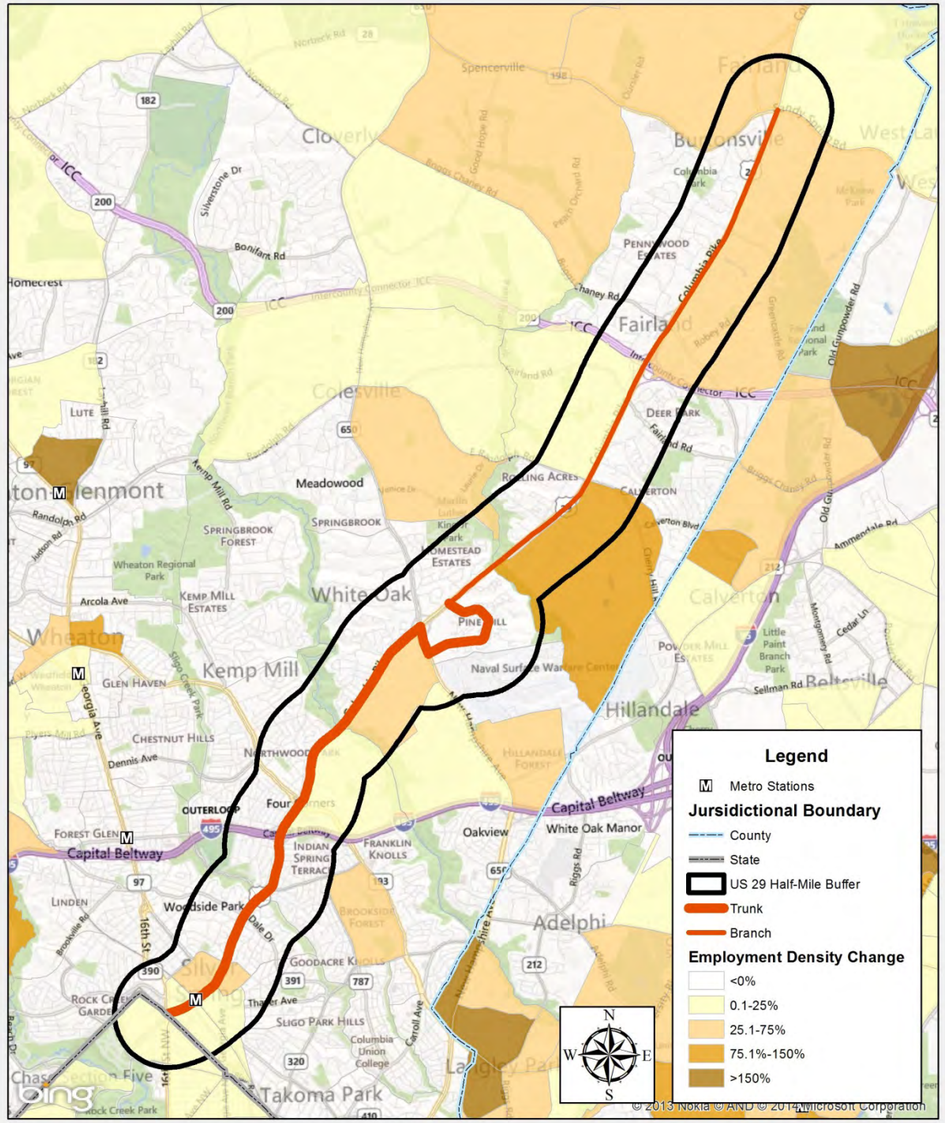
2010-2040 Household Density Change

US-29 BRT Corridor

Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 8-8 US 29 Change in Employment Densities - Percent (2010-2040)



2010-2040 Employment Density Change

US-29 BRT Corridor

Vanasse Hangen Brustlin, Inc. Transportation | Land Development | Environmental Services

0 0.5 1 1.5 2 Miles

Figure 8-9 US 29 Change in Household Densities - Absolute (2010-2040)

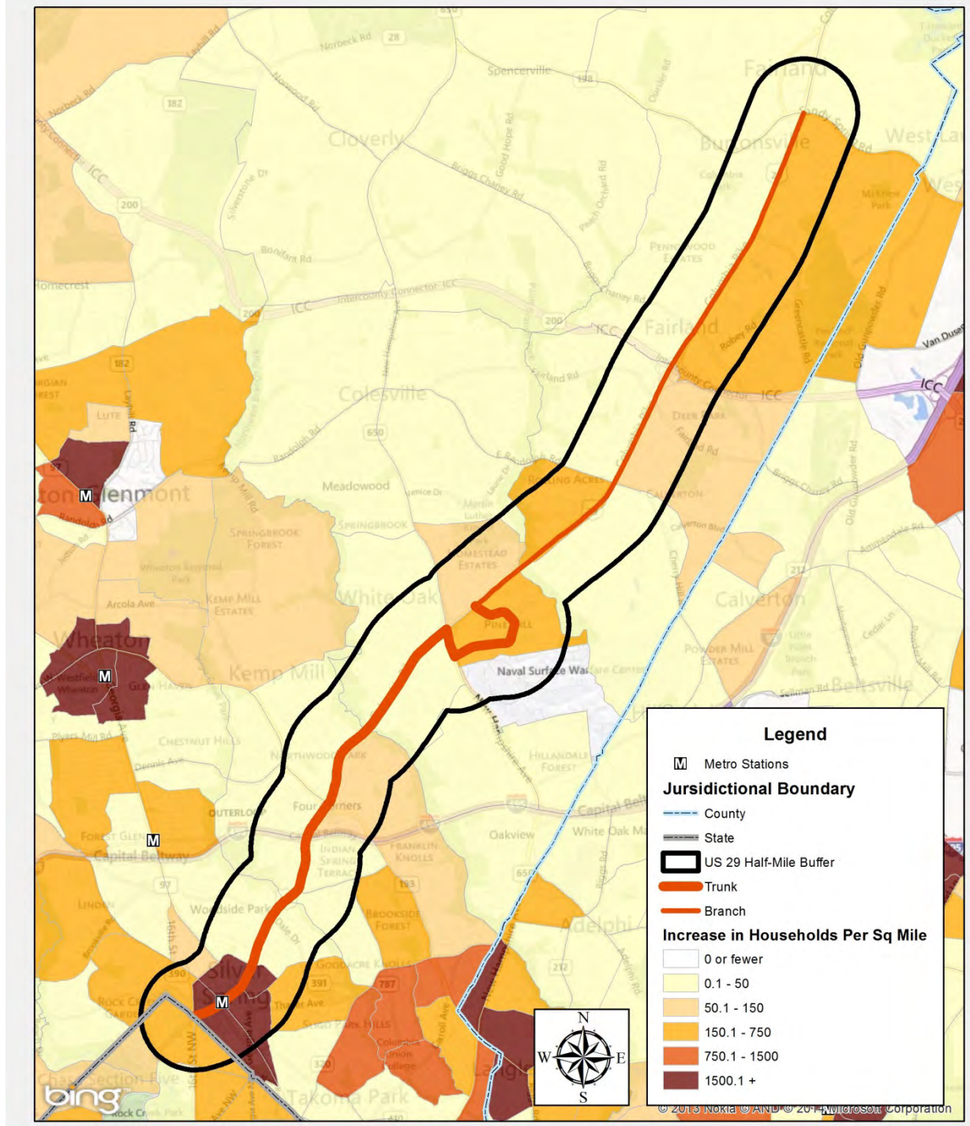
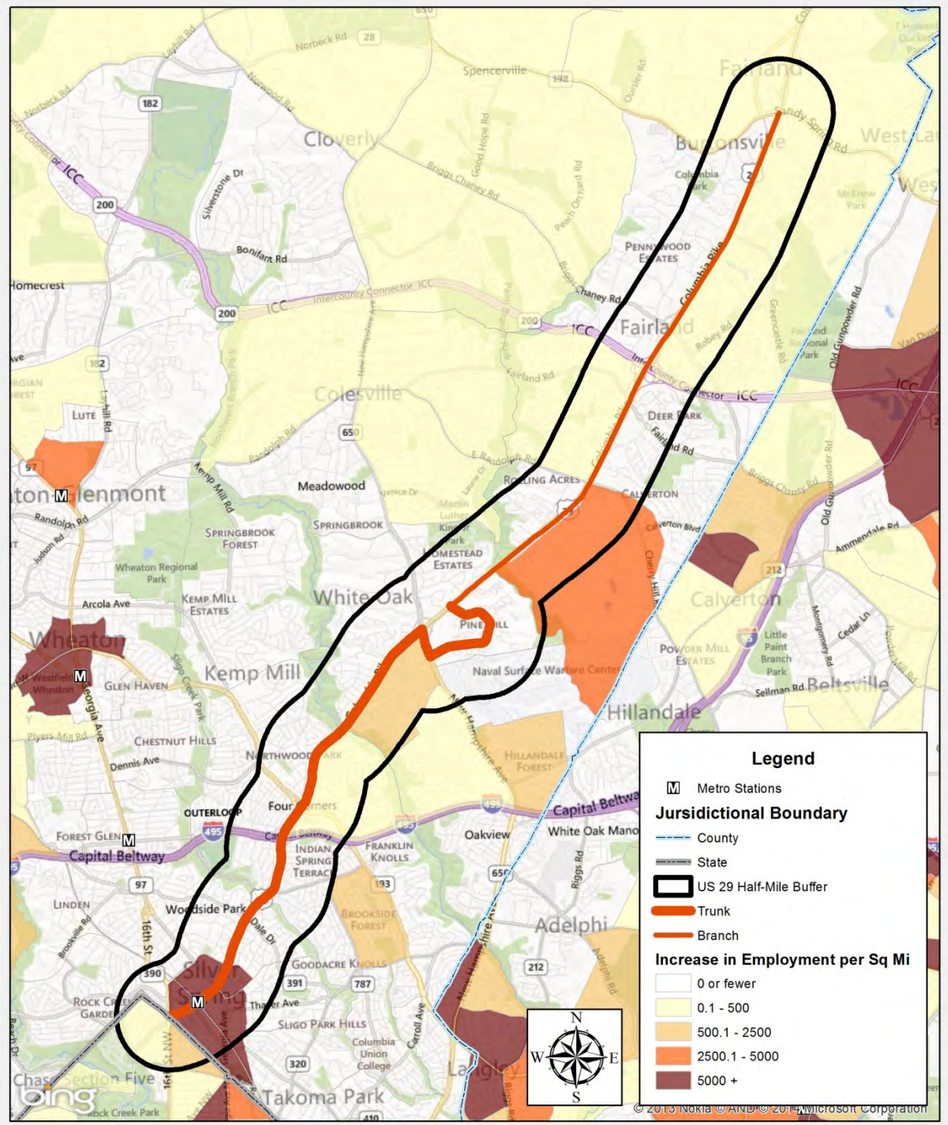


