

BUS RAPID TRANSIT IN MONTGOMERY COUNTY, MARYLAND:
DETERMINING STOP AND STATION LOCATIONS IN SPECIFIED CORRIDORS

By

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To my family

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LIST OF ABBREVIATIONS

ASCE	American Society of Civil Engineers
APTA	American Public Transportation Association
BART	Bay Area Rapid Transit
BRT	Bus Rapid Transit
DC Metro	Washington DC Area Metro Bus and Metro Rail
DOT	Department of Transportation
FTA	Federal Transit Administration
GHG	Greenhouse Gas
ITE	Institute of Transportation Engineers
ITDP	Institute for Transportation and Development Policy
LRT	Light Rail Transit
MARC	Maryland Rail Commuter Service
MCDOT	Montgomery County Department of Transportation
Metro Bus	Washington DC Area Bus System
PB	Parsons Brinkerhoff
PPP	Public Private Partnership
Ride On	Montgomery County Bus System
ROW	Right-of-Way
RTV	Rapid Transit Vehicle
TCRP	Transportation Cooperative Research Program
TOD	transit-oriented development
U.S.	United States of America
VMT	Vehicle Miles Traveled
WMATA	Washington Metropolitan Area Transit Authority

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The congestion affecting the metropolitan area surrounding our nation's capital is at a level that surpasses New York City, Los Angeles and Chicago in terms of hours lost in traffic (Haysley, 2011). This is detrimental to the environment and the economy of the region that includes Montgomery County, MD. Many hurdles and impediments exist to alternative transportation systems and their implementation such as; government policies, politicians, interest groups, lobbyists, and the institutions that manage these systems. The Transit Task Force under the direction of the Montgomery County Council is actively developing a Bus Rapid Transit (BRT) system to improve transportation throughout the region.

The goal of this system is to provide an alternative to the automobile that can offer comparable (in many ways improved, especially during peak-hour) levels of speed and service comparable to a rail system at far less cost. This research recommends stop and station locations for further investigation along four of the six additional corridors recommended by Transit Task Force Work Group D (routes and sequencing). These stop and station locations have been selected in relation to their proximity to current and planned transportation routes, activity

centers, and other criteria that are considered when determining stop and station location for BRT and LRT.

CHAPTER 1 INTRODUCTION

The Washington D.C. metropolitan region suffers from the worst congestion in the nation in total hours wasted stuck in traffic (Hayley, 2011). This includes Montgomery County, MD which is currently trying to address this issue with a state of the art county-wide bus rapid transit (BRT) system. This process is in its early stages and those involved with its design and implementation are aiming for the first true Gold standard BRT (as set forth by the Institute for Transportation Development Policy - ITDP) for the United States to provide an example for future systems to strive for.

ITDP's Gold standard BRT includes, but is not limited to: multiple routes using the same infrastructure, peak-period frequency, integrated collection with other systems, center-line bus lanes, passing lanes at stops for express service, level boarding, a branding campaign for the system and also multi-modal connections with other transportation options (ITDP, 2011, p. 17). These new systems are a change in perspective in American transportation and come after many decades of a far different approach.

Moving forward into this century and addressing transportation issues related to energy use, public health, the environment, and consumption of fossil fuels have contributed to a strategy of investing in alternative transportation and is now seen as a more viable and necessary approach. Many barriers exist to alternative transportation systems and efficiency that are unique to the United States due to our history of development among many other contributing factors. According to Randolph and Masters (2008) transportation is the fastest growing and most oil dependent energy consuming sector in the U.S. and relies almost exclusively on oil at a rate of 96% (p. 495, 491).

This topic resonates more and more with the public and politicians on a daily basis as oil costs continue to fluctuate due to: political turmoil in the Middle East, the depths and cost associated with extraction from the earth, the cost of transporting and refinement of oil, environmentally degrading spills that continue to occur and urban air quality exceeding standards that negatively impact children and the elderly most severely. With limited funds available for infrastructure, it is essential to invest in alternative modes of transportation that rely less on environmentally degrading practices and attempt to decrease or stabilize our consumption of fossil fuels while giving consumers other options to the automobile to move within, through and between their environments.

Some barriers to transportation efficiency that are built into the physical, social and political environments we live in, and the perceptions of what functioning transportation systems in society should look like. Some of the uniquely American barriers we must deal with when addressing these issues are a result of the youth of our nation that is well represented by Randolph and Masters (2008) when they compare U.S. cities to those of Europe:

Despite having the same income per capita, the average European city is nearly four times as dense, has half the freeway length per person, and has half the parking spaces per 1000 jobs. The U.S. urban dwellers have three times the passenger car miles per person, four times the passenger CO2 emissions per person, and 1.5 times the energy use per passenger mile. Whereas Europeans use non-motorized and transit modes for 50% of their travel, U.S. city residents use them for only 11%. (p. 584)

The U.S. pattern of development is a result of a short period of development on a vast open landscape that many immigrants came here to settle and claim as their own property. Europe has had the benefit of dense historical development over a much longer period of time with much less dependence on the automobile, and subsequently has a more traditional urban form that is generally intertwined with more transportation options in areas that are much more pedestrian

friendly. The majority of Europe also benefits from a higher tax rate on gasoline and dedicates far more funds to balanced transportation networks.

This unique transportation and development patterns that characterize the U.S. will be further developed in the literature review that follows. The literature review provides an overview of the history of development in the U.S. and the evolution of our current transportation system, the current state of our transportation network, alternative transportation networks and their benefits, barriers to BRT implementation, how to overcome institutional barriers, and the factors to be considered in evaluating stops and station locations for LRT and BRT.

Montgomery County hired Parsons Brinkerhoff (PB) to work in conjunction with Montgomery County Department of Transportation (MCDOT) to conduct a Countywide BRT feasibility study which produced; *Proposed BRT Network and Treatments, Ridership and Operational Costs, and Capital Costs*. With these route recommendations in conjunction with the original proposed routes by Council-member Marc Elrich, the Montgomery County Transportation Task Force has designed a network for a proposed BRT system. This research produced the most suitable locations, recommended for further investigation, for BRT stations along specified corridors in Montgomery County, Maryland for implementation of a BRT system consistent with their long term transportation goals on routes that were not included in the PB study.

CHAPTER 2 BACKGROUND INFORMATION AND LITERATURE REVIEW

Historical Development and Transportation in the US

The United States has unique challenges to more efficient transportation systems.

Understanding how the U.S. has evolved is critical to understanding how BRT can address the issues that the transportation sector now faces and specifically how the locations of stops and stations for new systems of transit can be helpful to reach the goals of these systems and provide more mobility and accessibility to users.

Originally the development patterns of our cities were traditional dense urban areas that provided walkability and led to some of the great cities of the world. The late nineteenth century saw street cars replace cable cars that evolved from horse drawn cars and buggies. The railroad helped to provide a step towards an efficient system of movement for goods and people that provided significant growth to a flourishing nation.

Street car companies were eventually phased out due to social, economic and political factors, and made way for buses that took their place that were much more efficient in serving the sprawling car-oriented development that the country was experiencing (Weinstock et al. 2011, p. 12). This was accelerated more during the post WWII car boom and even more suburbanization. Also influential was the national highway system that provided our country with one of the best transportation networks in the world in conjunction with an auto industry that defined much of our nation's economy and also a growing air travel sector. This led to a significant vested interest in highways, automobiles and airlines.

These trends led to a shift in public transit and rail funding to heavy subsidies sent to road and air travel. Wickizer & Snow (2011) state that these subsidies made competition from rail virtually impossible and unable to compete for the remainder of the 20th century (p. 12). The

combination of these factors led to sprawling car dependent suburbs that are rarely served by transit. Many times these sprawling suburban residences still seem affordable but are negated in value when the individual's commute surpasses 12 to 15 miles (Puentes, 2008, p. 35). The result of these development patterns has been congestion, air pollution, urban decline and blight, a variety of transportation related health issues and development in environmentally sensitive lands (habitats, watersheds and agricultural). This sprawling development makes density (one of the most important factors for public transportation to be viable and effective) difficult to achieve for a large portion of the U.S. All of these factors have contributed to the current landscape and a transportation network that is in need of repair, poorly funded and congested.

While sprawl has characterized much of the landscape of the U.S., we now are a more urbanizing population. With the top 100 metropolitan areas accounting for 12% of the land, 65% of the population, 68% of jobs and 75% of economic output, transportation within and between these regions is crucial to remain competitive in the global economy (Puentes, 2008, p. 4). This is particularly true in Montgomery County, MD where a once suburban bedroom community now has urban city centers, in many cases dictated by the DC Metro Red Line.

Current State of U.S. Transportation Network

The federal gas tax: While we look to address these transportation issues that alternative transit systems and more balanced networks can address it is important to first note what has contributed to the poor infrastructure and lack of non-automobile mobility that has now become the norm in the U.S. One central problem is the inherent deficiencies with the existing gas tax primarily that it has not increased with inflation since the 1970s and has contributed to the fact that the U.S. pays far less per gallon in taxes than many other countries. Dutzik & Davis (2011) points out that highways never really paid for themselves, gasoline taxes cover a fraction of the

cost with a few exceptions and that the gas tax is not even close to a true 'user fee' argued by its supporters and advocates (Pp. 15-16).

Actual 'user fees' or costs that give consumers a more realistic gauge of their consumption are advocated by West & Robertson (2011) that incorporate pollution, congestion and accident externalities to calculate that the "marginal damages at 83 cents per gallon in 2000 dollars" while also stating that "the existing tax in the U.S. is far below what almost any economic analysis would indicate as the optimum" (Pp. 609, 611). As vehicle efficiency improves and MPG increase, the declining revenue from this already insufficient tax compared to the increase in total VMT continue to go further in the opposite direction. Dutzik & Davis (2011) explain that "drivers who use vehicles with better fuel economy pay less into the system than those who drive gas guzzlers, since the collection system for gasoline taxes is based on fuel sales, not mileage driven," and is "another way in which the fees charged to drivers through gasoline taxes are unrelated to their use of the system" (p. 7). This lack of revenue and increased use has contributed to the crumbling of our infrastructure, rated with a grade of 'D-' by the American Society of Civil Engineers (ASCE).

Dutzik & Davis (2011) raise two excellent points. The notion that users pay extra into the system is overstated and that the money they put into the system actually benefits the part of the system that they use (p. 11). The problem is that in 37 states the funds from the gas tax are dedicated to highways, and the local roads that these drivers use more frequently are denied much of the funding that true 'user fees' should be sent to. The few exceptions like Maryland, New York and Wisconsin use gasoline taxes for a variety of transportation issues other than highways, while in some other states these funds are dedicated to the general fund and in some rare cases even used for education (p. 13).

Many options are available to create a true ‘user fee’ tax that address infrastructure maintenance and improvements that can better maintain and prolong the life of these systems. One general goal of transportation planning is to simply get people to reduce their use, or their overall VMT. This can be done by incentivizing reduced consumption through tolls, congestion or peak-hour pricing, creating a tax based on VMT or offering alternatives that provide a comparable level of service. Instead of the gas tax that is bundled into the per gallon cost, a tax on how much you actually drive can then be set to the cost of maintaining that infrastructure drivers use. This would do a great deal to address our poor infrastructure and help people to realize their level of consumption while giving consumers a true ‘user fee.’

Morrow et al. (2010) explains that “transportation sector-specific policies such as fuel taxes, mileage charges, fuel economy or GHG emission intensity standards, and/or purchasing incentives will need to be put into action if emissions reductions from this sector are desired” (p. 34). Many of these advanced taxation policies are politically challenging especially in the current economic situation and fiscally restrained political environment, but could be effective in funding a balanced transportation network that incentivizes the reduction in VMT and inherent inefficiencies associated with automobile transportation.

State of infrastructure: In the midst of the current recovery from recession many obstacles exist to programs that address transportation and infrastructure needs as funds are shrinking and investments must be made must be made strategically and in an “economically-enhancing way” (Puentes, 2011a, p. 1). The average U.S. household currently spends twenty percent of its income on transportation related items, such as gasoline and insurance (Puentes, 2011a, p. 1). With these kinds of costs placed on consumers, alternatives need to be available. As the nation becomes more urban and once affordable areas are gentrified and the cost of living

rises with demand, the suburbs are becoming more populated with lower income residents who are burdened with spending a larger portion of their income on transportation. Investments in the current network are extremely important to keep these areas accessible with alternatives to the private automobile which can make these areas more affordable for residents to commute from.

The physical neglect of our infrastructure, congestion and environmental degradation associated with the transportation systems all negatively impact sectors critical to our national interests (Puentes, 2011b, p. 5). On an individual level, potholes from simple road neglect and congestion (that increases fuel costs, maintenance and emissions) can cost individual commuters greatly. The U.S. DOT estimates 15% of major U.S. highways, excluding rural and local, are in unacceptable condition and 41% are in fair condition (Puentes, 2011a, Pp. 16-17). The average age of U.S. bridges are 45 years old with a life expectancy of 40-50 years (Kahn & Levinson, 2011, p. 5). Our highway system was once hailed as the pride and joy of our nation and now is “a source of crippling deficiencies that does not reflect current travel patterns or embrace advances in technology” (Puentes, 2011a, p. 5). Many of these deficiencies directly affect the quality of our environment, considering urban commuters lost 14.2 and 29 hours in 1982 and 2009 respectively (TTI, 2010). These delays compound issues of urban air quality as well as other environmentally degrading factor associated with our transportation network.

Environmental transportation issues: Transportation accounts for 1/3 of the CO₂ emissions in the U.S., while per capita emissions are generally lower in urban areas due to land use patterns and greater transportation options (Puentes, 2011a, p. 30). The most susceptible to these health problems that stem from emissions are the very young and very old. The addition of roads is often counter-productive in addressing congestion as more drivers will take to the road that otherwise would have avoided congestion and emissions will increase along with impervious

surface, that is detrimental to natural habitats and watersheds. More efficient alternatives to automobiles and additional highway construction exist that can reduce emissions and help municipalities and metropolitan areas reach their transportation and emission reduction goals in more sustainable ways.

Alternative Transportation Networks and Benefits

Several criteria need to be considered to assess the efficiency of the transportation networks and the improvement of the U.S. transportation system. A variety of factors should be considered; speed and mobility, accessibility, energy required in construction and operation, and frequently of the utmost importance is cost of implementation, operation and maintenance. These costs are also associated with the energy inputs required to build the systems. The most efficient system varies from place to place and in different countries and regions, but is a combination of all of these factors. Urban areas must have a far different approach to transportation systems than rural and suburban areas due to a wide variety of comingled issues. Urban air quality is a main concern that provides incentive to reduce automobiles that cause congestion and compound these issues particularly when optimal traffic flow is impeded. In suburban areas ridership is often hard to attain due to density of development issues. What must be discussed are the alternatives to traditional car-oriented transportation and what options are the best choice for specific cities and regions.

Rail, if it has sufficient ridership, is the most efficient form of transportation for moving people (Randolph & Masters, 2008, p. 588). Rail projects are expensive and are most common in highly urbanized areas that can provide the necessary ridership. Other transportation options to the automobile contribute to efficiency and a balanced transportation network. Baily et al. (2008) found that transit reduces U.S. travel by an estimated 102.2 billion VMT each year

(3.4%), and the total of that energy savings (less the energy used by public transit and adding savings from reduced congestion) is equal to 4.2 billion gallons of gasoline (p. 1-2).

Multi-modal transportation involves connecting walkable, bicycle friendly areas to transit options including bus and rail. When thinking of multi-modal systems we first think of these urban areas. While each place has unique factors to consider in meeting specific goals, striving to use the least amount of energy in production and use of the system to provide the most accessibility to users seems like a logical approach. This, accompanied by sufficient ridership, can help to determine what the best option is and to justify a specific transit system's implementation. Heavy, usually expensive, rail investment that is often energy intensive and is most appropriately used in areas where there is the density and demand (or predicted ridership) to support it. Some lower-density areas may be best served by car travel and bus service.

However, there are many instances in the U.S. where these rural or suburban areas must be connected more efficiently, due to congestion of the already-built-out highways that are near or over capacity, and the prevalence of sprawl. The problem in these areas is that there are so many SOVs that could hold several additional passengers. This makes their trips very inefficient in terms of energy consumed (gas primarily) and emissions produced (CO₂), especially when congestion occurs and they are not moving through these areas at a desired pace. Several options are available to address this inefficiency; carpooling, HOV lanes, and also providing alternative options (Commuter Buses, Commuter Rail, LRT, and BRT) to complement the existing highway system or even replace lanes in some cases. Investments in rail and other alternative means to the automobile are essential as we continue to experience fluctuating fuel costs and the energy in retrieving these energy sources become more intensive and environmentally hazardous.

Wizicker & Small (2011) state a well-designed rail system can help reduce congestion, especially in highly populated corridors, mitigating the adverse impacts of congestion (p. 13).

Wizicker & Small (2011) also note two central issues regarding expanding rail service and its impact on air pollution along with the energy required to power trains:

Trains, both diesel and electric, require significantly less energy per passenger-mile than automobiles or airplanes. In 2008, Amtrak trains burned 1,745 British Thermal Units (BTU's) per passenger-mile, while passenger cars burned 3,501, and domestic air carriers burned 2,931 per passenger-mile. This implies that in terms of energy conservation that trains are approximately fifty and forty percent more efficient than automobiles and airplanes, respectively, as measured by the amount of energy expended per passenger-mile. (p. 14)

To frame this energy efficiency in yet another important way, Wizicker & Snow (2011) state:

In 2004, passenger rail (heavy, light, commuter) accounted for 25,822,000,000 passenger-miles traveled and consumed 969,694,000 gallons of gasoline (or gasoline equivalent), resulting in an average fuel consumption rate of 267 passenger miles per gallon of gasoline. In contrast, in 2004, the average fuel efficiency for U.S. automobiles was twenty-two and one-half miles per gallon (one passenger). (p. 14)

BRT and LRT are similar in that they facilitate transit-oriented development (TOD), but they differ in other respects. LRT produces less regional urban emissions than BRT but is also more costly to implement (Puchalsky, 2005, p. 31). Thus, BRT is the next best option and can even be considered as a precursor to LRT. By dedicating lanes and providing guide-ways BRT can be promoted as a future option for LRT implementation if the ridership supports it. Both BRT and LRT provide riders with an efficient transportation option.

Today's reliance on instant communication and technology often are impediments to car transportation as they distract drivers, cause accidents and create delays. Alternative transportation modes allow us to use these devices on our daily commutes without the negative and hazardous implications associated with personal transportation (Wickizer & Snow, 2011, p. 13). Riders can be productive and make up time lost compared to a commute in an automobile,

while decreasing their environmental footprint associated with personal transportation. The use of BRT and LRT may explain the 7% reduction from 1995 (from 21% to 14%) in VMT among 21 to 30 year olds since 1995 (Wickizer & Small, 2011, p. 13).