Figure 8-10 US 29 Change in Employment Densities - Absolute (2010-2040)



Transportation Network

Existing Transit Characteristics

While serving origin and destination locations are an important element of the RTS, it is also important to facilitate transfers between the RTS and other buses and modes that operate along the corridor. There are a number of Ride On, Metrobus and MTA Commuter services that operate either along or intersect with US 29. Figure 8-11 details which of these services interact with the US 29 RTS.

Service Characteristics for Primary Routes

There are Metrobus and Ride On bus routes operating on the corridor. Their general routes and service characteristics are described below. Average weekday ridership for each route was examined for the calendar year spanning September 2011 to August 2012.

Metrobus:

- Metrobus Z6 serves the corridor from Burtonsville to Silver Spring in addition to serving Calverton and Westfarm. The route carries approximately 2,700 riders per weekday.
- Metrobus Z8 travels the corridor between Briggs Chaney and Silver Spring. The route carries roughly 3,000 riders per weekday riders.
- Metrobuses Z9 and Z29 provide express peak period service between Laurel and Burtonsville to Silver Spring. The Z29 travels from Laurel to Silver Spring, stopping in Burtonsville. The Z9 travels from Burtonsville to Silver Spring. Combined, the two routes carry roughly 700 riders per weekday.
- The Z11 and Z13 provide a combined service between the Greencastle and Briggs Chaney Park & Rides and Silver Spring. The Z11 provides morning service in the southbound direction and evening service in the northbound direction. The Z13 provides morning service in the northbound direction and evening service in the southbound direction. Combined the two routes carry approximately 1,000 riders per weekday.

Montgomery County Ride On:

- Ride On Route 21 provides peak travel and direction service between the Briggs Chaney Park & Ride and Silver Spring via US 29. The average weekday ridership was approximately 200 riders per weekday.
- Ride On Route 22 serves the corridor between Hillandale and Silver Spring during peak travel times. The average weekday ridership for the route was around 400 riders per weekday.

Major Feeder Routes and Connections

The Silver Spring Transit Center is the termini for the major feeder routes in this corridor. It is a multimodal hub providing heavy rail and commuter rail services into the urban centers and core. Additionally, Four Corner and White Oak are major transfer points for local bus service.

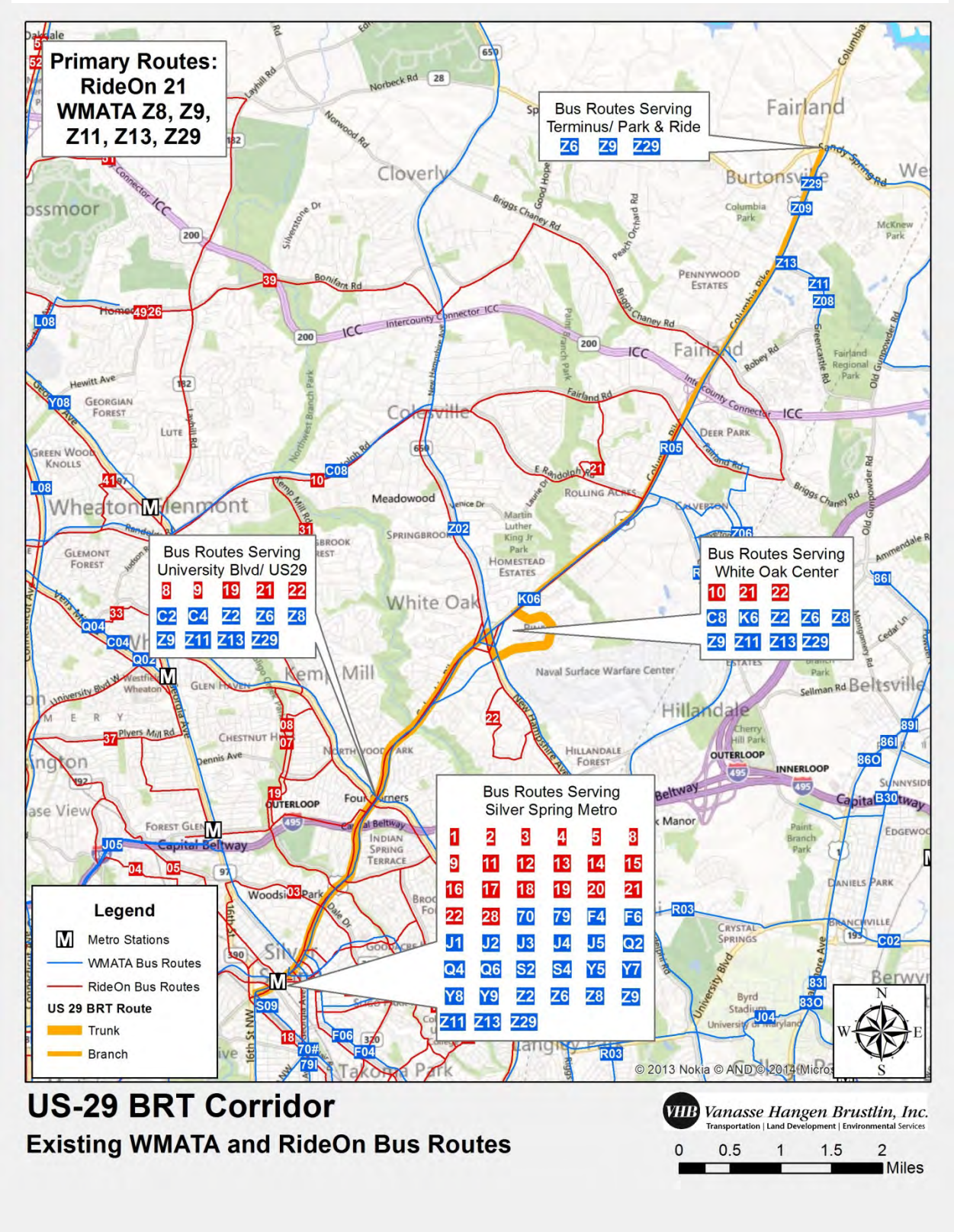
Table 8-4 shows the routes that currently terminate at points along the US 29 corridor or cross the corridor.

Table 8-4 Bus Service US 29 Corridor

Operator	Route Name	From	To
WMATA	70	9th/10th & Constitution Av Nw	Silver Spring Station
WMATA	79	Silver Spring Station	Nw Constitution
WMATA	C2	Greenbelt Station	Wheaton Station
WMATA	C4	Prince George's Plaza Station	Twinbrook Station
WMATA	C8	College Park UMD Station	White Flint Station
WMATA	F4	New Carrollton Station	Silver Spring Station
WMATA	F6	New Carrollton Station	Silver Spring Station
WMATA	J1	Medical Centr Station	Silver Spring Station
WMATA	J2	Westfield Montgomery Mall	Silver Spring Station
WMATA	J3	Westfield Montgomery Mall	Silver Spring Station
WMATA	J4	College Park UMD Station	Bethesda Station
WMATA	J5	Twinbrook Station	Silver Spring Station
WMATA	K6/K9	Lockwood Dr & White Oak	Ft Totten Station
WMATA	Q2	Montgomery College	Silver Spring Station
WMATA	Q4	Rockville Station	Silver Spring Station
WMATA	Q6	Shady Grove Station	Wheaton Station
WMATA	S2	Silver Spring Station	10th St & Constitution Ave
WMATA	S4	Silver Spring Station	10th St & Constitution Ave
WMATA	Y5	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y7	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y8	Montgomery Gen Hospital	Silver Spring Station
WMATA	Y9	Montgomery Gen Hospital	Silver Spring Station
WMATA	Z11	Greencastle Park & Ride Lot	Silver Spring Station
WMATA	Z13	Silver Spring Station	Greencastle Park
WMATA	Z2	Georgia Av & Sandy Spring Rd	Silver Spring Station
WMATA	Z29	South Laurel Park & Ride Lot	Silver Spring Station
WMATA	Z6	Burtonsville S/C & National Dr	Silver Spring Station
WMATA	Z8	Greencastle Park & Ride Lot	Silver Spring Station
WMATA	Z9	Burtonsville S/C & National Dr	Silver Spring Station
WMATA	RED	Shady Grove Metro Station	Glenmont Metro Station
Ride On	1	Friendship Heights Station	Bonifant St
Ride On	2	Lyttonville Operations Cntr.	Wayne Ave
Ride On	3	Takoma Station	Bonifant St
Ride On	4	Bonifant St	Armory -Knowles
Ride On	5	Twinbrook Station	Bonifant St
Ride On	8	Wheaton Station	Dixon Ave

Operator	Route Name	From	To
Ride On	9	Wheaton Station	Wayne Ave
Ride On	10	Powder Mill Rd & New Hampshire Ave	Twinbrook Station
Ride On	11	Bonifant St	Friendship Heights Station
Ride On	12	Bonifant St	Takoma Station
Ride On	13	Bonifant St	Takoma Station
Ride On	14	Bonifant St	Takoma Station
Ride On	15	Lebanon St & University Blvd	Bonifant St & Bay W
Ride On	16	Bonifant St	Takoma Station
Ride On	17	Bonifant St	Lebanon St & University Blvd
Ride On	18	Takoma Station	Lebanon St & University Blvd
Ride On	19	Forest Glen & Brunett Ave	Bonifant St
Ride On	20	Powder Mill Rd & New Hampshire Ave	Bonifant St
Ride On	21	Briggs Chaney Park & Ride	Dixon Ave
Ride On	22	Powder Mill Rd & New Hampshire Ave	Dixon Ave
Ride On	28	Ramsey Ave	Ramsey Ave

Figure 8-11 Existing Local Bus Service along US 29



Corridor Key Stops and Stations

A review of transit stops with 200 boardings or alightings revealed few locations outside of Silver Spring. The following locations are considered key stops along the corridor based on existing ridership.

- Briggs Chaney Park & Ride – Located just off the corridor near the intersection of Briggs Chaney Road and Gateshead Manor Way. The lot provides 240 spaces and is served by routes Z6, Z8, Z11, Ride On 21.

- The stop at White Oak provides a key connection between routes traveling north-south along US 29 and those routes traveling along New Hampshire Avenue.

Table 8-5 Key Bus Stop Ridership

Stop	Boardings	Alightings
Briggs Chaney Road	225	200
White Oak	370	370
Four Corners	500	475
Silver Spring	3,500	3,500

Other Transit

The US 29 corridor connects with the Silver Spring Metro in Silver Spring. The Silver Spring Metro station is served by the Metrorail Red Line. The Red Line travels between the Shady Grove Metrorail station into Washington, DC and then into eastern Montgomery County with stations in Silver Spring, Wheaton, and Glenmont. In addition to bring served by the Red Line, the Silver Spring station is major transit hub for regional transit including MTA commuter buses, local buses and MARC commuter rail trains from Martinsburg and Frederick.

RTS Concept

Summary of CTCFMP Service

In the Planning Board draft of the *Countywide Transit Corridors Functional Master Plan* (CTCFMP[7]), ridership estimates for the US 29 RTS were calculated under three different scenarios for the year 2040. The first scenario, a two-lane median busway, yielded a corridor-wide daily ridership of 17,700. The second scenario had a mix of curb lanes and two-way median busway, and yielded slightly lower ridership, with 16,500 riders. The third scenario for US 29 which was similar to the second alternative except for a segment north of White Oak that operated in mixed traffic resulted in a daily ridership of 15,800. The Approved CTCFMP does not prescribe the type of busway treatment (i.e., curb vs. median), but instead states the number of lanes and right-of-way required. The approved plan busway treatments will be determined in later studies, but the potential for reasonable ridership levels on this route is feasible.

Recommended Service Plan

The recommended service concept for the US 29 is develop the RTS service to link White Oak and Silver Spring activity centers. The land use development north of White Oak has limited transit accessibility for non-motorized modes. It does have a system of park and ride lots that are currently served well by express bus service in the peak periods. The service concept presented here could build on that service by keeping the existing express bus service. The express bus service would use any future RTS infrastructure. This would continue the point to point service of the express buses while providing a travel time benefit resulting from the any proposed guideway treatments for the RTS.

In the off-peak periods the RTS would travel the full corridor. In the off-peak every other RTS bus would travel the full length of the corridor. This would include the minor deviation from US 29 into the apartment complexes adjacent to the White Oak Shopping Center with continuation to the proposed White Oak Transit Center. Half of the RTS buses would only travel between Silver Spring and White Oak. For service beginning or stopping at White Oak the RTS would serve the White Oak Transit Center and then continue to FDA. In the peak periods White Oak would be the termini for the RTS and all buses would start or end at FDA.

Table 8-6 presents key corridor bus characteristics for the US 29 corridor. The table shows that there is currently considerable bus service along the corridor. This continues into the future. The table shows only what is planned in the Constrained Long Range Plan (CLRP). It does not include any RTS operations. With the RTS there is the opportunity to reduce some of the service between White Oak and Silver Spring. Many of the current bus routes may be able to be modified into a feeder routes for the RTS. This will be determined in future studies.

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[7] The Montgomery County Council approved the Countywide Transit Corridors Functional Master Plan in November 2013. As part of the approval the Council proposed some changes to the US 29 corridor. The changes result in slight modifications to service along Lockwood Drive.

Table 8-6 Key Corridor Bus Operations Characteristics

Locations	Number of Buses Peak Hour[1]	
	Existing	Year 2040
North of ICC	28	38
North of MD 650	53	57
North of MD 193	57	63
Inside Beltway	87	94

1. MWCOG/TPB Version 2.3 CLRP Networks

The transit service on the US 29 corridor is currently commuter based. Based on the MWCOG/TPB forecast the transit mode share for trips in the corridor to destinations in the regional core is 56 percent. For non-commuting trips it is approximately 38 percent. This is well above the County wide transit mode share of 16 percent for commuting trips and three percent for non-commuting trips. The service concept here would serve the entire corridor but with a focus on serving and developing the synergies between Downtown Silver Spring and the redeveloping activity center of White Oak.

Based on future needs reviewing the option of continuing the US 29 RTS service from Burtonsville to White Oak and then continuing service on New Hampshire Avenue could be evaluated. Initial review of this concept focused on operations along US 29, but a greater review of travel patterns and travel times could be included in future project planning studies.

Key Locations

The location of RTS stops is an important factor in the success of the RTS system. Stops that are located at, or within a reasonable proximity to, activity generators in terms of both residential origins and commercial, medical, government or other destinations will assist the initial marketing of the service and with ongoing ridership growth. It is important to note that exact stop locations have not been selected. This step should occur when more detailed planning for the individual corridors takes place.