All of these systems have done well to provide alternatives to less efficient vehicle transportation. However, in these fiscally restrained times, a lower cost alternative like BRT that can be built atop or adjacent to existing roads and infrastructure often make far more sense logistically and fiscally. One of the most important advantages to alternative transportation is TOD.

TOD has numerous benefits that include increased quality of life for residents, stimulation of economic growth, and improvement of urban air quality from reduced congestion. BRT systems have been found to promote TOD very similarly to LRT at a fraction of the cost. For private developers this is useful information when considering the implementation and branding process and the difficulty of achieving consensus between constituents on the merits of alternative transportation options. However, several barriers exist to the successful implementation of alternative transportation systems and BRT specifically. Before a review of different BRT systems and BRT-like systems and an explanation of what they have been designed to address, these barriers and obstacles are discussed.

Obstacles to Implementing BRT

Weinstock et al. (2011) separate obstacles to implementing higher standard BRT systems in the U.S. into three main categories: technical, political, and administrative and institutional (p. 48).

Technical obstacles: In the U.S. buses make up a much smaller share of traffic compared to other parts of the world (Weinstock et al. 2011, pg.49). Many BRT systems are currently in place in developing countries where demand for public transit is already high. In the U.S. the

goal is often to increase ridership and gain users that otherwise would have driven without the option of a rapid transit system. Weinstock et al. (2011) make it clear that it is often better to frame conversations on BRT in the sense that “giving buses a dedicated lane will still result in a net savings benefit overall, as time savings to multiple passengers outweigh any time loss to individual motorists” (p. 49).

This is the shift in transportation thinking that needs to resonate with voters, commuters, politicians and stakeholders so that they may influence the choice riders that these systems must attract for them to be successful. Some of the most effective branding or marketing campaigns highlight these benefits and are effective in explaining to commuters that these buses will now be off of the main roads so that even when they do drive they won't be stuck behind them, which is a positive association that helps with this process. The other side of this argument is that taking lanes for BRT in some areas that can have a negative connotation especially considering how transportation issues have historically been approached to cater to the automobile. Promoting the reduction in vehicles on the road to those skeptical vested interests can help to alleviate concerns.

Only the most successful bus routes in U.S. cities exceed the 2,000 passengers per hour that mixed traffic lanes generally carry, which is important in consideration of these systems. In order to take a lane for BRT, the expected ridership and especially the increased ridership that will now use the system should be able to compete with this amount of passengers. With the alternative parallel roads that often exist in the U.S. as opposed to other parts of the world, these routes can be considered for “opportunities of area-wide traffic mitigation measures” (Weinstock et al. 2011, p. 49).

Many of the obstacles to successful BRT are associated with stop location and specifically its orientation to intersections. The trade-off lies between a slight inconvenience for pedestrians

that benefits the speed of the system in conjunction with the minimization of mixed traffic flow impediments, specifically setting back stops from existing intersections. Weinstock et al. (2011) notes the importance of technical considerations to minimize traffic impacts as crucial to “minimize the risk of political backlash” (p. 50). One of the most frequent problems to address are the left turning lanes for median running BRT lanes and right turning lanes for dedicated curb lanes, each require innovative strategies to maintain the integrity of the BRT system as well as traffic flow. Keeping these issues at the forefront of thought in planning can have immeasurable benefits when the system is in place and when the positives are weighed against the negatives in a public setting.

Political obstacles: Political obstacles and special interests have a huge effect on many aspects of our everyday life including policy issues on energy and transportation. Automobile corporations, energy companies, developers, and private business have interests that often affect the policies we have toward transit and other transportation options.

These interests rely on consumption that promote habits that make many of the desired goals of transportation policies (reduction of VMT, emissions, etc.) and conservation of natural resources such as oil, land, and water seem at odds with economic growth and vitality. Bin et al. (2005) describes an alternative view of consumption and estimates that 80% of the energy used in the U.S. results from consumer demands and the activities that support those demands (p. 198). The majority of these costs are associated with the transportation of goods which is favorable to several of these interests as well as perceived economic vitality. The transportation of these goods in mixed traffic could also benefit from alternative systems that relieve congestion and improve traffic flow.

The automotive industry has a vested political interest that in most cases does not favor providing or promoting alternate transportation systems and they often lobby against policies that promote these systems, as well as taxes that support alternatives to highway construction. Energy interests, specifically oil, operate very similarly as they promote oil consuming activities. They also promote more highway construction and oil dependent systems of transportation and run advertisement campaigns about their investments in renewable energy and alternative sources that often seem misleading.

Land developers, property owners and contractors are sometimes a political hurdle to measures of sustainable and efficient development and transportation policies. However there seems to be a shift in the market promoting more mixed-use and TOD as a result of the economic recession and housing crisis. As mentioned in our past historical development, there has been much sprawl and growth dictated by the market and the proliferation of car-oriented development. This has slowed, but has significantly contributed to the sprawl of much of the nation. All of these interests contribute in varying degrees to the lack of priority to explore alternative options to the automobile that provide more energy efficient transportation systems and can improve quality of life on many levels. These special interests also contribute to some other factors that could help reduce consumption or at least make citizen's level of consumption resonate more with them.

Public perception: Public perception of bus transportation of non-bus users is often biased against it for a wide range of reasons. Many of these have evolved from our car-oriented society and simply the negative perception that transit has to the non-user (Beirao & Cabral, 2007, p. 487). The Model-T Ford and industrialization helped to make the automobile affordable to many. Some of whom may have never had the ability, but traditionally median to higher income

people with the means of purchasing automobiles have done so and therefore avoided the use of transit. This stigma is not the only problem associated with transit.

What must also be considered is the public's perceived notion that the level of service is not up to par with the automobile. In many cases, especially with bus systems, this is accurate. BRT systems must promote their rail like qualities and negate the traditional notions that they lack speed, availability and convenience that traditional bus systems offer. Often using the term 'rapid transit vehicle' can help start to reframe the negative connotation associated with the term 'bus.' Other factors can play a role in each system's effectiveness as well, such as perception of privacy, parking availability at destination, weather and self-image that are often the perceived comforts provided by private automobile travel (Randolph & Masters, Pp. 588,590).

Administrative and institutional obstacles: In much of the developing world with BRT there is little resistance to the implementation of these systems for reasons that range from a lack of public interest or clout in the decision making process, to out of date design guidelines that are vague and disregarded by engineers (Weinstock et al. 2011, p. 56). Whether one views this positively or negatively, it is not the case in the U.S. There are many implications for the design and implementation of these systems and they often impede on the traditional engineering approach of "maximizing traffic flow and overdesigning for safety, with little thought to transit priority, traffic calming, or complete street design" (Weinstock et al. 2011, p. 56). This is found at the local, state and federal level.

The federal level obstacles to transit projects are three-fold. First, the drawn-out bureaucratic nature of the process that is overwhelmed with applicants for funding, while limited resources are dedicated to support the initiatives. This delay often gives opponents time to organize (Weinstock et al. 2011, p. 58). Second, the Federal Transit Administration (FTA) is

still based on corridor level approval, based on historical precedence of corridor assessments that were typically done one at a time. This is one of the obstacles of the PB study, it only looked at specific corridors that satisfied qualifications characteristics for federal funding based on a system designed to evaluate rail lines. If treated as overall network operational improvements, they may be easier to implement. Focusing on the best investment could also help improve these systems on a smaller scale. Lastly, the review process needs to be updated so rail projects do not receive priority in the decision making process as they seem to do also in public discourse (Weinstock et al. 2011, p. 58).

Overcoming Federal, State and Local Obstacles

To overcome hurdles in addressing transportation issues the Brookings Institute highlights three main areas of focus to address transportation needs at the different levels in ‘A Bridge to Somewhere: Rethinking American Public Transportation in the 21st Century’:

Federal: The recommendations for the US are as follows:

1. Lead in areas where there are clear national uniformity or else match the scale of geographic reach of certain problems.
 - a. U.S. needs to define, design and embrace unified, competitive vision for transportation policy, its purpose, mission and overall rational.
 - b. Congress should authorize a permanent independent commission – STIC (strategic transportation investment commission) – to prioritize federal investment.
2. Empower states and metropolitan areas to grow in competitive, inclusive and sustainable ways.
 - a. Embrace market mechanisms and establish a national policy for metropolitan road pricing to allow for better management of the metropolitan network.
 - b. Establish a policy of modality neutrality.
 - c. Assist states in developing truly integrated transportation, land use and economic development to serve the protected growth over the next several decades.
3. Optimize Washington’s performance and that of its partners to maximize metropolitan prosperity.

Funding for the federal programs – both funding levels and sources should be considered after the reform ideas are put into place. (Puentes, 2008, Pp. 56-75)

State: The recommendations for the US at the state level are as follows:

1. Use transportation funds to leverage other state investments and the strengths of other metropolitan areas.
2. Use market discipline to find savings and new revenue sources.
3. Create or augment new public private institutions like infrastructure banks. (Puentes, 2011b, p. 1)

Public private partnerships: The recommendations for the use of Public Private Partnerships are as follows:

1. Choose PPP for the right reasons: They often result in earlier completion of projects, lower costs and maintenance of infrastructure than would occur under public provision.
2. Use the right PPP contract.
3. Account for PPP transparently in government budgets as if they were public investments. (Puentes, 2011b, Pp. 3-4)

Until these improvements to the processes of improving transportation systems can be implemented, jurisdictions may be more likely to pursue advances on their own.

These topics on infrastructure and transportation are at the forefront of many political conversations currently and the creation of an Infrastructure Bank seems to be a topic that is discussed frequently. This may be the best option to address the growing needs of this sector in order to catch up to other countries that have surpassed us in an extremely competitive global market. Making Public Private Partnerships (PPP) more easily implemented and acceptable by local governments is also a very important step in the ever important financing of these improvements and the ability of officials in government to have an impact. Unity among politicians and heads of relevant departments is much more crucial in the U.S. than in some other parts of the world where successful BRT has been implemented.

The main strength of successful BRT-like systems in the U.S. and across the globe stem from a political champion on some level that was successful in advocating and implementing the

system. These figures can be on a local or more regional level, but generally have a good knowledge of what constitutes a successful system and strive to attain that goal. On the international level, there is generally more power to political figures to implement such a system, while in the U.S. these figures often need the help of other political figureheads whether they are local, state and/or transportation officials (Weinstock et al. 2011, Pp. 50-51). The areas that have experienced limited success on multiple levels have had discrepancies between key politicians and role players that have led to divisiveness about implementation and harmed the effectiveness of the system. Leaders speaking in a collective voice can be influential in bringing citizens together in support of improvements to existing transportation systems as well as new systems.

Weinstock et al. (2011) suggests overcoming these obstacles by increasing awareness of the qualities of these systems such as time savings over other modes as well as cost-effectiveness during implementation and operation (p. 51). Perhaps the biggest strength of BRT systems, especially in these financially constrained times, is how cost effective it is as an alternative to rail investment, even though rail is often much more popular. Spreading this knowledge to politically influential figures helps to create knowledgeable figures that can impact public perception and provide an additional support group that is informed on the merits of these proposed systems.

Political lobbying interests greatly influence transportation options within the U.S. Weinstock et al. (2011) points to the fact that there is a “lack of a pro BRT lobby” in the U.S., and that “a strong, well organized business community can be extremely helpful in getting a BRT program off the ground” (p. 52). What also helps to address the concerns that many communities have about any type of ‘bus’ system, as the traditional thought of buses still

reminds the public of inefficient systems that operate within mixed traffic and serve limited areas often containing lower income citizens.

Assuring community members that higher and lower income communities will be served by advanced systems is a good way to deal with these issues. The Brookings Institute's recent report found that high-income households are located in areas with the worst transit coverage while high-income jobs are located in the areas most accessible by transit (Tomer et al. 2011, p. 1). The demand for transit options is not as high in high-income areas, and the norms established by traditional car-oriented residential development makes it more difficult for people who can afford to commute by automobile, to consider another option. Much of the congestion that these transportation systems look to curtail is created by those more affluent members of society who can afford to drive themselves in their own vehicle a significant distance to work every day. However, the trend of urbanization the country has been experiencing that has made the suburbs seem more affordable accompanied by the housing market collapse and increasing unemployment, makes it vital to connect these areas to provide mobility and accessibility to all income levels.

While BRT systems should be directed at those who already use transit in order to make their trips more efficient, in order to attract riders these systems must also get the existing vehicles out of traffic. Some of the most important riders need to be enticed by an alternative 'Rapid Transit' system. Making sure that these systems reach out to car-oriented communities is vital to their being viewed as successful, as well as attracting sufficient ridership. Adjusting parking availability in city centers and offering park-and-ride service as an option on these outer areas is also a strategy that should be considered on a case-by-case basis.

Parking is an integral part of the viability of transit systems and the likelihood of their use. Often in BRT implementation removing parking spots or altering their availability during peak-hour use is necessary for lane dedication. In a business sense, to not scare off local interests, it is often good to note the positives of these lane takings as increasing the amount of passengers in the area instead of the few people that the parking spots may have provided each business (Weinstock et al. 2011, p. 54). Removing these parking spots can also be seen as a non-coercive measure to influence different transportation options for commuters, decreasing car trips by eliminating those who have the flexibility to use other options. Certain businesses (such as big box retail) are more prone to need parking which must be included in the evaluation of each area and its attributes.

When addressing administrative and institutional obstacles creating special exception areas have been used on projects such as Cleveland in reducing the required lane size of their BRT from 12 to 11 feet (Weinstock et al. 2011, Pp. 56-57). This is particularly relevant due to the limitations that Montgomery County has in its available right-of-way and limited amount of median space available. Options of reducing speed limits to accommodate smaller lanes have been discussed for certain areas. This type of traffic calming measure has been traditionally unpopular to engineers, as previously mentioned, but there is a bit of a trend of DOTs adopting design manuals like ITE and APA that advocate other options and are far less conservative and traditional in their approach (Weinstock et al. 2011, p. 57).

What is BRT and What Makes BRT a Good Policy Decision?

Bus Rapid Transit has numerous advantages to the traditional rail and bus investments that characterize traditional negative perceptions of public transportation. However politically unpopular due to the bus stigma that is attached, the cost of the infrastructure for BRT is much less than rail investment whether it be heavy or light rail. There is not an official definition of

what BRT is, but there are a few that share similar characteristics from some very reputable sources:

1. “A high-quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service.” – Institute for Transportation and Development Policy
2. A “Flexible, rubber-tired rapid transit mode that combines stations, vehicles, services, running ways, and Intelligent Transportation Systems (ITS) elements into an integrated system with a strong positive identity and unique image.” –The U.S. Transit Cooperative Research Program (Levinson, 2003, p. 12)
3. “An enhanced bus system that operates on bus lanes or other transit ways in order to combine the flexibility of buses with the efficiency of rail. ...It also utilizes a combination of technologies, infrastructure, and operational investments that provide a significantly better service than traditional bus service.” –USDOT, FTA (Weinsotck et al. 2011, P. 18)

The following Case Studies discuss what issues the BRT systems were designed to address and what the outcomes of the systems have been.

Summary of BRT Case Studies

Levinson et al. (2003) conducted case studies to help with the planning of new BRT systems or assist in upgrading existing systems. The reasons for using BRT in these case studies varied but had a common theme across the globe in the study; cost (especially as an alternative to rail), congestion and delays, avoidance of further freeway creation, environmental concerns, quality of life, ability to meet planning goals, using existing infrastructure and right-of-way. Ottawa considered BRT for similar reasons however took a distinct and progressive approach to transit that is different from the U.S. approach, Ottawa giving public transportation projects priority over all forms of road construction or widening (Levinson et al. 2003, p. 16). In Brisbane, BRT was used to promote TOD in less dense corridors and also used existing HOV lanes of a major motorway. In Europe, queue bypasses at congested locations contributed to the success as well as new town development.

In S. America, accommodating exponential population growth was critical and there was not time to wait for rail systems to be developed. Necessity and time has led to the creation of some of the most successful systems in the world using dual median bus lanes in Bogota, median lane in Curitiba led to a 'structural axis' of transit and development, and Quito provided a new clean system helped meet cultural and heritage related community goals (Levinson et al. 2003, p. 17).

This study highlights BRT systems that include extensive systems with attributes of median bus lanes, evolution of rapid transit vehicles, and a focus on level of service and branding of systems (Levinson et al. 2003, p. 26). The trend of current systems to find success cannot be understated for their importance in the U.S. as skepticism to public transportation, especially bus systems persists. Trends of this study show that new riders can be attracted, TOD was successful and ridership levels met goals that were expected of rail (Levinson et al. 2003, p. 31-32).

The study by the Break Through Technologies Institute (2008) found that BRT could spur similar development as rail projects and agencies in these areas seemed to not discriminate between the two. This reaction was similar between public agencies as well as the private development sector. Perhaps the most significant finding was that there seemed to be no correlation between the level of public investment and private TOD investment, highlighted by the York Region investment being so heavy with the least infrastructure-intensive BRT (BTTI, 2008, p. 5).

Brisbane was successful in reversing a decline in public transit use by placing BRT in areas that were already characterized by TOD and just needed the transit system (BTTI, 2008, p. 5). At the time of this study, Cleveland's system was not yet complete, but with many financial incentives to promote development along the planned BRT corridor, they had already

experienced significant investment as the project took shape creating a more lively pedestrian and urban community (BTTI, 2008, p. 6). Boston's Silver Line BRT is an example of public-private revitalization using BRT as the catalyst to bring back the mix-used character that formerly existed in the area (BTTI, 2008, p. 6). Ottawa started exclusive bus way development in the 1980s and in the face of urban sprawl was still able to concentrate development around transit served areas, mixed-use centers, and TOD that have attracted plenty of investment (BTTI, 2008, Pp. 6-7).

The survey results of this study noted the following key themes learned:

1. Cooperation among key stakeholders, including public agencies, non-profit development organizations, property owners, and private developers, is critical to success.
2. For developers, performance of the BRT is an important factor. However this perception can be created even with relatively low infrastructure investment, if there is a clear, long-term public agency commitment.
3. Frequency, speed and convenience of the service were important to many developers and property owners. These features differentiated BRT from conventional bus service, which was generally not considered appealing for TOD.
4. In Downscale corridors, streetscape improvements that accompany the BRT may be at least as important as the transit service for attracting new investment.
5. In some cities, developers and property owners cited the value or prominent visual profile for the BRT and aesthetically appealing infrastructure.
6. It does not appear to be necessary to provide financial incentives for BRT-related TOD. Developers appeared much more interested in an expedited permitting or rezoning process, as time is a critical factor in making developments financially feasible. (BTTI, 2008, p. 8)

The Research Results Digest 336 found that one of the most critical factors in evaluating a lane taking for BRT is the potential benefit of all corridor users (Savage et al. 2007). The negative benefits of drivers can be offset by improvements for transit riders that can be influenced by a significant mode shift from private autos to transit, or focusing on moving people

through corridors as opposed to vehicles. In some cases improvements to overall vehicle flow were achieved by lane takings for BRT vehicles.

As in other studies, these systems were found to support TOD and redevelopment that concentrated in the corridors and brought about better access to employment and housing. Benefits were also found in air quality; reduced emissions per passenger, mode shifts from private auto to transit and improved efficiency from previous transit systems. These systems also help governments to meet policy goals for energy efficiency through more efficient transit options.

Now that BRT has been stated as the desired means to address Montgomery County's transportation problems and the additional routes and segments have been selected, the stop and station locations along those corridors need to be addressed.

Determining BRT Stop and Station Location

The implementation of BRT is different in the U.S. than other countries as previously noted due to several factors, particularly in low density suburban areas. The routes that Work Group D (routes and sequencing) have added are not along the main corridors and represent a unique challenge in planning the stop and station locations through the corridors. These routes would not stand up to rigorous standard for LRT and BRT to capture significant ridership from the residential and commercial areas that it serves. However, the criteria that determine the location of these stops and stations should be used in evaluating these segments.

As previously noted, the TOD that occurs from BRT and LRT are very similar. The methods of selecting stops and locations for both system types are therefore viable for consideration in the selection process. This research does not promote or foresee LRT as the final product, but does recognize the effects of these stop and station locations as similar enough in these instances to warrant their connection. When looking at BRT as a possible precursor to

LRT development, Henry & Dobbs (2010) observes two possible situations; the alignment is ultimately going to be for BRT and the low cost BRT is implemented until ridership grows strong enough; or the installation of a new LRT is underway. The corridors analyzed in this research are not likely to be converted to LRT as they are not the main routes.

Making stops reliable to the riders is essential, therefore must be considered when considering the location and frequency of stop and station location. Samanta & Jha (2008) note the importance of both ridership and public perception in determining the stop location (p. 82). This is important to consider when assessing the placement and what characteristics should be considered in order to provide value to users of the system.

According to the American Public Transit Association (APTA) (2010) stations should be designed to; attract new riders, promote visibility and facilitate branding of the system, provide information (maps and real-time preferred), provide passengers with sense of security (cameras, phone, lighting, fencing), provide multiple door access, level boarding, off-board fare collection, amenities (signage, newspapers, recycling, lighting, seating, bicycle parking), attractive aesthetics, provide sense of place and multi-modal connectivity (p. 1). While some of these are purely design guidelines, the location can be critical to meeting some of the goals, particularly attracting new riders. By putting stations that connect residential car oriented developments to transit, choice riders can be attained and be provided with the sense of neighborhood security. Selecting locations that provide access for bicycles and pedestrians are also desired as most transit trips start and end with pedestrian travel (Foda & Osman, 2010, p. 1).

Kuby et al. (2004) notes the importance of land use and accessibility, and looks specifically at how LRT is able to generate ridership in low-density, automobile-oriented, polycentric US cities with smaller downtowns. Other important factors are employment,

population, and the percent of renters within walking distance, bus lines, park-and-ride spaces, and centrality (p. 223). All of these factors will be considered in the assessment of locations along the corridors in this research.

Summary

The benefits that BRT can provide are numerous to system users and the entities that put them in place whether they are privately funded or pursued by governments. In this fiscally restrained economic time, governments have limited resources to implement the highly touted rail projects that are so appealing to politicians and the general public. BRT offers a similar level of service at the fraction of the cost of these systems and most importantly provides the flexibility of service as there are no rails laid down, just guide ways or dedicated lanes. The main reasons BRT has grown in popularity are; low development costs, greater operating flexibility compared to rail, a practical alternative to highway reconstruction, and it is a catalyst for redevelopment.

Laying down tracks for rail provide a designated route at a much more significant cost per mile that can serve only certain vehicle. Some BRT advocates even promote these guide ways or dedicated lanes to be used by emergency vehicles in order to not only make their routes more direct, but minimize their effect on traffic flows. In many cases, transit signal priority at an intersection to allow the BRT vehicle to pass through is all that is needed to alter a route to a new dedicated lane or running way with a much faster implementation time in comparison to adding another line to a rail system. BRT dedicated lanes or runways provide a critical sense of permanence, but additional routes can be created off of these lines with minimal impact on existing infrastructure and the environment, both important considerations.

The life of existing infrastructure can be prolonged by reducing VMT via offering alternative transportation options. Instead of building additional lanes to roadways, BRT

systems can reduce the use of existing roadways by providing bus lanes that have less impervious surface than traditional roads. The runways that BRT systems recommend (not previously used lanes) are concrete pads that include a green space in-between that can be used for stormwater runoff. Also important to consider are the emissions that can be reduced through the choice riders that will use BRT over their private vehicle, particularly the single-occupancy vehicles. This can help urban areas that deal with non-attainment of GHG emissions to come closer to reaching international goals.

BRT is able to accomplish metropolitan transportation goals in very efficient ways that can help to curb emissions through congestion relief, stimulate the local economy through TOD, and decrease transportation costs associated with automobile travel, while prolonging the life of existing infrastructure and much more. With constrained and congested roads already built out, the least expensive option that provides a level of service comparable to rail is a very attractive proposition. This must be accompanied by a proactive branding campaign and public outreach that highlights the numerous benefits and explains to different members of communities the benefits that they will receive. It is critical to be voiced by public figures who are also influential in the decision making process. Financing these new systems must be made easier for all levels of government to seek innovative financing through PPPs and prevent federal funding from favoring rail projects. The combination of these steps can be effective in promoting and implementing these systems that can provide transportation options to consumers other than the automobile as energy costs continue to fluctuate and the congestion they produce negatively affect urban areas in so many ways.

Montgomery County has had transit as part of their comprehensive plan for decades now and has development in place that already supports transit. Instead of building the transit to

encourage TOD, the new BRT system could follow the development patterns that have already occurred in anticipation of more transit options to the DC Metro. Montgomery County is already served by RideOn, MetroBus, MARC, and in some areas by the DC Metro, but suffers from the worst congestion in the nation (Haysley, 2011). Building additional roadways is not an option due to emissions and physically constrained right-of-ways, so an approach of moving people through intersections via a BRT network has been adopted to address their transportation issues.

The goal of the Transit Task Force is to develop and implement a world-class, county-wide, rapid transit system that is consistent with state transportation objectives and that will be complementary with regional transit operations. The system will need to provide improved mobility for riders, improve the quality of life, stimulate economic development in the County, improve air quality, reduce GHG emissions, and reduce energy consumption. With these goals stated, the following research looks to achieve these through the additional route segment's stops and stations in areas that will be attractive to riders without inhibiting the speed of the system by having an excessive number of stops.

CHAPTER 3 METHODOLOGY

Overview

The objective of this research is to determine what locations merit stop and station location along additional corridors in Montgomery County, MD recommended by Transit Task Force Work Group D (routes and sequencing) not studied by PB. These stops and locations were recommended to meet the overall goals of the BRT system. This research builds on the analysis of the original sixteen corridors studied and initially recommended by PB using the following specified factors. Some of these routes provide the east-west connection of the county that will provide the connectivity of the system, as well as some extensions of the routes identified by PB. PB used the following criteria to determine station location:

1. route termini
2. intermediate locations with existing Metrorail, MARC, and/or bus transit center access (*the addition of the routes proposed by this work group dictate new intermediate locations for transfers between BRT vehicles)
3. intermediate locations with intersecting bus routes
4. intermediate location with major activity centers not served by Item 2 or 3 in this list (MCDOT & PB, 2011, C-8)

In order to improve on the above methodology, the following recommendations from the APTA (2010) are considered in the stop and station selection:

1. spacing, walking distance, availability of parallel service, and speed and service objectives for the BRT service
2. density and Land-use patterns in the corridor
3. other factors: width of streets, stops shared with or separate from conventional service, near-side versus far-side stops, topography, weather, customer demographics (e.g. seniors), typical spacing for non-BRT service (bus and rail) in the region, local conditions and expectations (Pp. 11-13)

There was no specific density used in the evaluation of these areas as they are all low-density residential. The use of a density threshold was considered, but due to the unique nature of providing BRT service in low-density corridors it was not deemed appropriate.

Method of data collection: The following data was collected and includes:

1. Ride On route location and intersects, and current bus stop location (Appendix B)
2. BRT route termini, transfer locations to other routes and modes (Appendix A, B)
3. current land use in corridors (Appendix C)

Method of data analysis: The locations will be determined by the overall satisfaction of the above criteria. The first step was to identify each corridor and all of the current stops along the corridor as potential stop and station locations (Appendix B). With those stop locations identified, they are analyzed to determine whether they satisfy PB's criteria; route termini and/or intersecting with other transit service, intermediate location with other bus routes (Appendix B), or activity centers not served by previous items (Appendix C).

These routes are in addition to the originally proposed BRT routes. Many of the additional routes do not connect to existing rail transit in the region (intersecting with other transit service). The stops and stations will be mostly associated with new transfer points that arise out of the addition of these routes, and the intersection of these new BRT routes with existing bus service. Where these routes originate at other planned BRT origins and termini, there will be stop or stations located there to accommodate. This will result in only additional stops and stations that arise from these additional routes and segments being recommended for further investigation.

Once each criterion is analyzed and the stops that meet these qualifications are determined, they will be analyzed further. With these stops selected, the APTA best practices will be applied to determining which stops warrant further investigation. Spacing will be considered first, however there will not be a specific requirement for spacing of these stops. What will be

considered is the walkability of the area, determined by the current land use in the corridor.

After considering the land use in the corridor, spacing of stops will be considered as to not hinder the speed of the overall system.

Locations will be recommended as stop or station depending on their meeting the specific requirements set forth. These will be general recommendations as a result of their current attributes, future estimates of daily boarding's will be more representative of the demand that these stops will serve. The ridership data was not made available for this research and will have to be analyzed later by the MCDOT to determine suitability of the stop and station locations. Some routes will be express service and will be limited stop routes initially therefore there will not be a preferred distance between stops, just a recommendation of further investigation. The phasing of these routes will determine what is available where and how the system takes shape.

Data: The data used for this research was determined by the previous research of PB and the methodology they used in determining stop and station locations for the initial system. Appendix A shows the full BRT system proposed by PB with the additional route segments and extensions added by Transit Task Force Work Group D. Appendix C shows the current routes along the four corridors being analyzed. Appendix B shows the current bus stops along the specified corridors with the routes from appendix B overlaid as a base for selecting the BRT stops and stations. These routes will be studied and adjusted by the MCDOT after the preliminary engineering has been completed and will be subject to elimination or adjustment accordingly. Appendix C shows the current land use of the corridors for additional information about locations that meet the specified criteria.

CHAPTER 4
RESULTS

Montgomery County, Maryland

The following results are derived from information provided while interning in Montgomery County, Maryland while interning for Council-member at-large Marc Elrich in the fall of 2011.

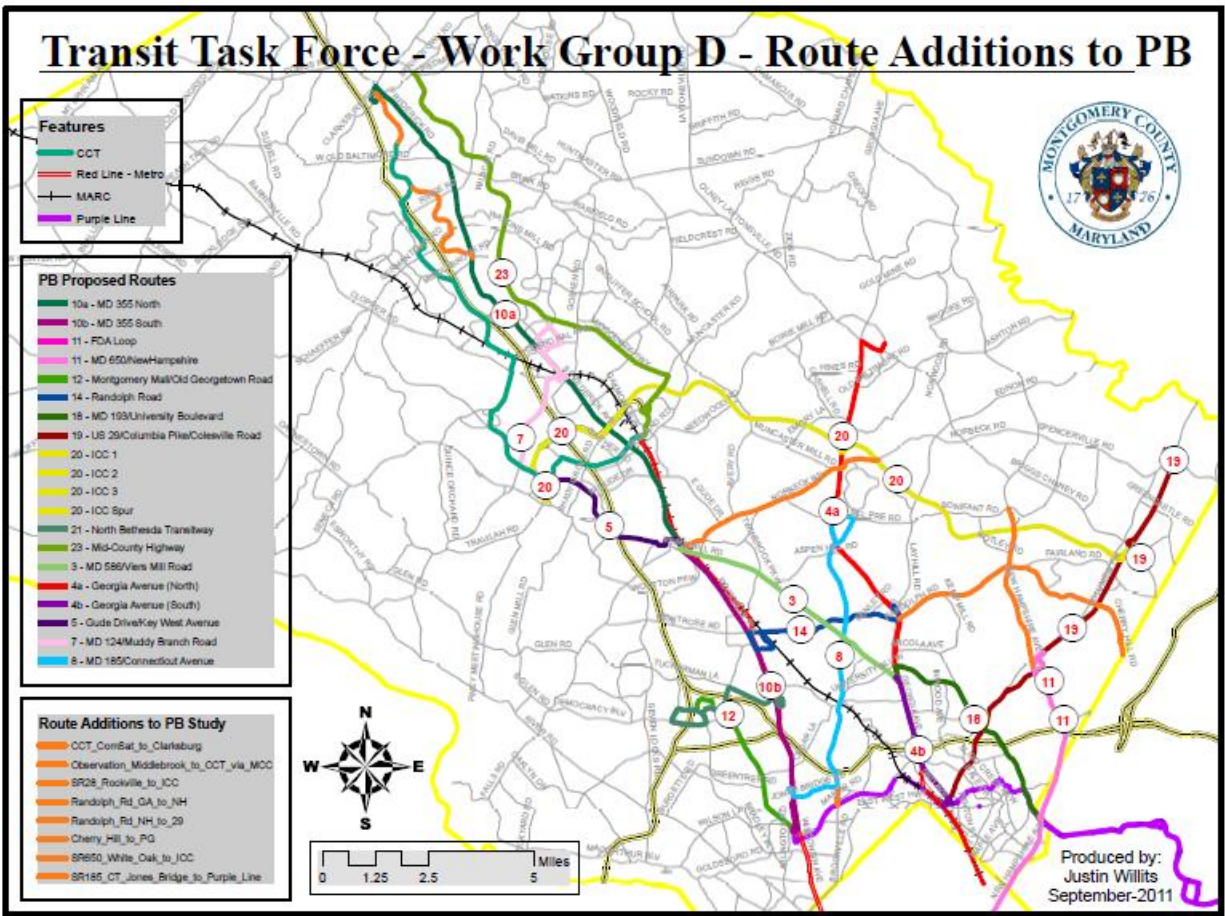


Figure 4-1. Map of full Montgomery County bus rapid transit system

In addressing the choking congestion that occurs in the entire Washington DC Metropolitan region, a County-wide BRT system is being studied and implemented as a partial solution to the problem. There are a few corridors; Corridor Cities Transitway (CCT), Inter-County Connector (ICC), and Purple Line that are transitways and are currently in the research

and design phases or already being built. The BRT system will compliment these corridors that have been planned in some cases over 20 years.

Montgomery County, MD is one of the most affluent counties in the nation, and many of the stakeholders are concerned that this state of the art system won't serve the lower income populations that need it most, primarily on the east side. The routes and stops that this research studied and recommends for further investigation provide the connectivity to this area of the county.

The County Park and Planning Office is currently updating the Master Plan to include right-of-way (ROW) appropriations to allow for BRT lanes on corridors where it will be appropriate (Appendix F). The priority of the system is to use center lanes and medians for BRT development, however there is no presumption that there won't be exceptions throughout the system as there are numerous constrained areas that will require innovative strategies.

Route Segments

This analysis was performed on a current route by route basis and current stop locations along those routes. With those routes and stop locations as the foundation for analysis, stops were selected that satisfied the methodology of PB as well as the specified additional characteristics set forth by APTA to varying degrees. What was also considered in the analysis of these routes was their proximity to other BRT routes and the recommended stop or station was identified. A majority of the current Ride On (current county bus transit system) routes are assumed to be modified or adjusted to compliment the BRT system by acting as feeder routes. Stops and stations were located at current stop locations, so that future construction costs, land acquisition, and current route adjustment would be minimized if current structures are able to be converted or modified for use by the BRT system. This is dependent on where the BRT lane is

located subject to further analysis by Montgomery County Park and Planning and the preliminary engineering by the MCDOT.

Stop and Station Location

Of the six additional routes recommended by the Montgomery County Transit Task Force, four of them warrant additional investigation due to their significant length and subsequent need for stop and station locations. These routes were seen as vital to provide the connectivity to the east side of the County and establish more of a complete network for the entire BRT system. The routes that the county is proposing are not corridor only and will have multiple bus service and routes on each segment. The following stops and stations are recommended for further investigation before implementation into the County BRT system. With that stated, these stop and station locations, subject to approval of the transit task force, are recommended for consideration in the official recommendation made to the Montgomery County Executive and Council.

Two route extensions are still being contemplated by the task force that, even if implemented, will not warrant any additional stops or stations due to their location length. The number in parenthesis refers to the location in the memo (Appendix G) that Word Group D (routes and sequencing) submitted, and was subsequently approved, by the Transit Task Force.

These routes are the additions and extensions to the original system and make connections between existing transit service. There is a strong likelihood that they are not going to be the most heavily used routes that spur TOD along them. Many of the corridors they span are in residential areas that lack a significant density, mostly single family suburban homes. For this reason, residential densities were not considered as part of the analysis. However, residential neighborhoods were noted in consideration of these stop and station locations so as not to

exclude them from consideration and to encourage one of the most important factors, choice riders.

It is also important to mention the 'regional' concept that this BRT system addresses. The 'Red Line syndrome' is commonly referred to within the transportation community in this region. The Red Line is the U-shaped corridor that extends into Maryland and has sparked significant TOD in the region. Many of these BRT routes connect the Red Line's northern stations to each other via BRT routes and will provide much better connectivity for those passengers who use the current Ride On system. The west portion of the county, the Potomac region, has not expressed interest in the BRT system. The Potomac region does not allow for roads greater than two lanes and this is the reason for there being no routes serving the area.

These factors produced the most important considerations for the location being determined by; the location of activity centers, and the location of intersecting routes, and residential access in specific areas. With those as the primary indicators, locations within residential neighborhoods were also considered with no specific rigidity to their evaluation. The additional factors recommended previously by the APTA were applied to these locations. The Route descriptions are in sequence of the more prominent with a larger number of stops and stations to the least, which is also an indication of importance and perceived use. The length and depth of the route descriptions express this.

Sr28-Norbeck Road (6, Appendix G)

The State Road 28 Norbeck Road Corridor provides the East-West connectivity that is one of the most desirable traits of the entire BRT system. This Route connects the northern ICC (east-west connecting toll road) and Georgia Avenue (north-south arterial), both BRT routes, west to Rockville. Rockville is the location of the next-to-last stop on the western portion of the DC Metro Red Line. Rockville is also the location of several other BRT Routes; 10a and 10b (355), 3 (Veirs Mill), and 5 (MD28/Gude).