For this service concept plan, preliminary stop locations have been identified by the County's plan. The plan presented 10 locations for the corridor. The distance between stop locations ranges from 0.37 to 1.80 miles, with an average stop distance of 1.30 miles. A desired stop distance range for BRT service is between 0.50 and 0.75 miles. Table 8-7 shows the distance between stop locations along the US 29 corridor as well as the distances between each stop. For the trunk service from Silver Spring to White Oak the stop distance would be closer to the desired range. The nature of the facility north of White Oak results in the longer distances between stops.

Table 8-7 Stop Locations and Distances for US 29

From	To	Segment Distance (miles)
Burtonsville P&R	Briggs Chaney P&R	3.50
Briggs Chaney P&R	Fairland Road	1.80
Fairland Road	Tech Road	1.50
Tech Road	White Oak Transit Center	2.05
White Oak Transit Center	Lockwood & Oakleaf	0.37
Lockwood & Oakleaf	Hillwood Drive	0.57
Hillwood Drive	MD 193	1.08
MD 193	Franklin Avenue	0.84
Franklin Avenue	Fenton Street	0.94
Fenton Street	Silver Spring Transit Center	0.39
	Total Trip Distance	13.04
	Average Stop Distance	1.30

Service Span and Frequency

The levels of service, in terms of span of service and headways, for the RTS service have to be at a premium level in order to meet passenger demand and obtain high ridership levels. Ideally, the RTS service concept would operate from the early morning until late at night, with ten minute headways or less. Ten minute headways provide a level of service that doesn't require the need to check a schedule. The wait times between vehicles is understood to be frequent enough to meet rider expectations. This frequency falls in the middle of the range of headways for rapid transit systems in North America, and is a reasonable headway expectation for a new service. As service demand increases along the corridor, headways can be further reduced to accommodate the growing demand. The service span was designed to complement and match Metrorail service spans. The initial US 29 RTS levels of service for the fully built out system are displayed in Table 8-8.

Table 8-8 US 29 Levels of Service

Period	From	To	Span of Service	Headways	
				Peak	Off-Peak
Weekday	Burtonsville	White Oak Transit Center	6AM-12AM	0	20
	White Oak Transit Center	Silver Spring Transit Center	6AM-12AM	10	10

Table 8-9 provides a comparison of headway and travel speed savings associated with the RTS service on this corridor. These savings are a comparison between existing local service and the trunk portion of the RTS corridor. The travel speed savings are based on figures for estimated travel speeds from the Federal Transit Administration's *Characteristics of Bus Rapid Transit for Decision Making* report.

Table 8-9 Comparison of Headway and Travel Speeds

Service	Headway (minutes)			Speed (mph)		
	AM	Off-peak	PM	AM	Off-peak	PM
Existing[1]	30	30	30	11	14	10
US 29 RTS[2,3]	10	10	10	14	17	14
Difference	20	20	20	3	3	4
Percent Travel Time Savings				27%	21%	40%

1. Based on WMATA timeTable 8-for Route Z8.

2. Headway is for the trunk portion of the corridor

3. Speed estimate is provided for the trunk portion of the corridor based on type of running way, location, and time of day

Branches, Overlaps, and Deviations

The service concept plan does not identify any major deviations for the US 29 RTS. This concept does advocate for the RTS buses starting or ending in White Oak serve the FDA campus. This service concept also does not promote RTS service on Lockwood Drive and suggest RTS service stays on US 29 south of White Oak. The plan concept is strongly tied to the service outlined in the CTCFMP. The objective was to remain on US 29 and limit the impact of any deviations on travel time. Currently there are no proposed branches for the service; however, the branches of the Randolph Road RTS service would overlap the US 29 RTS between Randolph Road and White Oak. This overlapping would enhance service levels just to the north of White Oak.

Integration with Local Service

RTS on US 29 would supplement the commuter bus service that already exists along the corridor. This would include the Z11 and Z9 service along with MTA's commuter service from north of Montgomery County. Metrobus Route Z8 would be replaced by the RTS. It is also important for the US 29 RTS service to connect with the other RTS routes. As currently planned, the US 29 RTS service would provide connections to the Randolph Road, New Hampshire, University Boulevard, Georgia Avenue, and Veirs Mill RTS services, as described in Table 8-10.

Table 8-10 Connections to Montgomery County RTS Services

Stop Location	RTS Service
Randolph Road; US 29 at Tech Road	Randolph Road
White Oak Transit Center	New Hampshire
MD 193/Four Corners	University Boulevard
Silver Spring Metro Station	Georgia Avenue and Viers Mill

Fleet Requirement

The fleet requirements for the US 29 RTS service are based on the service plan discussed previously. As planned, the route would require 11 vehicles in service during the peak

periods, with an additional 3 vehicles reserved for the spare fleet, for a total fleet of 14 vehicles.[8]

Operational Hours

A planning-level operating requirement was developed based on the assumptions related to the travel speed that could be achieved associated with various BRT treatments. These speeds allowed for a calculation of the number of vehicles that would be required to operate the service using the prescribed headways discussed above. This results in typical weekday service hours of 142. This Figure 8-calculates to roughly 647,700 annual service hours. The deadhead hours (i.e., hours to and from the bus garage) have been factored to 15% of the revenue hours, which equates to approximately 57,850 total vehicle hours.

Corridor Outcome and Summary

The proposed RTS service for the US 29 corridor adds frequent and reliable transit service to a corridor that currently lacks a high quality transit alternative throughout the day. The RTS will provide a new connection between two major employment and residential centers, White Oak and Silver Spring, while accommodating projected growth in transit ridership along the corridor. The RTS will also provide vital connections to other RTS routes as well as Metrorail and Marc commuter rail. Given the limited capacity available on US 29 and the increasing travel demand, the implementation of RTS will be critical to the further development and mobility of travel in the corridor. The RTS will be an important element in establishing reliable transit alternatives. These alternatives will provide high quality transit service between the White Oak and Silver Spring activity centers and further help the economic development of the eastern side of the county.

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[8] These figures are based on a 5 mile long trunk service, and 5 mile long branch services. Peak period speeds assumed 17 mph during peak service and 19-21 mph during off-peak service. Spare ratio is 1.2 times the total vehicle requirement.

RTS Implementation

Montgomery County would certainly benefit from early implementation of improved transit. The planning, design, and construction may take many years. A phased implementation strategy allows the RTS service to grow with the community that it serves with available financial resources and management capacity. As ridership builds and land uses are developed, the service can justify greater use of various corridor treatments to improve travel time, and expand in terms of span of service and headways. This growth in service will also include extensions to other areas of the county that may not warrant RTS service initially. The following general characteristics are associated with each level of development; additional details are included for each specific corridor.

- **Low-Intensity –** Is used to describe an enhanced, limited-stop service. This level of service does not require costly right-of-way acquisition, signal priority, or other major infrastructure improvements. It would also likely only provide a peak-period, or even peak-direction service. The goal of the low-intensity service is to introduce improved transit service into the corridor without costly infrastructure improvements.

- **Medium-Intensity –** Is used to describe a service that is an expansion of the Low-Intensity service, but not the fully-operational RTS service. There are many iterations that this level could take. It could be an expansion of the enhanced, limited-stop service with the addition of some priority treatments, such as signal priority. Another consideration may be the construction of a shorter segment of RTS service, including separated running way, signal priority, improved stops, and off-board fare collection. This initial segment would be constructed on a portion of the corridor ideally suited to supporting RTS, but not the full corridor identified.

- **High-Intensity –** Is used to describe the full RTS service. This service would include all feasible transit treatments suited for the corridor in question, and would operate for the entire corridor identified.

Phasing system growth and expansion will allow time for additional funding to be secured, and to utilize resources in the most efficient and effective manner. The proposed development levels are not intended to be the only possible path to RTS service in Montgomery County. If the funding, desire, and planning support a fully operational RTS service for the entire corridor, then no interim service deployments may be required. This may be feasible for some corridors, but may not be possible for the entire system. The following are phased deployments for each of the corridors.

Randolph Road Corridor

The **low-intensity** service would operate between the White Flint Metrorail station and White Oak. This service would provide peak period-only service at a 10 minute frequency.

The **medium-intensity** service option would include the extension of enhanced, limited stop service to the Montgomery Mall Transit Center. Peak period service would continue to be operated at a 10-minute frequency. Service between Montgomery Mall and New Hampshire Avenue would continue to be provided at a 10 minute frequency all day. Service to White Oak would have a 10 minute effective headway with 20 minute headways for the New Hampshire Avenue and Randolph Road/U.S. 29 corridors respectively. TSP should be in place at this time as well as the construction of level platform boarding stations with off-board fare collection.

The **high-intensity** option would provide all day 10 minute frequency RTS service between Montgomery Mall and White Oak. The headways along New Hampshire and Randolph Road from New Hampshire to White Oak would be provided at 20 minutes.