Five locations are recommended for further investigation and one is recommended as a probable station location. The analysis is as follows from east to west, Rockville to the ICC. Currently Route 52 (Appendix B) runs the almost the entire length of the proposed BRT route and will be subsequent to modification or removal upon the implementation of the new BRT route. Additional routes that intersect or parallel are routes 45, 48, 49, 51 and 53.

The first recommended stop is at East Gude Drive. This stop is approximately one mile away from the origin of the route at the Rockville Metro Station, which will attract much of the residential area that the route passes through up to this point. The location on Gude Drive provides a transfer point that none of the previous stops along the route provided up to this point. This was identified in the first step of the methodology as an intersection of routes 48 and 52 (Appendix B). This stop will act as a transfer point to route 48 and connect a commercial activity center to the north (Appendix C).

The next recommended stop location is 1.1 miles northeast at Bauer Drive. The two sets of stop locations leading up to this point were not selected due to the following factors; only a golf course is located on the north at the first set of stops, and the next set of stops at Baltimore Road are only .15 miles before Bauer Drive. This also represents a transfer point to routes 48 and 52 (Appendix B), specifically where route 48 intersects from a residential area to the south that

will still be served by the local bus service (Appendix B). This area is also an activity center with access to a Middle School, as well as a commercial center (grocery, banking, dining) (Appendix C). The middle school is considered an activity center as there has been much discussion on integrating the BRT system to incorporate school service into its routes.

The next stop is located at Bel Pre Road and Emory Lane. While the land use in the corridor (Appendix C) does not have commercial use, it is surrounded by a residential neighborhood. The current route 49 (Appendix B) intersects at this location and would provide a transfer point. Depending on the adjustment of routes 48 and 52, this stop and the previous stop may not be necessary for the BRT system, but further investigation will determine which of the two routes, and therefore stops, is more viable.

The next recommended station location is at Georgia Avenue, which is one of the original PB recommended routes and will be a BRT Transfer Point with BRT Route 4a. There was no station proposed here by PB. The area of this corridor leading up to this point is residential with a golf course to the south, and was not considered viable for a stop or station at the current locations. This location intersects with three current routes; 52, 53 (Appendix B). There is also a Park and Ride location on the northwest corner of the intersection that warrants mentioning in the analysis of the siting of this station location (Appendix B).

The last stop location is currently planned as termini at the ICC, which is a planned BRT route. This extension from Georgia Avenue to the ICC is still being contemplated, but for this research it warrants suggestion for further investigation. If this extension is made, it will most likely warrant a station for transfers with the ICC.

Table 4-1 Norbeck Road stop and station attributes

Location (West to East)	Stop/Station (West to East)	Attributes/Justification
Gude Drive	Stop	Transfer point- intersects with route 48 and 52 Stop location is recommended as it is ½ mile from the Rockville Metro Station (route origin) within a residential area.
Bauer Drive	Stop	Transfer point- intersects with route 48 and 52, one's termini Activity center - commercial location – middle school
Bel Pre Road	Stop	Transfer point- intersects with route 49 Located within residential area
Georgia Avenue	Station	Transfer point- intersects with 2 routes and has close access to a third Transfer with PB-RTV route 4a
ICC	Stop	Transfer point- intersects with current route 51 Route terminus (possibility that this extension of the route extension is removed because it will not connect to the ICC)

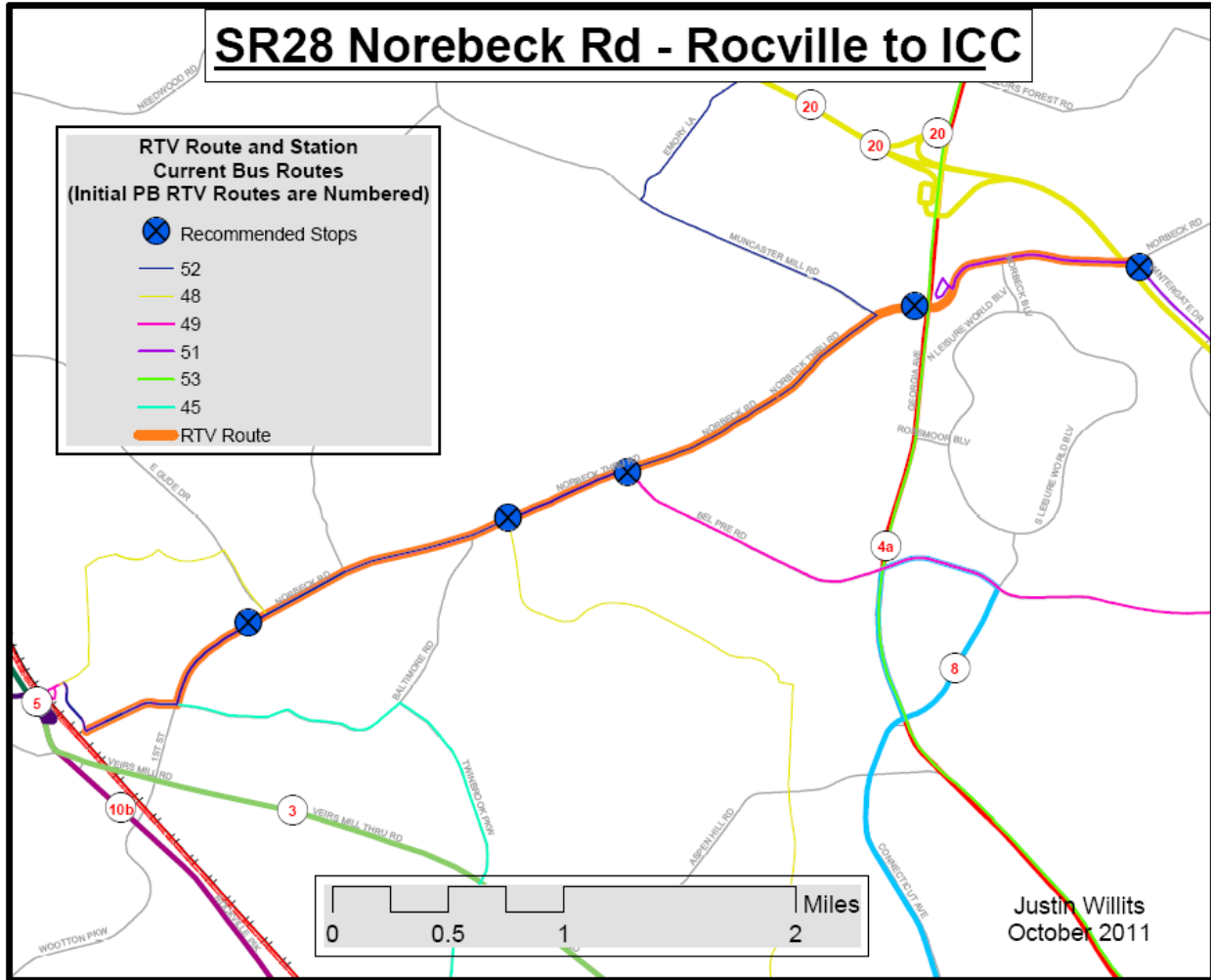


Figure 4-2. Map of Norbeck Road stop and station locations

Randolph Road (2, Appendix G)

The Randolph Road Corridor is another important extension that provides the east-west connectivity of the BRT system. The original Randolph Road segment connects the White Flint Metro Station (2 stops south of Rockville on upper west side of the red line) to the Glenmont Metro Station (upper east end of the red line). The Red Line is a U shaped segment of the DC Metro. The additional proposed segment further connects the east county to the Glenmont Metro Station. There will already be BRT station at the origin and the stop and stations will be described moving from west to east. Currently route 10 runs parallel for the majority of the route, and route 31 briefly runs parallel from the Glenmont station to Kemp Avenue (1.25 miles) (Appendix B).

The first stop is located at JFK High School approximately 1 mile from the route extension origin at the Glenmont Metro Station and also serves as a transfer point with route 31 (Appendix B) which serves the residential area to the south (Appendix C). This location also provides some access to the low density residential areas to the north and south.

The second stop location at Randolph Road #500 (between Springtree Drive and Hammond Road) is recommended as an activity center located within a residential area (Appendix C) one mile west of the first proposed stop. After deliberations within work Group D there was a discussion of the need to include places of worship (3 at this location) in activity centers as they draw many minorities and immigrant populations who rely heavily on transit. This location also provides access to a low density residential area within a half mile.

The next recommended stop, 1.1 miles northeast, is a station location at New Hampshire Avenue. This will be a transfer point with the New Hampshire Avenue BRT Route 11 Extension. Current Route 10 (Appendix B) also runs parallel at this location. This location is also an activity center with several commercial uses (Appendix C).

The next location is 1.1 southeast of New Hampshire Avenue at Tamarack Road. This was originally not included in the recommendation. Due to the size of the residential area that would be given access it was considered a good addition to attain the choice riders from this low density residential area (Appendix C). This stop was located under the APTA recommendations of goals of the system. Not providing access to this residential area would seem to have alienated the residents by having a transit lane for BRT with no access.

The next location at Columbia Pike, approximately 1.1 miles east, is recommended as a station as it is a transfer point with BRT Route 19 (Appendix A). This is also an activity center (Appendix C). The location is currently offset to the left due to the overpass of Randolph Road at New Hampshire, this is not an indication of preference, just a selection of the stop in the vicinity of SR 19 Columbia Pike.

The last location is .6 miles southwest recommended as a stop as it is the termini of the route located at an activity center (Appendix C). This route was extended to the County line at Prince George’s County to promote future transportation coordination, but this stop would be the logical termini of the route until further coordination takes place.

Table 4-2 Randolph Road stop and station attributes

Location (West to East)	Stop/Station (West to East)	Attributes/Justification
JFK High School	Stop	Transfer point- to current route 31 of bus system
Middlevale Lane		Located within residential neighborhood.
Randolph Rd #500 (between Springtree Drive and Hammond Road)	Stop	Activity center- places of worship Located within residential neighborhood
Tamarack Road	Stop	Centrally located within a low density residential area
New Hampshire	Station	Transfer point- Transfer with RTV route 11 extension (north-south)
Columbia Pike	Station	Transfer point- with PB-RTV route 19-SR29 Activity center
Cherry Hill Rd & Broad Birch	Stop	Route terminus Activity center – commercial center

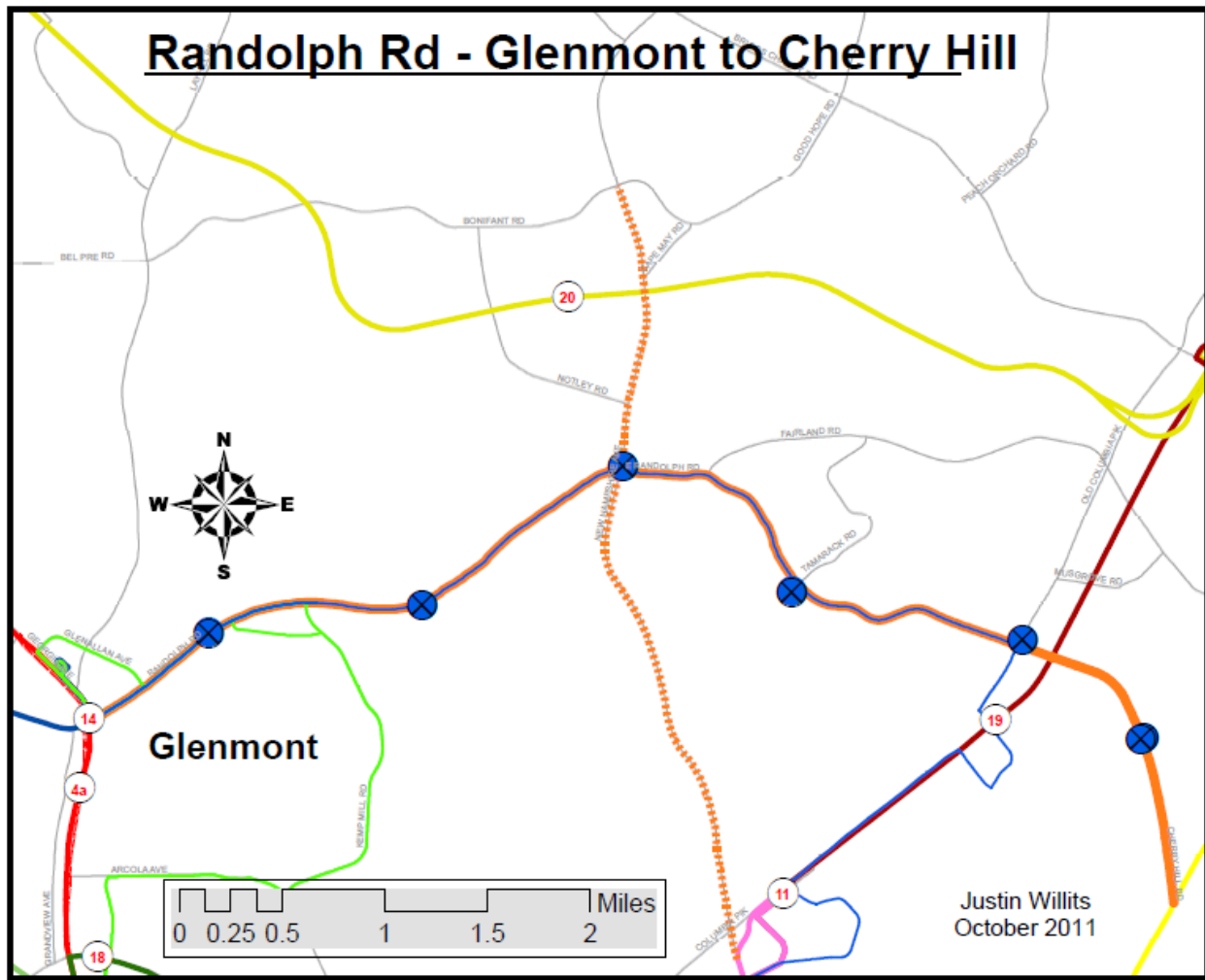


Figure 4-3. Map of Randolph Road stop and station locations

New Hampshire Avenue (5, Appendix G)

The New Hampshire Avenue Route is an important North-South connection to the ICC that extends Route 11 of the original PB routes that had originally terminated at White Oak, where it intersects with BRT Route 19. This route was added to connect further into the north county and provide connectivity with the ICC.

The first recommended stop location at Bonifant Rd and Good Hope Rd is the route termini and also a transfer location with route 19 of the current bus system (Appendix B). Depending on whether this is made a park and ride location will determine the level of investment as a stop or station, but is beyond the scope of this research.

The next location, .5 miles south, is recommended as a station due to its intersecting with the ICC BRT Route. There is discussion of this as a possible park and ride location. Depending on if and where a park and ride location is located, will determine the extent of development of the first two stop and station locations. The next location depicted was described previously along the Randolph Road Corridor at New Hampshire.

The last location at Valley Brook Drive is recommended as a station location due to it being an activity center with proximity to a high school, elementary school and recreation center (Appendix C). This location is located within a low density residential area, but has somewhat limited access. There is also no connectivity with any existing routes, however the activity center location warrants enough significance for the location.

Table 4-3. New Hampshire Avenue stop and station attributes

Location (North to South)	Stop/Station (North to South)	Attributes/Justification
Bonifant/Good Hope	Stop	Route terminus Transfer point- to current route 39 of bus system
ICC	Station	Transfer point- with PB-RTV route ICC
Valley Brook Drive	Station	Activity center High school and middle school located within ½ mile Recreation center located within 1 mile

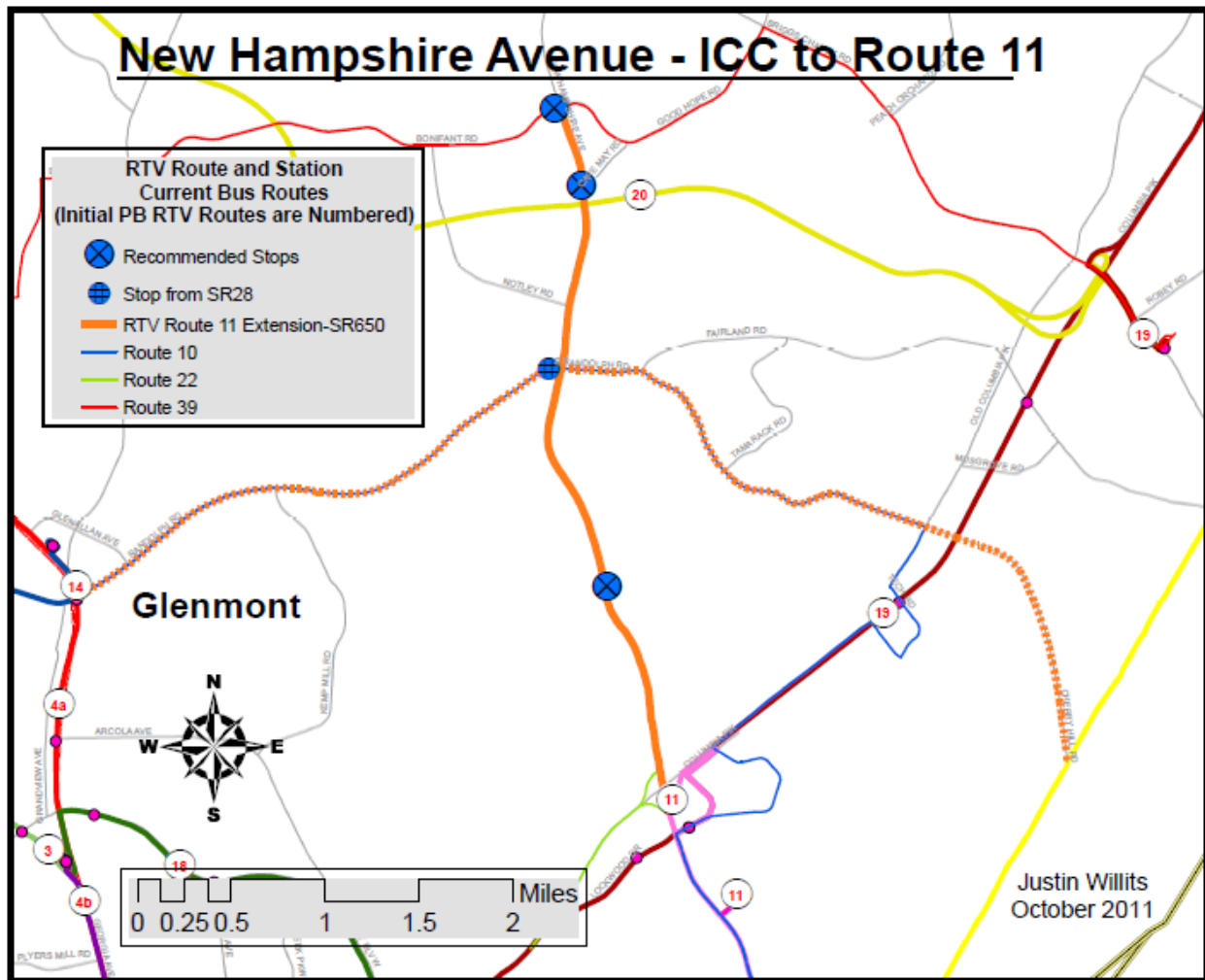


Figure 4-4. Map of New Hampshire Avenue stop and station locations

Observation Drive (3, Appendix G)

Observation Drive was recommended by the Transit Task Force (TTF) to connect CCT through Montgomery County College to route 10a of the RTV system. As there are currently limited crossings on I-270, it was seen as essential to provide this where available in the North so commuters have the flexibility to use both north-south routes.

The first recommendation is a stop located at Ridge Road that is a transfer point as it currently intersects with route 83 (Appendix B) of the bus system. Location is also an activity center to the southeast with a considerable amount of retail (Appendix C), however mostly big box retail not traditionally associated with transit.

The other recommended stop location is an activity center (Appendix C) at Montgomery County College and is in close proximity with route 55 (Appendix B) of the current bus system.

Table 4-4 Observation Drive stop and station attributes

Location (West to East)	Stop/Station	Attributes/Justification
Ridge Rd	Stop	Transfer point- to current route 83 of bus system
Montgomery County College	Stop	Transfer point- less than ¼ mile to current bus route 55 Activity center- Montgomery County College

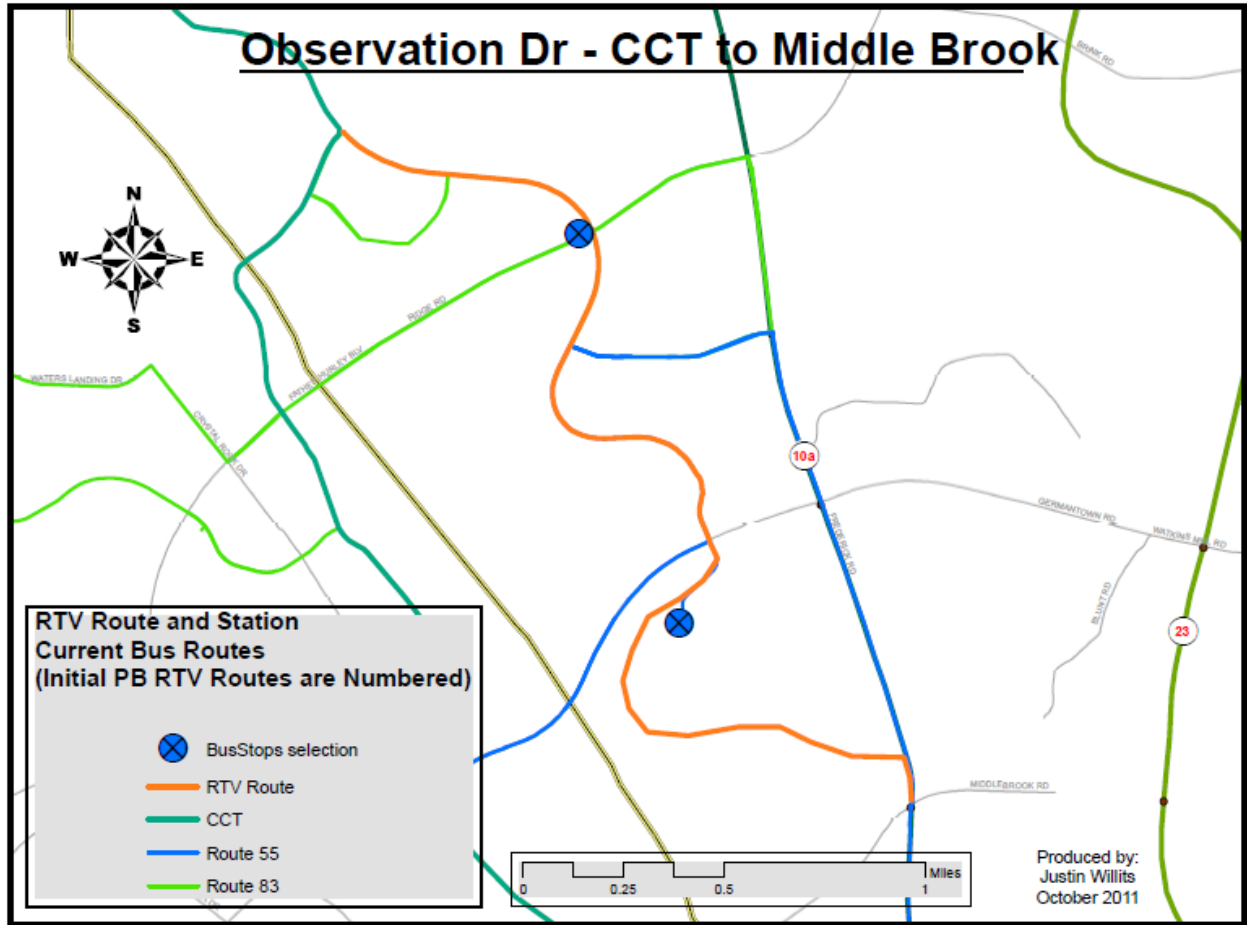


Figure 4-5. Map of Observation Drive stop and station locations

Summary of Results

The majority of the stops and stations selected met the requirements of the methodology with a few exceptions. In order to meet the specific goals of this BRT system there were some corridors with no characteristics described in the methodology, but provided long distances between stops. Providing access to these areas was a goal of the overall system and was seen as providing service to these otherwise car-oriented communities.

The overall spacing of the stops through these corridors is fitting with the methodological goals of not inhibiting the speed and service of the system. This will be particularly true when express routes are designed to pass these more rural stops and are not inhibited whatsoever by their location.

CHAPTER 5 DISCUSSION

Through the methodology used, many of the stop and station location met the goals provided in the literature for determining stop and station selection. The challenge of selecting these locations was quite unique as these corridors are typically suburban routes with a lack of density; density is frequently assessed in determining locations for transit services. As long as the system provides the express routes that will bypass some of these stop and station locations proposed in this research, the locations will still be effective in meeting the goals of the level of service. One of the most critical parts of the methodology used was to ‘meet the speed and service objectives of the system.’ Depending on the routes and services offered at specific times, these locations provide the flexibility to meet those goals.

Through the development of the routes and service provided, some of these low density residential areas may only be served at peak periods with any frequency or bypassed by express routes during certain periods. This is one of the aspects kept in mind while evaluating these unique areas for transit. Just because a stop would be located there, did not mean each vehicle would be stopping, as the goal is to have a bypass lane at stations for express routes. Providing access to these areas was critical to the goals of the system, and for the peak reduction in congestion. These locations can be very useful in reducing personal vehicle trips within the county as well as those trips from within the county to outside with the access provided to the DC Metro.

Perhaps the most appropriate example of an unexpected decision was to locate a stop at Tamarack Road and Randolph Road. On the surface there was no activity center located of other bus service to this area. However, the fact that this was the middle point of what would have been a 2.2 mile stretch with no access to the BRT that would be running through the area seemed

to alienate the residents that would have no choice other than observing this transit system in their neighborhood on a daily basis.

This distinct consideration is similar to the consideration of places of worship and schools as activity centers. While they will not generate the largest ridership, they are also located within residential areas. This stop was also made as a political point in the deliberations as to include the minority and immigrant populations that often use transit to access these locations.

Moving Forward

The problems confronting Montgomery County, MD and the entire Washington D.C. Metropolitan region are enormous and need expedited attention. There are a limited number of ways to address their congestion and air quality issues that continually worsen. The cost of highly attractive LRT is not feasible in the fiscally restrained economic times, and there simply is not the capacity for lane addition for vehicles within the majority of the areas proposed by the RT system. The addition of these lanes would also not satisfy any emission goals in the short term, and probably in the long term without any significant improvement in overall vehicle efficiency. What is far more important is the impact of not implementing this system and where the County and the region will be in 10 to 20 years without it. In many of the deliberations, a reference is made to where this region would be right now without the DC Metro, and the subsequent economic analysis that is currently taking place will produce those figures.

This process has better helped me understand and conceptualize the seriousness of the issues that affect the development of a new transit system and all the stakeholders that must be involved. Over the course of the TTF meetings many of the once skeptical interest groups, favoring LRT or just against the concept altogether, have come together in support of this system as the best alternative from several standpoints. Financially, this is the most resource savvy plan of action as LRT would be too large an expense for the county to pursue, especially without

federal funding. Logistically, this system is promoting the use of median space, existing curb space and ROW that can be used by more than just RTV's in certain locations. With approximately 170 miles of BRT lanes planned for this system, it is a bold means to address what is a critical issue as the entire DC region grows and transportation issues compound.

The phasing of this system will be critical to its vitality and perceived success by the citizens and interest groups involved. Work Group D is now piecing together recommendations for the phasing of this sequence in a manner that will minimize the traffic impacts during this process. This has been referred to as Montgomery County's 'carnagedon' of sorts, but if the people of Montgomery County can adjust their travel behaviors slightly as the construction and implementation process unfolds, this will bode well for the choice riders that are hoped to be attained.

Limitations

This research was limited by the actual logistics of the routes being addressed, and that the ROW or median location of the BRT lane feasibility is yet to be determined. This resulted in the locations only being based on characteristics that defined the area that they were recommended.

Further analysis needs to be made of the engineering aspects of these route segments and the impact that they will have on the location of these stops and stations. The ridership of the current routes that intersect the proposed BRT routes also need to be addressed to more accurately project which locations are more appropriate for consideration as stop and station location.

Additionally, an analysis of the trade-offs of some of these stops on overall system performance (speed and ridership) needs to be completed. This analysis will be done by MCDOT after several current studies are complete before they begin the preliminary engineering. Other studies currently underway that will be significant in the determination of the

physical characteristics of these routes include; Montgomery County Park and Planning's study of median and ROW of the additional route corridors, economic analysis by Johns Hopkins University, and build-out costs associated with an eleven mile portion of the CCT. With all these working parts coming together in the next six months, the feasibility of the locations on these corridors will be determined.

One issue that also must be mentioned is the ability of the entire system to reduce the emissions and congestion within the region. Depending on if and when the other jurisdictions that border Montgomery County participate in any BRT system there will be a limitation to the effect that this BRT system will have. This system will address primarily Internal to Internal trips within the county, and some Internal to external trips. These trips should be considered the priority of the system initially so the capture of riders can take place. The internal to external trips, connecting to the metro for example, can be very helpful reducing in-county congestion and provide connectivity at a much faster rate without some of the other issues associated with car travel like parking.

CHAPTER 6 CONCLUSION

Addressing the transportation and congestion issues being experienced in the Washington DC metropolitan region including Montgomery County, MD while their population grows is an important and vital task for their economy to remain competitive. The time that commuters lose in congestion negatively affects individuals economically and degrades their environment. These issues can be addressed through alternative transportation systems that provide them with comparable and often less travel times to their destinations. After a century dominated by the automobile and air travel, more value is now being given to balanced systems within and between metropolitan areas.

As our infrastructure maintenance continues to be an issue of concern, promoting alternatives to the system for which we have so long relied is critical and can extend the lives of our existing infrastructure and transportation systems. The benefits associated with alternative transit systems can save commuters time and money, while simultaneously benefiting the environment in which they live, work, and play. Many obstacles throughout all levels of government in the implementation of transit systems and improvements need to be addressed.

The stop and station location recommendations of this research accomplish many of the goals of the BRT system and can promote qualities characteristic of LRT. While two of the routes provide an east-west connection of the County, the historically less affluent east side will have a much better means of accessing the jobs in a quicker fashion than they have had in the past. Removing these transit vehicles from mixed traffic along these corridors (and other original routes) will help ease some of the current congestion while providing better service to those who currently use or will choose to use the BRT system.

The locations selected were based on limited locations that would not inhibit the ability of the system to move quickly and efficiently while still providing access along the corridors. The areas that these routes serve are not the main corridors that the initial routes serve that are planned for, and have been planning for, transit. This made the challenge of identifying these stops challenging.

This challenge of providing transit through low density corridors of a historically car dependent county was precarious. The methodology that was used weighed heavily on the connectivity of other transit options, in this case the Ride On bus service. Unfortunately these corridors have limited development and few activity centers, with even less residential density to support transit. At the same time, consideration of providing access to these suburban car oriented homes was important as their trips contribute to the congestion of the region. A balance was provided with appropriate locations and distances between locations that will improve mobility and multi modal connectivity within the county for all current and future transit users.

These routes, stops, and stations provide connectivity and an alternative to car travel within and through the less dense corridors of the county. With the reevaluation of the current Ride On and MetroBus routes acting as feeders to these routes and eliminating some, a better concept of the entire transit system of the County will develop to provide more efficient movement of transit vehicles and vehicle traffic. The implementation of a county-wide BRT system so close to the capital would provide a great model for future systems around the country that could be viewed by policymakers and government officials at every level. If Montgomery County achieves the Gold Standard for the majority of its system, there could be a profound effect on the way congestion and transportation is addressed throughout the Country.