MD 355 Corridor

The **low-intensity** service would operate between the Lakeforest Transit Center and Bethesda. This service would provide peak period-only service at a 10 minute frequency.

The **medium-intensity** service would result in the extension of enhanced, limited stop service to Clarksburg. Peak period service would continue to be operated at a 10 minute frequency. Service between Metropolitan Grove (pending the Watkins Mill overpass) or Lakeforest Transit Center and Grosvenor Metro would continue to be provided at a 10 minute frequency all day. Service between Clarksburg and the Montgomery College Rockville campus and the Montgomery College Rockville campus and Bethesda would be 30 minutes during the off-peak. TSP should be in place at this time as well as the construction of level platform boarding stations with off-board fare collection.

The **high-intensity** service would be RTS service between Clarksburg and Bethesda with a 10 minute peak frequency and 30 minute off peak frequency for the Clarksburg to Montgomery College and Montgomery College to Bethesda segments.

Georgia Avenue Corridor

The **low-intensity** service would operate between Olney and Wheaton. This service would provide peak period-only service at a 10 minute frequency.

The **medium-intensity** service option would provide peak-direction RTS service within a one-lane median busway. The service would be provided at a 10 minute headway.

The **high-intensity** option would be the increase in frequency of service as ridership demand warrants.

Veirs Mill Corridor

The **low-intensity** service would operate between Montgomery College and Wheaton. This service would provide peak period-only service at a 10 minute frequency.

The **medium-intensity** service option would provide RTS service between Montgomery College and Wheaton with all day 10 minute headways.

The **high-intensity** option would extend the RTS service from Wheaton to Silver Spring and Takoma/Langley Park. Depending on the timing with other corridors that share these alignments, this may occur with the medium-intensity phase.

New Hampshire Corridor

The **low-intensity** service would operate between Fort Totten and White Oak. This service would provide peak period-only service at a 10 minute frequency.

The **medium-intensity** service option would extend enhanced, limited-stop bus service from White Oak to the Colesville Park and Ride. Peak period service between Fort Totten and White Oak would remain at 10 minutes, and service would be added during the off-peak with a 20 minute frequency. Service between White Oak and Colesville will only operate during the peak period at a 20 minute frequency.

The **high-intensity** option would provide all day 10 minute frequency RTS service between Fort Totten and White Oak. The headways from White Oak to Colesville would be provided at 10 minutes during the peak period and 20 minutes during the off-peak.

U.S. 29 Corridor

The **low-intensity** service would operate between White Oak and Silver Spring. This service would provide peak period-only service at a 10 minute frequency.

The **medium-intensity** service option would provide RTS service between Burtonsville and Silver Spring with 10 minute peak period headways. Service would continue to be operated at a 10 minute headway between Silver Spring and White Oak during the off peak, and at a 20 minute headway between White Oak and Burtonsville.

The **high-intensity** option would be the increase in frequency of service as ridership demand warrants.

Appendix A

Corridor Placemat Summary Sheets

Montgomery County Rapid Transit System

Randolph Road Corridor

Purpose of RTS in the Randolph Road Corridor

Provide a new faster east-west transit option in the county connecting White Flint, Glenmont and White Oak. Existing land use patterns are traditional suburban development patterns for the majority of the corridor. This includes lower density single-family detached homes with deep setbacks, and in many cases an orientation away from the road. Commercial developments are auto-oriented with large surface parking areas in the front. The exception to this is White Flint, which is more intensely developed due to its proximity to the Metrorail station. Proposals for future development along the corridor are focused around the already existing activity centers. These include Montgomery Mall, White Flint, Glenmont and White Oak. The greatest intensity of redevelopment is slated for White Flint and White Oak. White Flint is proposed to increase residential units by 9,800 units, more than double the existing and currently approved units. The increase in non-residential square footage is slated to result in 19,100 additional jobs, bringing the total to 48,600[1]. White Oak is currently in the process of a master plan update. The draft plan proposes rezoning and redevelopment to result in a doubling of commercial square footage and dwelling units, primarily focused on multifamily units. This is forecasted to result in roughly 70,000 total jobs[2]. The resulting intensification of development in White Flint and White Oak provide a corridor with two strong anchor points. Connections to Glenmont and Montgomery Mall provide for additional multimodal interactions and future transit options.

Recommended Service Plan

Route Structure

- This route is a combination of the proposed routing and infrastructure for the Randolph Road and North Bethesda Transitway corridors from the Countywide Transit Corridors Functional Master Plan. The route will operate between Montgomery Mall and New Hampshire Avenue (Trunk – 11.1 miles) with branches to White Oak/FDA via New Hampshire (2.6 miles) and Randolph and U.S. 29 (5.4 miles)[3].

Service Characteristics

Service	Headway (minutes)			Speed (mph)		
	AM	Mid-Day	PM	AM	Mid-Day	PM
Existing[1]	15	15	15	13.7	14.8	12.6
RTS[2]	10	10	10	14.0	17.0	14.0
Difference	5	5	5	0.3	2.2	1.4
Percent Travel Time Savings	--	--	--	2%	15%	11%

1. Headway and Speed between Montgomery Mall and FDA White Oak shown, based on Metrobus C8 and RideOn 10 published schedule.
2. Speed assumptions pulled from the RTS Operating Cost Estimate Excel Spreadsheet for the Trunk portion of Randolph Road.

Modifications to Local Service

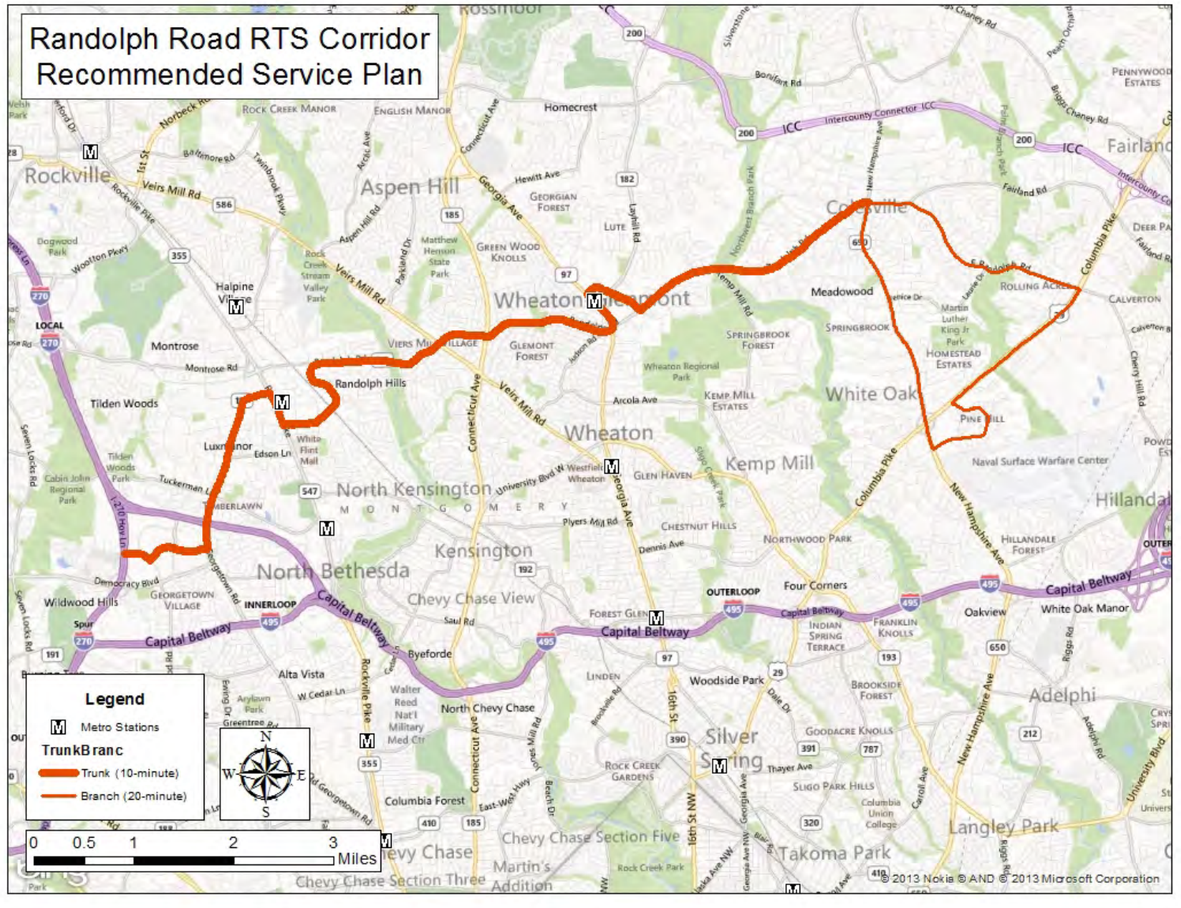
- Metrobus Route C8 and RideOn Route 10 would provide local service along the corridor.