APPENDIX A
FULL BRT SYSTEM

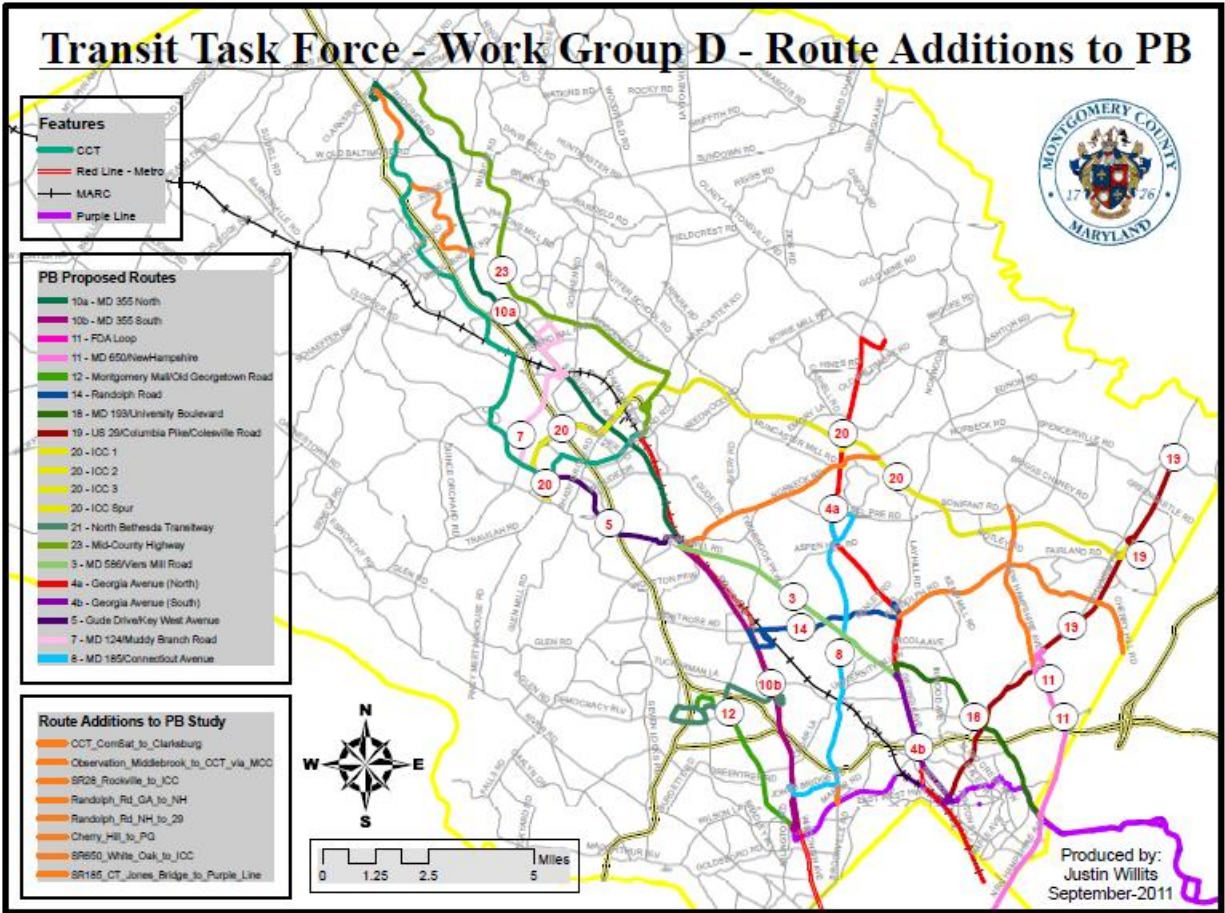


Figure A-1. Full map of BRT system

APPENDIX B
CURRENT BUS STOPS

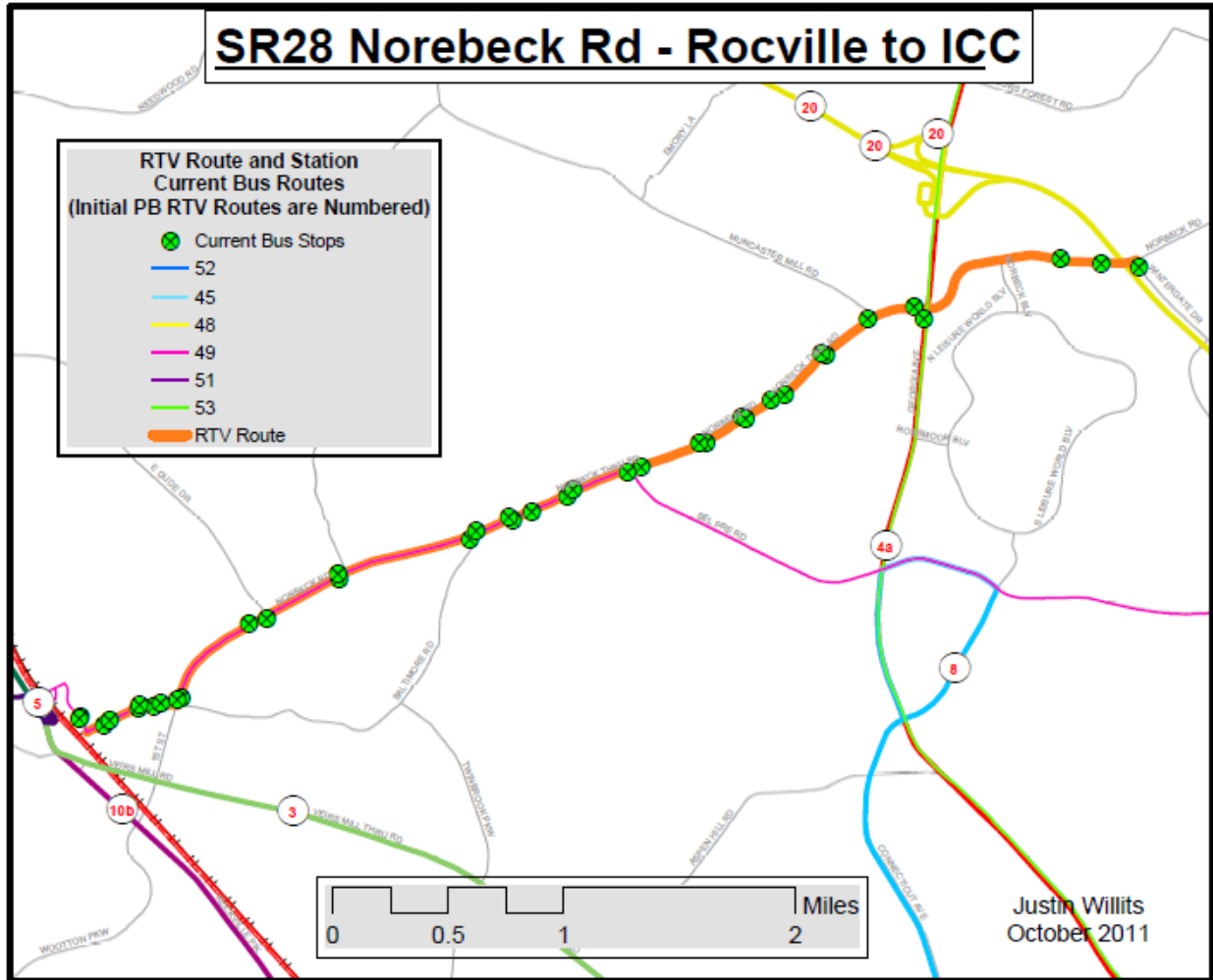


Figure B-1. Norbeck Road

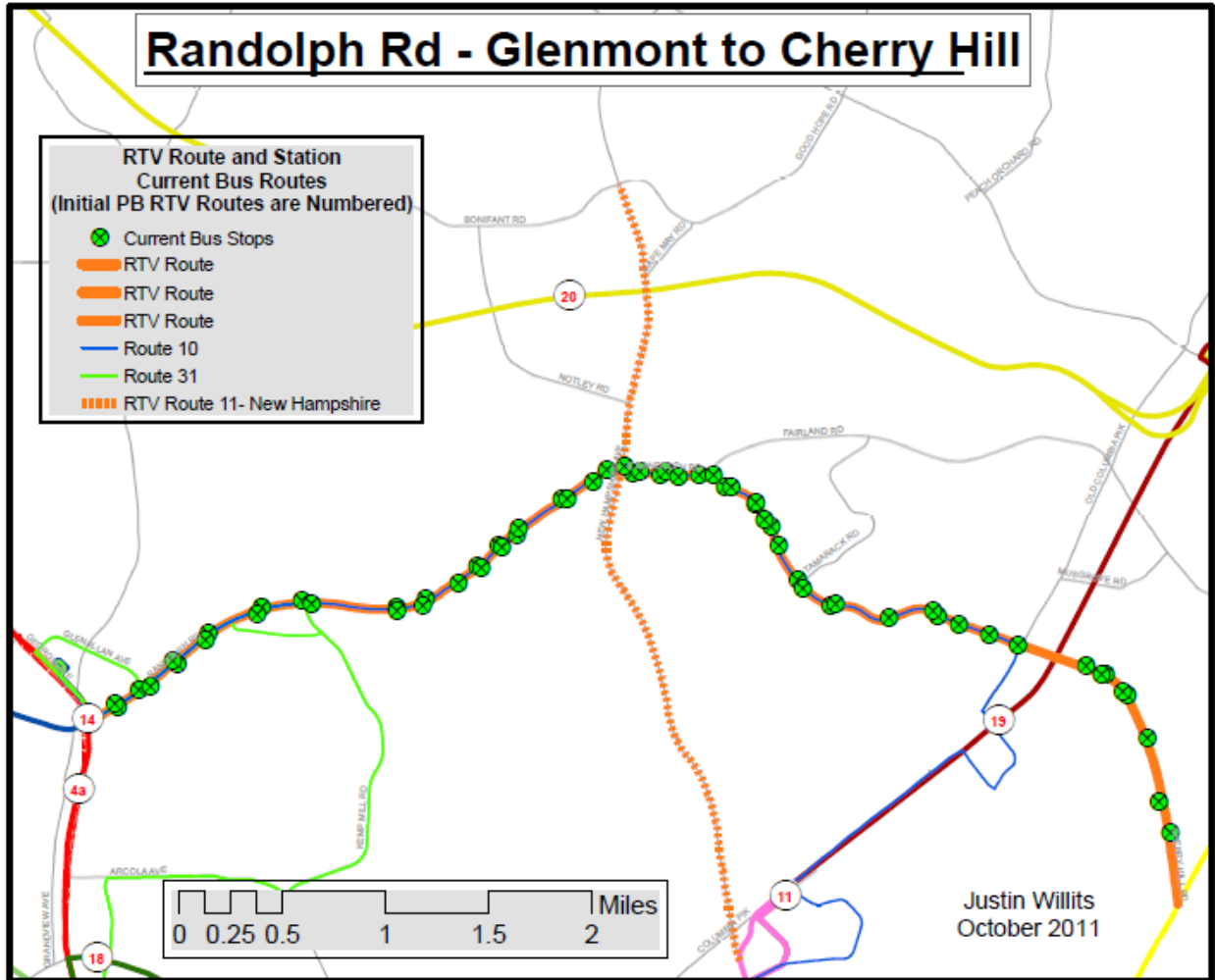


Figure B-2. Randolph Road

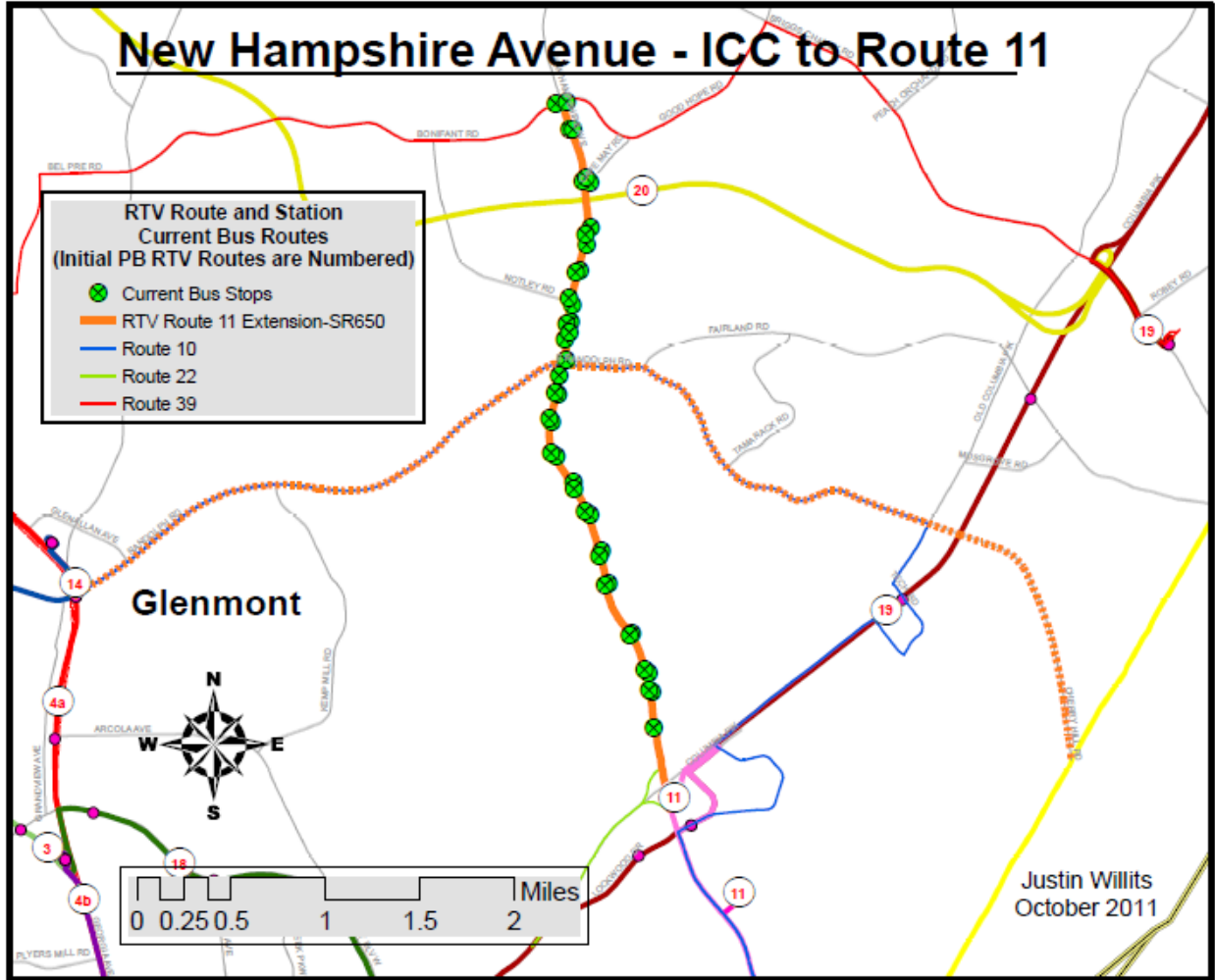


Figure B-3. New Hampshire Avenue

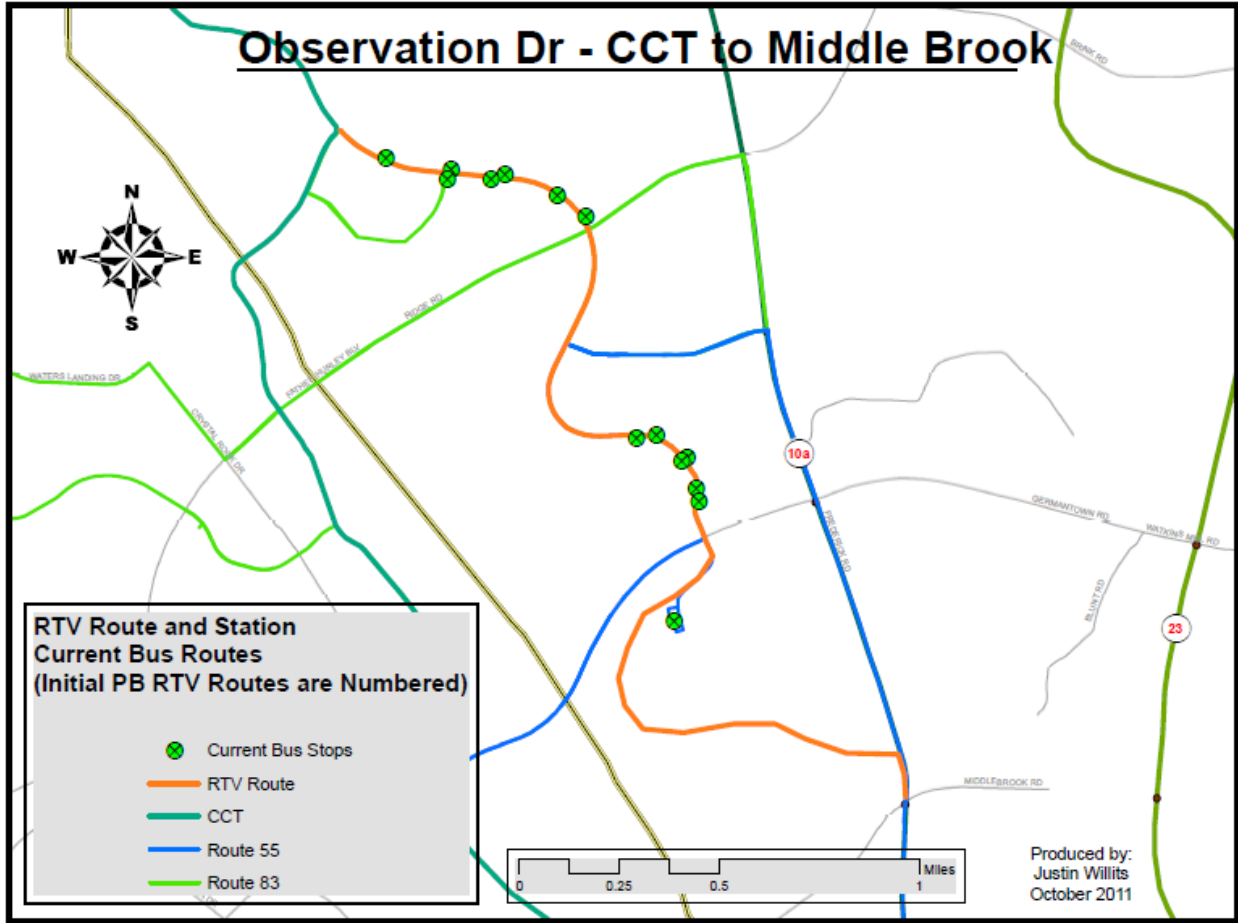


Figure B-4. Observation Drive

APPENDIX C
PROPOSED STOPS WITH LAND USE

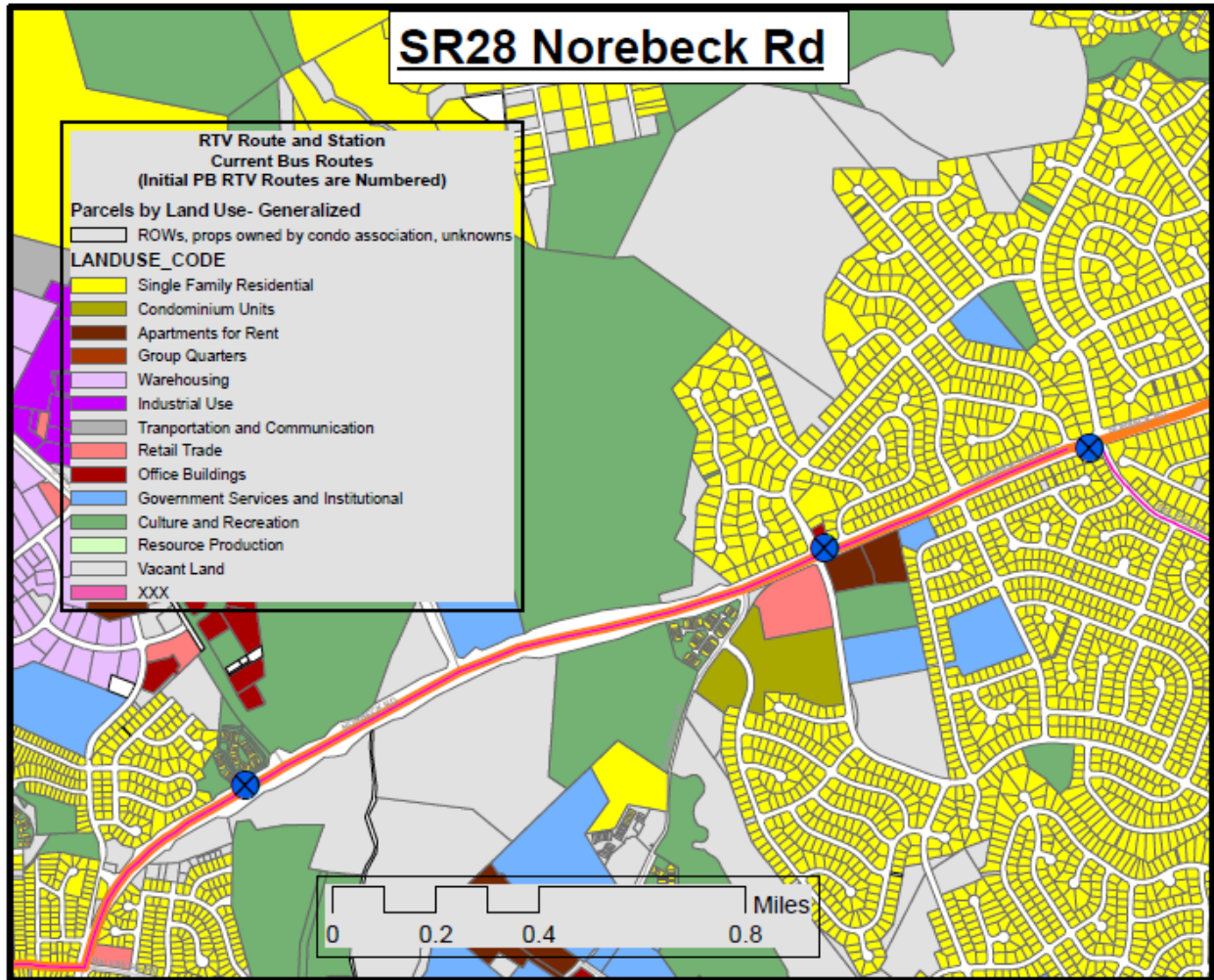


Figure C-1. Norbeck Road a

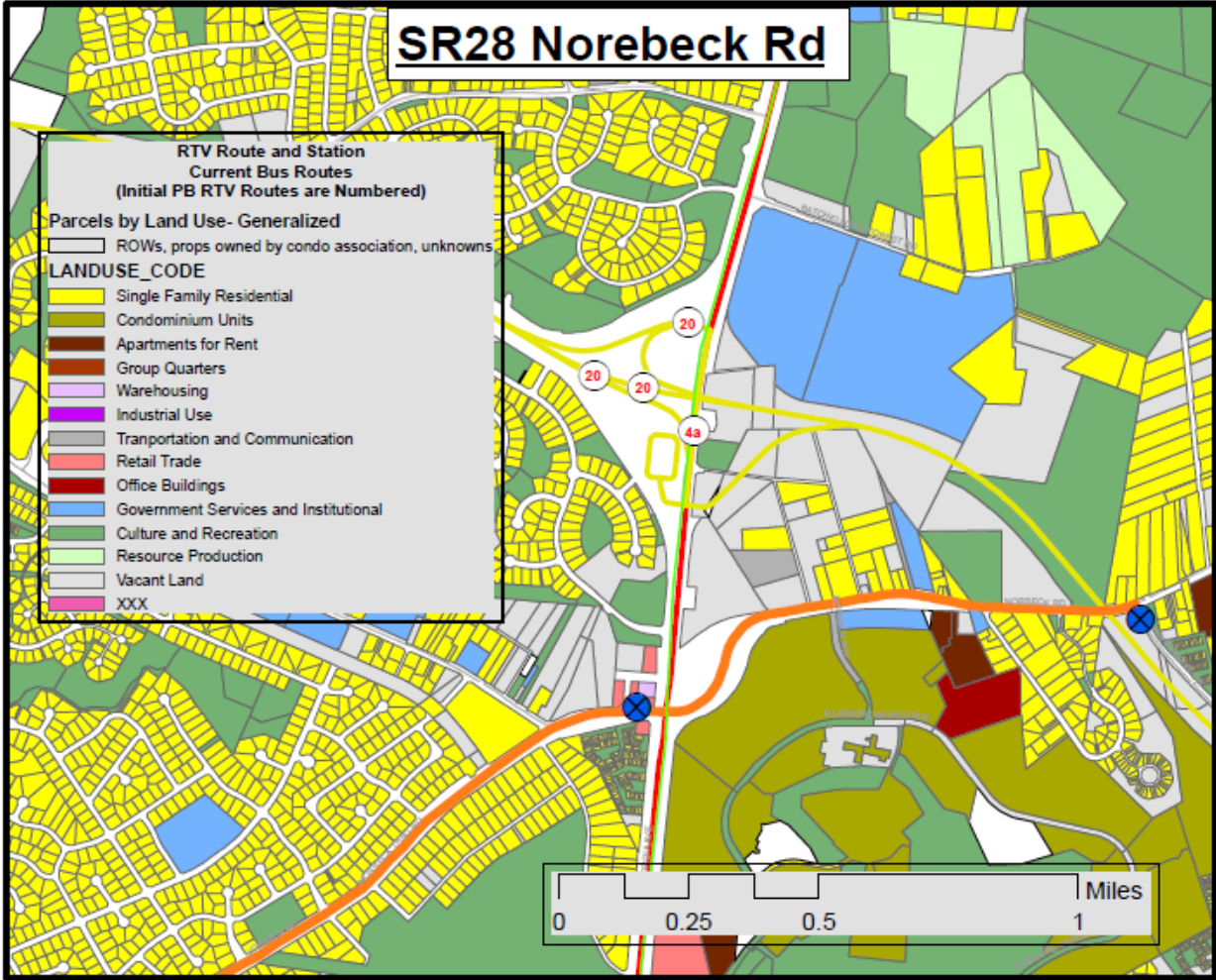


Figure C-2. Norbeck Road b

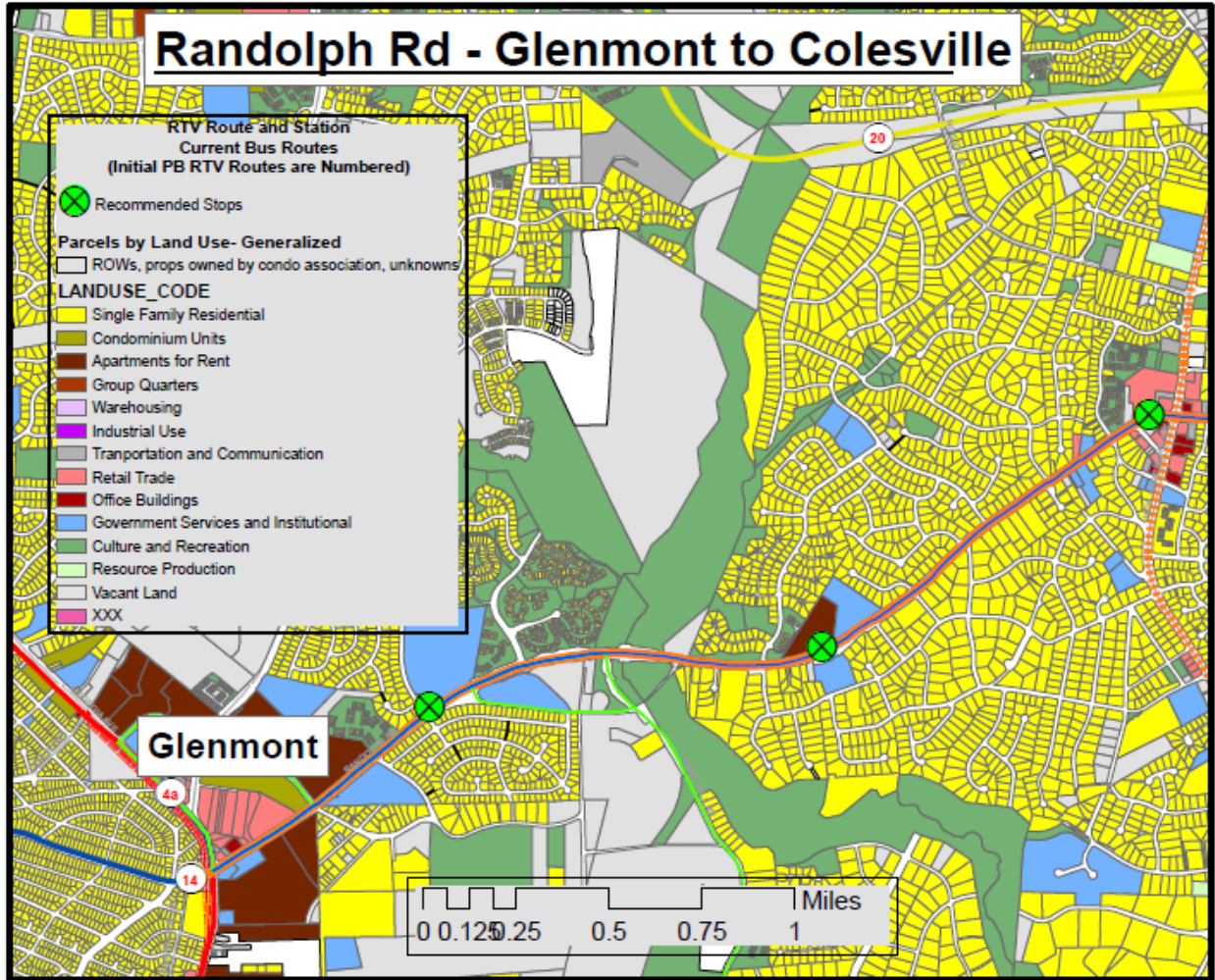


Figure C-3. Randolph Road a

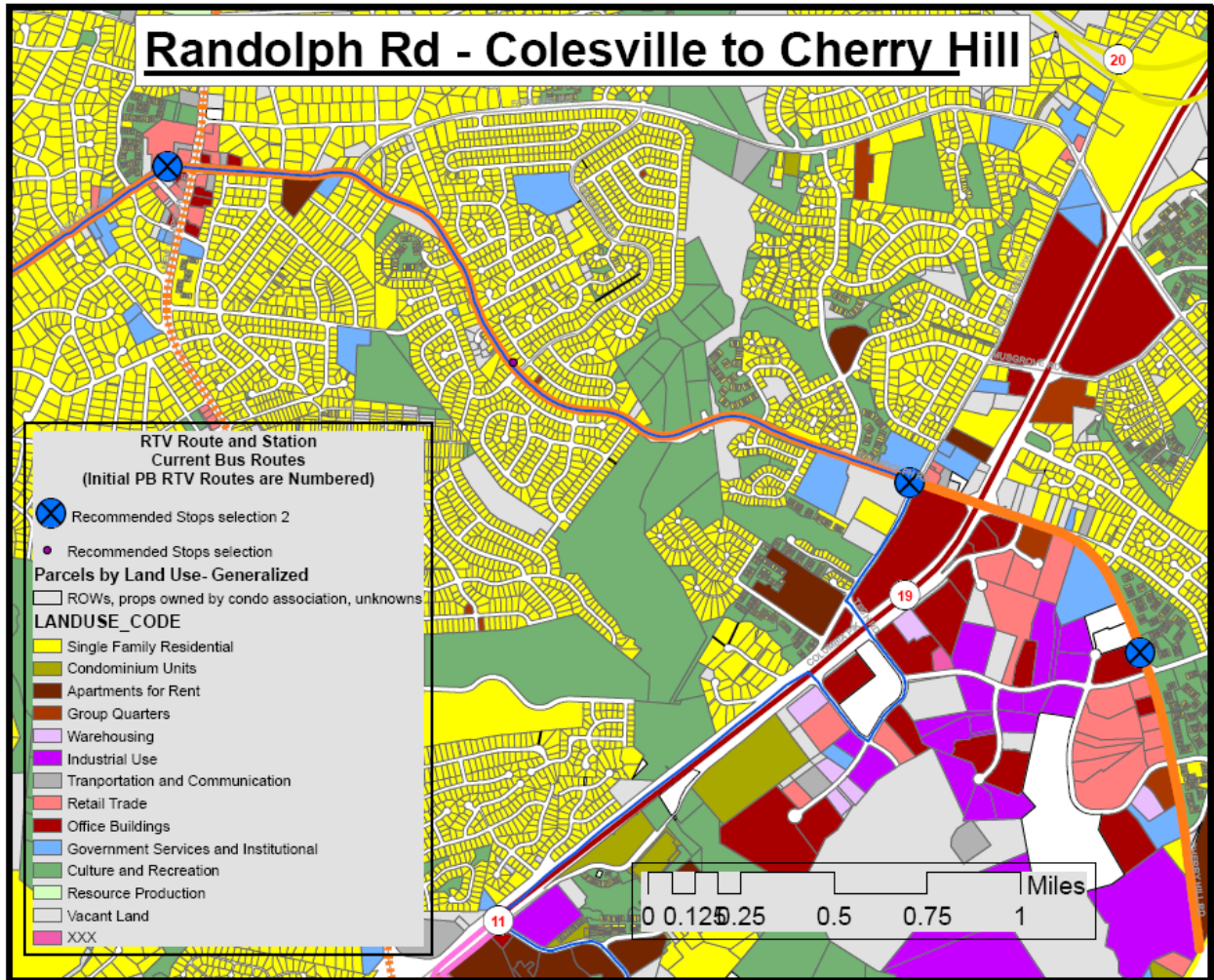


Figure C-4. Randolph Road b

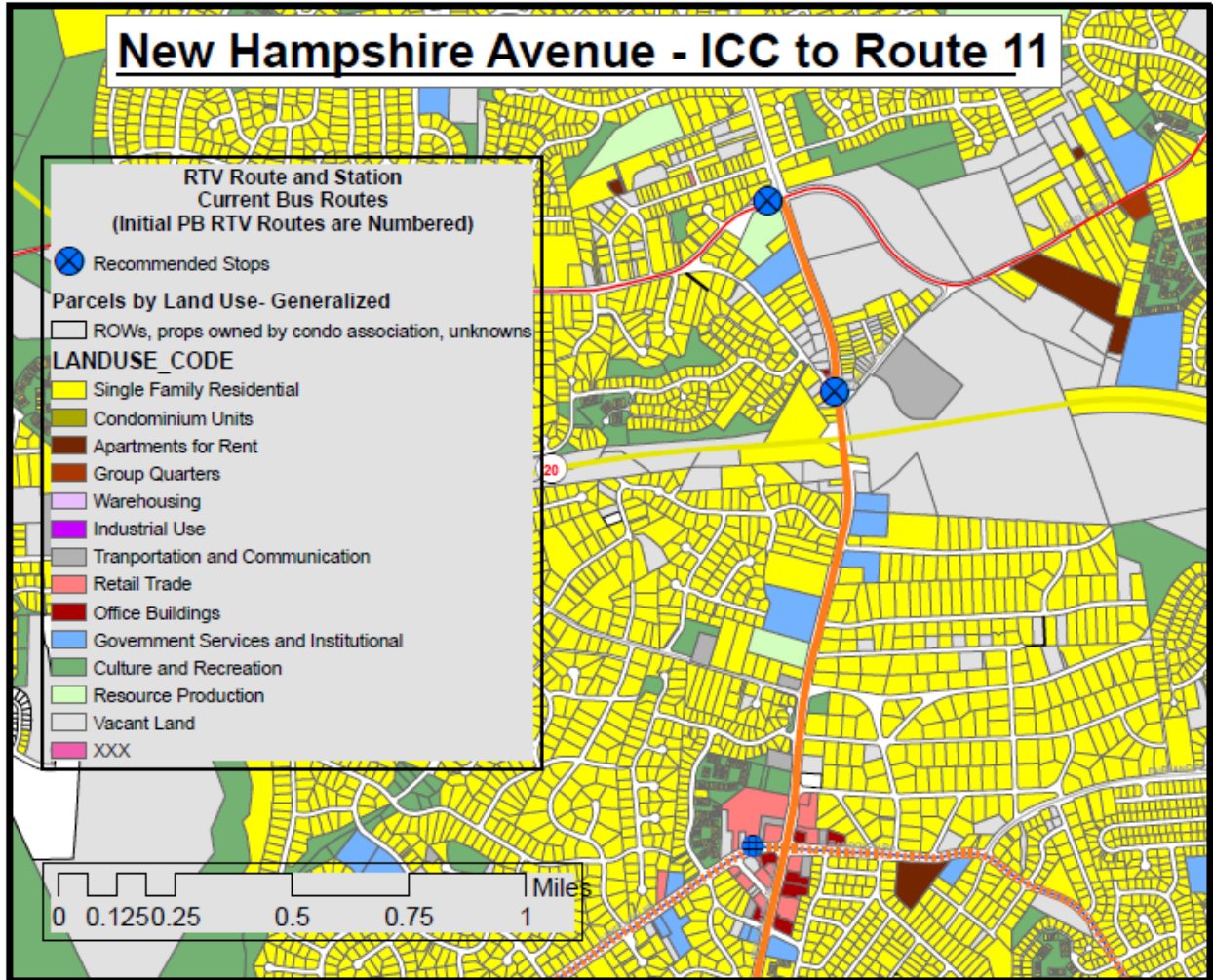


Figure C-5. New Hampshire Avenue a

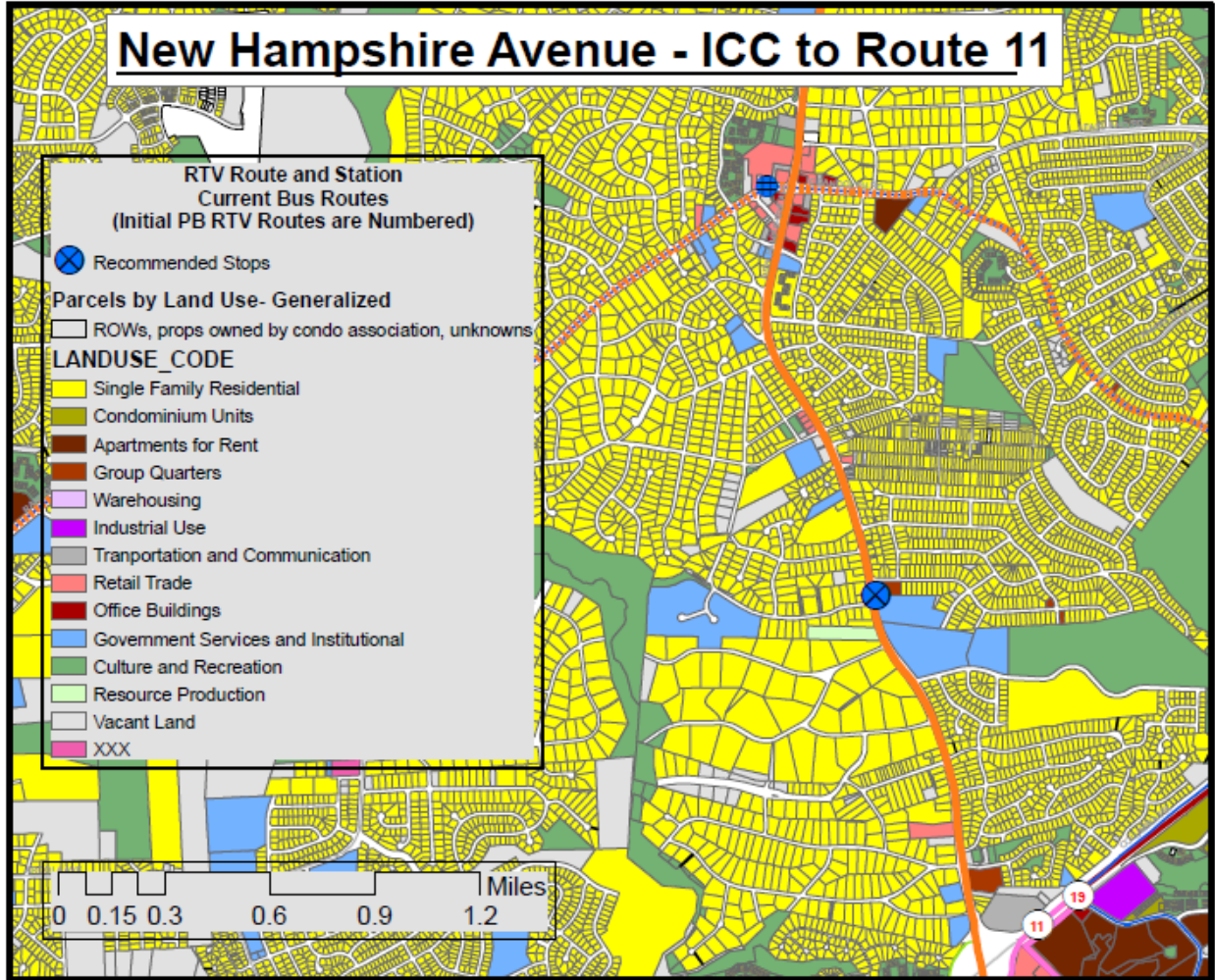


Figure C-6. New Hampshire Avenue b

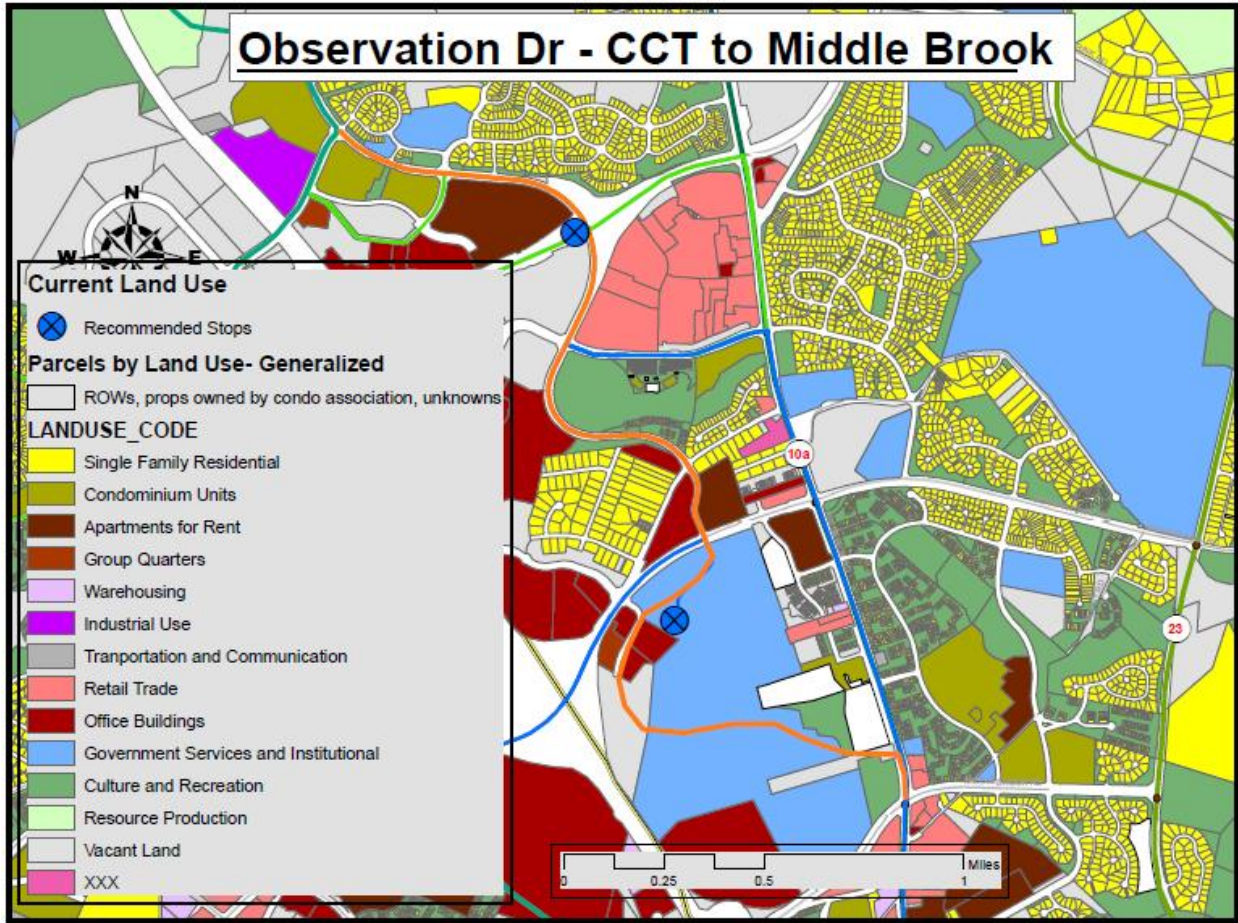


Figure C-7. Observation Drive

APPENDIX D COMPREHENSIVE PLAN REFERENCES

Montgomery County has been pursuing transit improvements for decades under the coordination of The Division of Transit Services. Their goal is as follows:

The mission of the Division of Transit Services is to provide an effective mix of public transportation services in Montgomery County. The Division operates the County's Ride On bus system, coordinates special transit services for seniors and persons with disabilities; regulates taxi services; provides commuter services; and oversees transportation management districts. More specifically, the Commuter Services Section manages programs and services to decrease single-occupancy vehicle trips during the peak travel hours by encouraging commuters to encourage alternative modes of transportation. The division also develops the County's Transit Strategic Plan.