Recommended Phasing

Phase I. Enhanced limited stop bus service along the Randolph Road Corridor between White Flint and White Oak/FDA with peak period service at 10-minute headways.

Phase II. Enhanced limited stop bus service along the Randolph Road Corridor between Montgomery Mall and White Oak/FDA with 10-minute headways. Service between Montgomery Mall and New Hampshire Avenue would operate with a 10-minute frequency, while service to White Oak/FDA would be have a 10-minute effective headway with 20-minute headway along New Hampshire and Randolph/US 29.

Phase III. As ridership increases and demand warrants, headways will be increased to accommodate the level of demand. According to the ridership projections in the CTCFMP, peak demand in the future would warrant six minute headways in the peak period and eight minute headways in the mid-day.



[1] Approved and Adopted White Flint Sector Plan, April 2010, Montgomery County Planning Department
[2] White Oak Science Gateway Master Plan Planning Board Draft, September 2013, Montgomery County Planning Department
[3] Since the release of the Countywide Transit Corridors Functional Master Plan to the County Council in July 2013, the Council has approved the plan with the following changes: 1. The North Bethesda Transitway would start at either Grovesnor or White Flint and operate to Montgomery Mall, 2.

Vanasse Hangen Brustlin, Inc. VHB

FOURSQUARE INTEGRATED TRANSPORTATION PLANNING

Montgomery County Rapid Transit System Service Planning Concepts

MD 355 Route

Purpose of RTS in the MD 355 Corridor

Provide a new faster transit option for commuters from Clarksburg and Germantown to Rockville with some service continuing to Bethesda. Existing land use along the northern portion of the corridor is primarily low-density traditional suburban development with a higher concentration of residential uses. There are moderately higher densities and a greater mix of land uses within Clarksburg and Germantown. Within the City of Rockville and along the southern half of the corridor the development density increases with a greater mixing of land uses. The greatest intensity is focused around the Metrorail stations. Future plans call for increases in development within Germantown, Rockville, and around many of the Metrorail stations along the Red Line. Germantown could see up to 9,000 new dwelling units and doubling of commercial space to approximately 24,000,000SF, resulting in over 30,000 new jobs[1]. The City of Rockville is currently revising its master plan, but existing redevelopment of the Rockville Town Center indicates a more densely development corridor in the future with a greater mixing of residential and commercial land uses. White Flint's sector plan proposes a tripling of residential units to 14,341 and growth in non-residential uses resulting in an additional 19,100 jobs[2]. These combined with moderate growth projected in Bethesda create an environment suitable for high capacity transit in addition to the existing transit within the corridor.

Recommended Service Plan

Route Structure

- This route is a combination of the proposed routing and infrastructure for the MD 355 North and MD 355 South corridors from the Countywide Transit Corridors Functional Master Plan. The route will operate between Metropolitan Grove (MARC) and Grosvenor (Trunk – 11.8 miles) with a continuation of service to Bethesda and branches to Clarksburg (Branch 1 – 6.7 miles) and Friendship Heights (Branch 2 – 4.5 miles)[3].

Service Characteristics

Service	Headway (minutes)			Speed (mph)		
	AM	Off-Peak	PM	AM	Off-Peak	PM
Existing[1]	15	15	15	14.7	15.6	14.4
RTS[2,3]	10	10/30	10	17.0	19.0	17.0
Difference	5	5	5	2.3	3.4	2.6
Percent Travel Time Savings	--	--	--	16%	22%	18%

1. Based on Montgomery County Ride On timetable for 46.
2. Speed estimate is provided for the Trunk portion of the corridor, taken from the RTS Operating Cost Estimate Excel Spreadsheet.
3. Peak period headways are 10 minutes for the entire corridor. Off-peak headways are 10 minutes for the trunk and 30 minutes for the branches with an effective headway of less than 10 minutes along the trunk.

Modifications to Local Service

- Portions of Ride On routes 75, 55, 46 and 34 would be realigned to continuously operate along the corridor and serve as the local option to RTS service.
- All Metrobus J routes would take advantage of the proposed RTS infrastructure at any time they are operating on MD-355.

Recommended Phasing

Phase I. Enhanced limited stop bus service (e.g., Metro Extra) along the MD 355 Corridor between the Lake Forest Transit Center and Friendship Heights with peak period service at 10-minute headways.

Phase II. Enhanced limited stop bus service between Clarksburg and Friendship Heights with 10-minute peak period headways and 30-minute peak period headways between Clarksburg and Montgomery College and Montgomery College and Friendship Heights. The headway will be 10 minutes all day for service between Metropolitan Grove (pending Watkins Mill overpass) and Grosvenor.

Phase III. All-day RTS service utilizing the two-lane median busway will be provided, with 10-minute headways all-day between Metropolitan Grove and Grosvenor. Branch Service will be provided between Clarksburg and Montgomery College and Montgomery College and Friendship Heights at 10-minute peak period and 30-minute off-peak period headways.

[1] Germantown Forward – Germantown Area Sector Plan Approved and Adopted, October 2009, Montgomery County Planning Department
[2] Approved and Adopted White Flint Sector Plan, April 2010, Montgomery County Planning Department
[3] Since the release of the Countywide Transit Corridors Functional Master Plan to the County Council in July 2013, the Council has approved the plan with the following changes: 1. The MD 355 North corridor will have two different routings through Germantown East 2. The MD 355 South corridor would no longer extend to the Friendship Heights Metro station, but instead stop at the Bethesda Metro station.

Georgia Avenue Route

Purpose of RTS in the Georgia Avenue Corridor

Provide a new faster transit option for commuters from Olney to Wheaton with some service continuing to either Silver Spring or Takoma-Langley (new one-seat ride to Takoma-Langley). Land uses north of Wheaton are low-density traditional suburban patterns fronting away from Georgia Avenue. Uses intensify approaching Aspen Hill and Glenmont, with higher intensities around the Glenmont Metro. Land use changes more dramatically around Wheaton with greater mixing of land uses, higher densities, and reduced building setback. The land use pattern changes back to a primarily residential pattern south of Wheaton, but with smaller setbacks and a higher density than found at the northern end of the corridor. Densities and land use mixing dramatically change approaching and into Silver Spring.

Recommended Service Plan

Route Structure

- This route will operate between Olney and Wheaton (Trunk – 9.6 miles) with branches to Silver Spring (Branch 1 – 3.9 miles) and Takoma/Langley (Branch 2 – 5.9 miles).
- Every other trip will operate to Silver Spring and Takoma/Langley.

Service Characteristics

Service	Headway (minutes)			Speed (mph)		
	AM	Off-Peak	PM	AM	Off-Peak	PM
Existing[1]	15	20	15	15.6	14.2	13.1
RTS[2,3,4]	10	10	10	23.0	25.0	23.0
Difference	5	5	5	7.4	10.8	9.9
Percent Travel Time Savings	--	--	--	47%	76%	76%

1. Based on WMATA metrobus timetable for Routes Y5,7,8,9 and Montgomery County RideOn timetable for 52 & 53.
2. Assumes 27 mph average speed between Olney and Wheaton (SHA/MTA) and 13 mph average Wheaton to Silver Spring from the RTS Operating Cost Estimate Excel Spreadsheet.
3. Trunk Service (Olney to Wheaton) – 10 minutes all day long. Branch 1 (Wheaton to Takoma/Langley Park) – 20 minutes all day. Branch 2 (Wheaton to Silver Spring) – 20 minutes all day.
4. Effective headways on both University Blvd and Georgia Avenue will be 8.5 minutes with Veirs Mill Road RTS included.

Modifications to Local Service

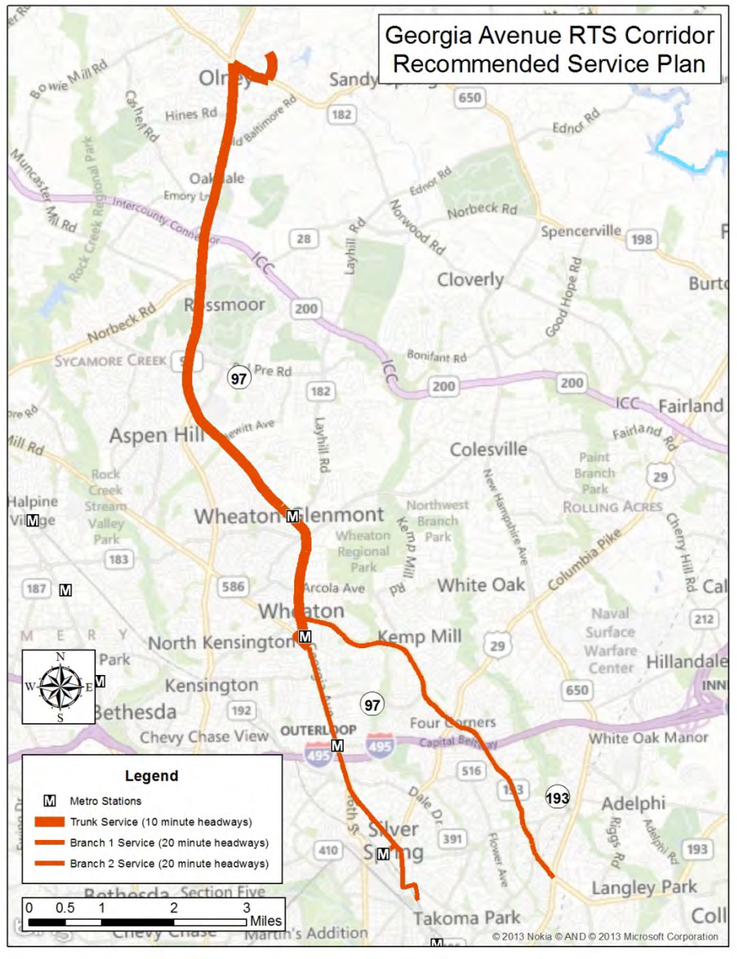
- Metrobus Routes Y5 and Y7 would be modified.
- Metrobus Routes Y8 and Y9 would be expanded to cover peak periods and would take advantage of the proposed RTS infrastructure curb lanes on Georgia Avenue.
- RideOn Route 53 would be truncated at Olney.
- RideOn Route 52 would connect to Georgia Avenue RTS at Norbeck P&R and Hines Road, but discontinue service on Georgia Avenue.

Recommended Phasing

Phase I. Enhanced limited stop bus service (e.g., Metro Extra) along the Georgia Avenue Corridor between Olney and Wheaton with peak period service at 10 minute headways.

Phase II. Peak period RTS service utilizing peak-direction one-lane median busway with 10-minute headways.

Phase III. As ridership increases and demand warrants, headways will be increased to accommodate the level of demand. According to the ridership projections in the CTCFMP, peak demand in the future would warrant five minute headways in the peak period and eight minute headways in the mid-day.



Montgomery County Rapid Transit System Service Planning Concepts

Veirs Mill Road Route

Purpose of RTS in the Veirs Mill Road Corridor

Provide a new faster east-west transit option in the county connecting Wheaton, Rockville, Montgomery College, Silver Spring and Takoma/Langley Park. Land use starting at the southernmost end of the corridor is dominated by auto-oriented commercial uses at high intensities, most notably the Westfield Wheaton Mall. As Veirs Mill Road continues northwest and passes University Boulevard, commercial intensities steadily decrease before transitioning to small lot, single-family residential uses. Between Rockville Pike and Rockville Metrorail Station, land use intensities increase dramatically, with multi-story residential and office space a typical sight.

Recommended Service Plan

Route Structure

- The trunk portion of the corridor will be between Montgomery College and Wheaton (6.7 miles).
- Every other trip will serve either Silver Spring (3.7 miles) or Takoma/Langley Park (5.9 miles).

Service Characteristics

Service	Headway (minutes)			Speed (mph)		
	AM	Off-Peak	PM	AM	Off-Peak	PM
Existing[1]	10	15	9	14.0	13.3	12.3
RTS[2,3,4]	10	10	10	18.0	20.0	18.0
Difference	--	5.0	--	4.0	6.7	5.7
Percent Travel Time Savings	--	--	--	29%	50%	46%

1. Based on WMATA metrobus timetable for Routes C2,4; Q2,4,6; and Montgomery County RideOn timetable for 8.
2. Based on CTCFMP infrastructure recommendations and RTS Operating Cost Excel Spreadsheet.
3. Trunk Service (Veirs Mill – Montgomery College to Wheaton Metro) – 10 minutes all day long. Branch 1 (Wheaton to Takoma/Langley Park) – 20 minutes all day long, Branch 2 (Wheaton to Silver Spring) 20 minutes all day long.
4. Effective headways on University Blvd. and Georgia Ave. will be 10 minutes with Georgia Ave. RTS.

Modifications to Local Service

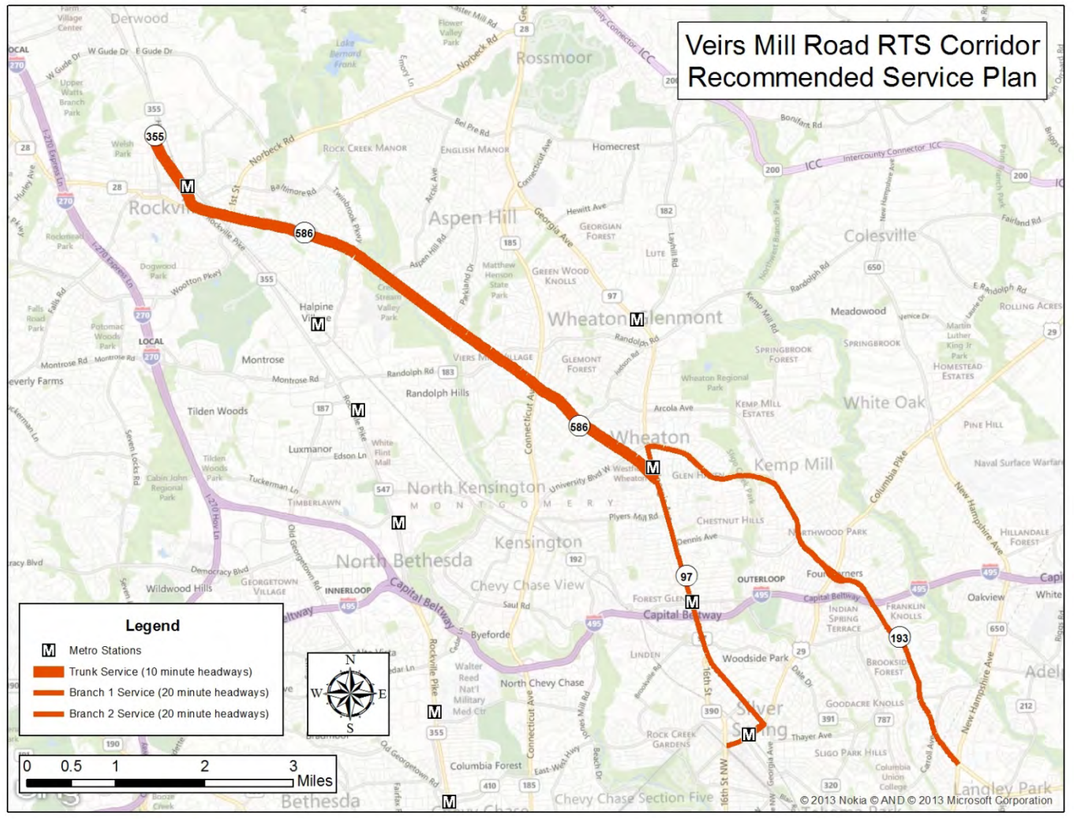
- Metrobus Route Q2 would serve as the local option between Montgomery College and Silver Spring.
- Metrobus Routes Q4, Q5 and Q6 would be modified in conjunction with MD 355Corridor.
- Metrobus Routes C2 and C4 would continue to operate as they do today and provide local service between Wheaton and Takoma/Langley Park.
- Metrobus Route C4 and RideOn Route 26 would use the median busway along Veirs Mill Road.

Recommended Phasing

Phase I. Enhanced limited stop bus service (e.g., Metro Extra) along the Veirs Mill Road Corridor between Montgomery College and Wheaton with service at 10-minute headways.

Phase II. All-day RTS service utilizing the planned busway infrastructure between Montgomery College and Wheaton. The service will be provided with service at 10-minute headways. Service to Silver Spring and Takoma/Langley Park would be offered once each corridor's improvements are completed.

Phase III. As ridership increases and demand warrants, headways will be increased to accommodate the level of demand and service will be all-day.