The most recent documentation of Transportation goals is located in the General Plan Refinement of the Goals and Objectives (1993):

Key Concepts: While some increases in traffic congestion may be a fact of life for the future, maintaining mobility is essential. Making better use of the transportation system already in place, getting more people into trains, cats, and buses in future rights-of-way, and creating an environment conducive to walking and biking are all necessary elements to achieve an affordable balance between the demand for, and supply of, transportation. Even with more efficient use of the existing transportation system additions to the network will be necessary to support this Refinement's Land Use Goal. Public Safety is a primary concern in the design of transportation facilities.

In order to comply with Maryland Planning Act of 1992, the transportation goal seeks to conserve resources through encouraging public and private efforts to reduce peak travel demand, devise land use patterns to encourage shorter trips, and to manage the supply of parking. The requirements to provide funding mechanisms to achieve other Planning Act visions is addressed by strategies 1E and 1F. Objective 7, preventing the degradation to the overall quality of air, land, and water, addresses stewardship of the Chesapeake Bay.

Goals and Objectives

Goal

Enhance mobility by providing a safe and efficient transportation system offering a wide range of alternatives that serve the environmental, economic, social, and land use needs of the County and provide a framework for development.

Objective 1

Develop and interconnected transportation system that provides choices in the modes and routes of travel.

Objective 2

Provide appropriate access to, around, and within communities by using a full range of travelways.

Objective 3

Improve the efficiency of the existing and planned transportation system by managing its supply and demand.

Objective 4

Provide a transit system in appropriate areas of the county that is a viable alternative to signal-occupant vehicle travel.

Objective 5

Reduce traffic delays on the road system without eroding the quality of life in surrounding communities, unless alternatives to the single-occupant vehicle are available.

Objective 6

Provide pedestrians and bicyclists safe, direct, and convenient means of travel for transportation and recreation.

Objective 7

Prevent degradation to the overall quality of life of the air, land, and water in the provision and use of the transportation system.

Objective 8

Maximize Safety in the use of the transportation system.

(Pp. 60-65)

APPENDIX E
LETTER FROM THE COUNTY EXECUTIVE AND COUNTY COUNCIL PRESIDENT

ROCKVILLE, MARYLAND

February] 6, 20 1 1

The Honorable Richard Madaleno, Chair The Honorable Brian J. Feldman, Chair Montgomery County Senate Delegation Montgomery County House Delegation 214 James Senate Office Building 223 House Office Building Annapolis, Maryland 2140 I Annapolis, Maryland 2140]

Dear Senator Madaleno and Delegate Feldman:

In light of the Draft FY2011-2016 Consolidated Transportation Program we have updated the State transportation priorities we transmitted to you on July] 6,2008. This letter describes our latest sets of priorities for currently unfunded State transportation projects and studies.

We acknowledge and commend the Maryland Department of Transportation (MDOT) for its ongoing support for the Washington Metropolitan Area Transit Authority multi-year capital improvement programs for infrastructure investment to maintain a state of good repair and to implement the National Transportation Safety Board recommendations. Additional capital funding beyond the multiyear funding agreement is needed to operate eight-car trains, eliminate the Red Line tumbucks at Grosvenor and Silver Spring, and to expand the existing station platform and circulation capacity to accommodate existing and projected riders.

Two other projects of significance to the County are noteworthy. The Base Realignment and Closure (BRAC) transportation improvements near National Naval Medical Center in Bethesda have been funded for design and land acquisition, but construction funds necessary to complete the improvements are not programmed. Also, the County is currently engaged in a feasibility study of county-wide bus rapid transit (BRT) service. Once the study is complete, we intend to incorporate elements of the countywide study in our master plans to then be in position to have MDOT begin project planning for specific routes in addition to those already underway.

The balance of this letter describes our priorities in several categories.

L Projects of regional significance that are in the D&E Program but not in the Construction Program. Two major transitways, the Corridor Cities Transitway (CCT) from Shady Grove to Clarksburg, and the Purple Line from Bethesda to Prince George's County are our highest, and co-equal, priorities. The next priority is to complete the BRAC transportation improvements for the National Naval Medical Center in Bethesda. Other regionally significant projects with high priority are the widening of I-270 for high-occupancy-toll (HOT) or high-occupancy-vehicle (HOV) lanes north of Shady Grove and the widening of I-495 for HOT or HOV lanes between the I-270 West Spur and Virginia. While there are issues to be worked out on important aspects of some of these priorities, decisions must be made and funding must be identified promptly to move them forward to completion.

II. *Projects of local importance that are in the D&E Program but not in the Construction Program.* are priority projects that identified by the Executive and Council to and/or Federal Delegations. We have already taken steps in the last few years dedicating extraordinary amount \$286 million of County funds to design, land and/or build projects that are or should be State's responsibility:

- \$14,463,000 to forward fund the MD 355/Montrose grade-separated interchange (being by the State).
- to construct a 1,200-space at Glenmont Metro
- \$66,961,000 to design and reconstruct Rockville Pike 355) through Flint.
- \$70,296,000 to design, land, and construct Montrose Parkway from east of Rockville Pike (MD to Park lawn
- \$14,362,000 design and land acquisition for the Georgia (MD 97)/Randolph Road interchange.
- \$6,447,000 to build improvements on State highways.
- \$10,000,000 to land the Avenue 97) around Brookeville.
- \$4,900,000 towards the of the I-270/Watkins Mill Road interchange.
- \$6,000,000 for preliminary the Mill (MD 586) BRT line between Wheaton and Rockville.
- \$2,000,000 preliminary engineering for a pedestrian underpass beneath Georgia Avenue (MD 97) at the Glen Station.
- \$5,000,000 for preliminary for the Avenue (MD 97) Busway from Glenmont to Olney.
- \$3,000,000 for preliminary the reconstruction Avenue (MD 97) through Montgomery Is, from 16th (MD 390) to Forest Glen Road (MD 192).

Our priority rankings for projects will for construction funding during next six and are currently in the or project - planning stages are listed below. The funding that needs to be programmed to complete each project is indicated as well.

1st 1-270/Watkins Mill Road Extended: build bridge over 1-270 \$110M Woodfield Road: widen to 6 lanes, Midcounty Highway to Snouffer School \$47M Avenue: build bypass Brookeville \$22M 4th Georgia Avenue/Norbeck Road: build grade-separated interchange \$142M Clopper improve from to State \$56M

6th 1-270/Watkins Mill Extended: complete grade-separated interchange

7th Road: to 4 from Columbia Pike to US 29 \$31M

Norbeck Road: widen to 4 lanes Georgia Avenue to Layhill \$135M

9th 1-270/Newcut Road: build \$138M 10th Woodfield Road: widen to 6 lanes Road and Fieldcrest Road to Warfield Road \$54M 11th 29/Fairland Road/Musgrove Road: build grade-separated interchange \$1 MD 281/198: to 4 from Layhill to Old Columbia Pike \$183M

The total funding that to be programmed to complete these 12 projects is more than \$1.1 billion.

III Transit projects that are not in the D&E Program. As noted above, the County has programmed sufficient funds for MOOT to conduct preliminary engineering studies for the Veirs Mill Road BRT and the Georgia Avenue Busway. MOUs are being finalized and these studies should appear in the D&E Program of the Draft FY 12-17 CTP. The County has also programmed funds for a project planning study of a pedestrian underpass beneath Georgia Avenue at the Forest Glen Metro Station.

Our priority in this category is to fund corridors proposed by our Countywide BRT Study and subsequent master plan amendments. These corridors may include, but are not limited to: US 29, MD 355, MD 650, the North Bethesda Transitway, and MD 193. Furthermore, as we move forward on this project, we seek support for interim steps to give higher priority for buses on State roads throughout the County.

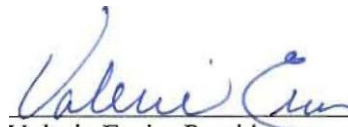
IV. Highway and bikeway projects that are not in the D&E Program. Our priority rankings for highway and bikeway projects to be added to the D&E Program are:

- 5th Frederick Road (MD 355)/Gude Drive: grade-separated interchange
- 1st Midcounty Highway Extended: construction from Intercounty Connector to Shady Grove Road
- 1st Intercounty Connector Hiker-Biker Trail: Shady Grove to Prince George's County 4th Sam Eigh Highway: grade-separated interchanges from 1-270 to Great Seneca Highway (MD 119); and grade-separated interchange at Great Seneca Highway and Muddy Branch Road
- 1st Frederick Road (MD 355): widening from 2000' south of Brink Road to future Frederick Road/Clarksburg Bypass
- 1st Rockville Pike (MD 355): improvement from Woodmont Avenue to 1-495, including a grade separated interchange at Cedar Lane 7th Veirs Mill Road (MD 586) | Randolph Road: grade-separated interchange
- 8th Veirs Mill Road (MD 586): widening from Twinbrook Parkway to Randolph Road
- 1st Frederick Road (MD 355): reconstruction north of Old Town Gaithersburg
- 10th 1-270/Gude Drive: grade-separated interchange
- 11th MD 108 Bypass around Laytonsville

V. Other comments. We appreciate your acceptance of the White Flint Sector Plan area as the State's first Bicycle and Pedestrian Priority Area (BPPA). We will work with you to coordinate an implementation plan that will time the State's bicycle and pedestrian facility investments so they are coordinated with White Flint's staging plan.

We also appreciate your having accepted the Wheaton, Twinbrook, and Shady Grove Metro Station areas as transit-oriented development (TOD)-designated areas under Section 7-102 of the Maryland Code. We now nominate the White Flint Metro Station vicinity as a fourth area to be granted TOO status, but with the understanding that capital projects in any of these areas do not supersede the priorities listed above. Maps describing these areas are enclosed.

If you need any clarifications about our recommendations, please contact us.


Valerie Ervin, President
County Council

Enclosures

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cc: The Honorable Martin O'Malley, Governor, State of Maryland
Beverly Swaim-Staley, Secretary, Maryland Department of Transportation
Francis Carrier, Chair, Montgomery County Planning Board

APPENDIX F
TRANSIT TASK FORCE WORK GROUP D MEMORANDUM

MEMORANDUM

TO: L. Mark Winston, chair, Montgomery County Transit Task Force
Thomas Street

CC: Member of the Transit Task Force
Director Arthur Holmes
Al Roshdieh
Gary Erenrich
Justin Willits
Alex Hafez

DATE: August 17, 2011

FROM: Tina Slater, Chair (Routes and Development Sequencing, Group “D”)

RE: **Statement of the Working Group on Routes and Development Sequencing
Regarding Additional Route Segments, Extensions and Connections**

The Working Group on Routes and Development Sequencing (Group D) of the County Executive’s Transit Task Force has considered the question whether it is necessary or desirable to propose that additional route segments, extensions and connections (the “Additions”) be included in the RTV system being considered by the Task Force (in addition to the original 16 route segments studied by and included in the Parsons Brinkerhoff report to MCDOT). Group D unanimously concluded that certain additions were warranted in order to make the RTV system more complete, and to create a system that would have maximum immediate and long term utility.

Accordingly, Group D recommends that the Task Force adopt the following resolution:

“Resolved, by the County Executive’s Transit Task Force that the Task Force shall (1) include the Additions identified on **Attachment 1** to this Statement in the RTV System being considered by the Task Force, and that said Additions shall form the basis of financial and other matters being studied by the Task Force and its consultants; and (2) convey to the County Executive its belief that the Additions identified on **Attachment 1** should become part of the work program of the Planning Board as it considers amendments to the County’s Master Plan of Highways to include an RTV system on roads and highways within Montgomery County, and that the Task Force requests that the County Executive communicate that recommendation to the Planning Board.”

The seven total new lines or extensions of existing lines that Group D recommends be considered as part of the system are described below.* These routes are recommended to provide robust “network connectivity” throughout the county.

1. **Connection between Corridor Cities Transitway (CCT) and Route 355 [Line 10a]:** Currently, these two routes connect only at Shady Grove. To avoid the “Red Line Syndrome” (the situation of people in the north part of the RTV system wanting to travel east/west, but needing to travel south along a V-shaped route to do so), there should be at least one east-west connection between the CCT and Route 355 toward the northern ends of those routes. An east-west connection could be made somewhere south of Route 27 (Ridge Road) and north of Muddy Branch Road, ideally in an area of relatively high population. This connecting spur can be built even if the CCT is light rail.
2. **Extension of Randolph Road [Line 14] from Georgia Avenue to FDA Boulevard/Prince George’s County Line:** Because the current master plan process may consider significant job and tax base growth in the White Oak area (anchored by the consolidation of the FDA Headquarters), the Randolph Road Route should be extended eastward from Georgia Avenue past Route 29 (where it becomes Cherry Hill Road) and continue at least to FDA Boulevard. Further, FDA Boulevard is only a short distance from the Montgomery -Prince George’s line; if Prince George’s County chose to connect to this route, it could provide a connection to the Greenbelt Metro.
3. **Spur from Route 355 [Line 10a] at Meadowbrook Road to the Corridor Cities Transitway via Observation Drive and Montgomery College-Germantown:** This spur would afford high quality transit access to the student population attending Montgomery College and be ideally located to serve the planned new Germantown Holy Cross Hospital.
4. **Short extension of Connecticut Avenue line [Line 8] south to Chevy Chase Lake Purple Line station:** This very short extension would allow connectivity to the Purple Line in both east and west directions.
5. **Extension of New Hampshire Avenue line [Line 11] from White Oak to the InterCounty Connector/Bonifant Road:** This line would connect FDA’s New Hampshire Avenue Entrance to the ICC, and to development planned in that corridor. By extending beyond the ICC to Bonifant Road, the route would connect to that commercial area and could provide for RTV turn-around.
6. **New segment: Norbeck Road (Rt. 28), connecting Rockville Pike to the InterCounty Connector:** This route would connect the central and eastern parts of the county via the ICC to central Rockville, as well as the three branches of County government.
7. **Connection between downtown Clarksburg, where Line 10a terminates, and COMSAT, where the Corridor Cities Transitway ends:** Group D suggests that regardless of whether or not the CCT is light rail or part of the RTV system, the proposed CCT line should be extended from the COMSAT station to Clarksburg. This should facilitate maximizing multi-modal ridership to and from Clarksburg with the rest of the county-wide transit system.

The route map provided by Group D represents a vision of the RTV system at full maturity. Not all routes will get the gold-standard treatment initially. Some routes will have other enhanced transit service, at least initially. Even if all these routes cannot be justified economically for the initial system, they should be included in the plan in order to provide true network connectivity.

Group D believes that Park and Planning should be given enough additional funding to study these additional lines for the Master Plan of Highways. Approximately 21 miles have been added to the original system.

Finally, Group D suggests that conversations should begin with officials in Frederick, Howard, Prince George's and Fairfax Counties, and Washington D.C., about extending the system into those jurisdictions.

*(Another line discussed, though in much less detail than the seven routes described, is a route from the Montgomery Mall to Tysons Corner Metro utilizing the I-270 HOV lanes.)

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BIOGRAPHICAL SKETCH

Justin Willits was born on St. Patrick's Day in Daytona Beach, FL. His mother worked for an attorney locally and father spent his career in county government. He spent his youth enjoying the beach and the outdoors and playing several sports while being an avid watersport enthusiast.

Justin graduated from Atlantic High School in 2001 and attended Daytona Beach Community College (now Daytona State College) where he earned his A.A. degree. In 2004, he transferred to the University of Florida to study political science. In his final semesters at UF, he developed an interest in Urban and Regional Planning which eventually lead to his applying to the University's Master in Urban and Regional Planning program in 2009. During his educational endeavors he was able to study in China and travel much of the country and the world. These experiences helped provide perspective on what issues affect different parts of the world and measures that can be taken to affect different regions and people positively.

His life experiences and education have brought him to the point where he now focuses his interests in transportation and how balanced systems of transit contribute to the quality of the environments that people live, work, and traverse on a daily basis. He now plans to embark on a career dedicated to promoting and implementing alternative transportation systems in the U.S. to accomplish goals of; traffic congestion mitigation, improvement of air quality, providing equal access to transportation systems for varying income levels, and reducing dependency on foreign energy sources as well as those that degrade the environment.

The time he spent at UF was invaluable to his understanding of the world and the issues that make his field so vital to civilization and the hopes and dreams of future generations. These include those who depend on our generation to provide them with the infrastructure and the means to carry on a way of life that can be sustained and enjoyed for many generations to come.