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FOURSQUARE INTEGRATED TRANSPORTATION PLANNING

NOV 2013

Montgomery County Rapid Transit System Service Planning Concepts

New Hampshire Avenue Corridor

Purpose of RTS in the New Hampshire Avenue Corridor

Provide a new faster transit option connecting Fort Totten with Takoma/Langley Park, White Oak and Colesville. Land uses along the corridor are primarily auto-oriented and low-density, with patterns transitioning between mostly residential and strip commercial moving from Fort Totten west towards White Oak.

Recommended Service Plan

Route Structure

- The trunk portion of the corridor will operate between Fort Totten and White Oak (5.8 miles).
- Every trip will continue to the Colesville Park-and-Ride (2.6 miles) during peak hours while every other trip will continue there during off-peak hours.

Service Characteristics

Service	Headway(minutes)			Speed (mph)		
	AM	Off-Peak	PM	AM	Off-Peak	PM
Existing[1]	10	18	10	13.8	15.3	13.4
RTS[2,3]	10	10	10	15.0	18.0	15.0
Difference	6	10	6	1.2	2.7	1.6
Percent Travel Time Savings	--	--	--	9%	18%	12%

1. Based on WMATA metrobus timetable for Routes C8,K6, K9, and Z2.
2. Speed assumptions pulled from the RTS Operating Cost Estimate Excel Spreadsheet for New Hampshire Avenue.
3. Trunk Service (White Oak to Fort Totten) – 10 minutes all day long. Outer Branch (Colesville to White Oak) – 10 minute peak service, 20 minute off-peak service, primarily due to a lack of demand/development along this portion of the route.

Modifications to Local Service

- Metrobus Routes K6 and Z2 will provide local service along the corridor.
- MetroExtra Route K9 will be replaced by RTS service.

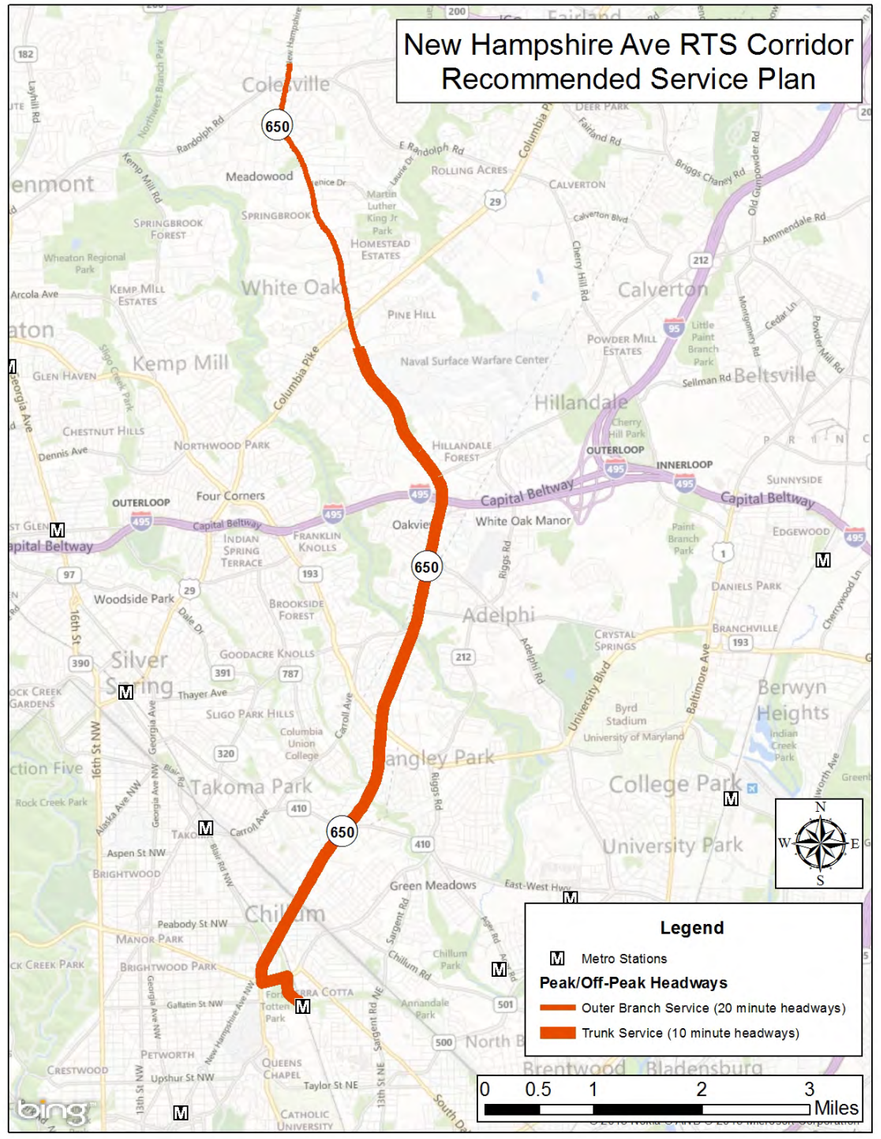
Recommended Phasing

Phase I. Enhanced limited stop bus service (e.g., Metro Extra) between Fort Totten and the White Oak Transit Center with peak-period service at 10-minute headways.

Phase II. Enhanced limited stop bus service between Fort Totten and the White Oak Transit Center with peak-period service at 10-minute headways and off-peak service at 20 minute headways. Service between the White Oak Transit Center and Colesville Park-and-Ride will be provided during peak periods with 20-minute headways.

Phase III. All-day RTS service utilizing the median busway between Fort Totten and the White Oak Transit Center with 10-minute headways. Service between the White Oak Transit Center and Colesville Park-and-Ride will be provided with 10-minute headways during peak periods and 20-minute headways during off-peak periods.

Phase IV. As ridership increases and demand warrants, headways will be increased to accommodate the level of demand. According to the ridership projections in the CTCFMP, peak demand in the future would warrant four minute headways in the peak period and six minute headways in off-peak periods.



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FOURSQUARE INTEGRATED TRANSPORTATION PLANNING

NOV 2013

Montgomery County Rapid Transit System Service Planning Concepts

U.S. 29 Corridor

Purpose of RTS in the U.S. 29 Corridor

Provide new faster transit option for commuters from Burtonsville to Silver Spring and between activity centers in the corridor (White Oak, Four Corners, and Silver Spring). Land Uses north of Randolph Road are primarily suburban in design, with low density single family residential being the predominant land use, with traditional suburban commercial retail located near major intersections. Land use transitions starting south of Randolph with office, commercial, and institutional uses located south of U.S. 29, transitioning to smaller lot single family. Land Uses begin to dramatically intensify approaching Silver Spring with a greater mix of uses and higher density development.

Recommended Service Plan

Route Structure

- This route will operate between White Oak and Silver Spring (4.2 miles) as the defined trunk.
- Service between White Oak and Burtonsville (5.9 miles) will operate only in the off-peak at 15 minute headways.
- The Randolph Road RTS service would operate on top of the US 29 RTS service between Randolph Road and White Oak – where one branch of the Randolph Road RTS service terminates.

Service Characteristics

Service	Headway (minutes)			Speed (mph)		
	AM	Off-Peak	PM	AM	Off-Peak	PM
Existing[1]	30	30	30	11	14	10
RTS[2,3]	10	10	10	14	17	14
Difference	20	20	20	3	3	4
Percent Travel Time Savings	--	--	--	27%	21%	40%

1. Note: There is no existing service that represents a local bus version of the proposed RTS. The Z8 service was used as a comparison given its connectivity in the corridor. During peak periods there are a series of closed door services connecting the PNR lots to the Silver Spring Metro. These services were not included in the headway calculations because of the limited stops.
2. Service between Burtonsville P&R and Silver Spring will be 20 minutes in the off-peak until demand warrants higher frequency. It will not operate in the peak. Current closed door service will continue to operate and use the facility in the peak periods. This includes all MTA commuter buses and the Z7, Z9, Z11, and Z29. From White Oak to Silver Spring the service will operate with 10 minute headways in the peak and off peak periods.

Modifications to Local Service

- Z8 would continue with half the headways of service today, RideOn would continue service and not be impacted but would use the infrastructure.
- All Z routes and MTA commuter buses would take advantage of the proposed RTS infrastructure at any time they are operating on US 29.

Recommended Phasing

Phase I. Enhanced limited stop bus service (e.g., Metro Extra) along the US 29 Corridor between Silver Spring and White Oak with peak period service at 10-minute headways

Phase II. After the US 29 Busway is completed RTS service would be provided between Silver Spring and White Oak at ten minute headways. Service in the off-peak would continue to Burtonsville PNR lot at 20 minute headways.

Phase III. 10-minute headways across the entirety of the US 29 RTS route alignment at such time as demand warrants it.