Sage Policy Group, Inc.

Montgomery County's RTS: Leveraging Mobility for Economic Growth

Submitted by:
Sage Policy Group, Inc.

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The Montgomery County Transit Task Force

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Executive Summary

This Sage Policy Group (Sage) report examines the economic and fiscal impacts associated with the initial development of Montgomery County's Rapid Transit System (RTS). The proposed RTS is a major countywide transit system. The initial development of the RTS will concentrate on five "corridors" which will serve major concentrations of employment and development: Phase 1 of the Corridor Cities Transitway (CCT), the Route 29 Corridor, the Route 355 South Corridor, the Route 355 North Corridor, and the Veirs Mill Road Corridor.

The fundamental question addressed by this report is how the net fiscal benefits created by the RTS compare to the costs of its construction and operation. This report focuses on the economic and fiscal impacts associated with the RTS in these specific corridors. In addition the report reviews:

- The importance and fiscal significance of commercial growth in these corridors.
- The impact of the RTS on the County's competitiveness in the Washington region, particularly with respect to Northern Virginia.
- Other economic benefits and metrics relevant to the creation of the RTS.

To assess development potential that might be supported by the RTS, master plans for areas served by the RTS five corridors. Most, but not all, plans included quantified estimates of future development, totaling over 81,000 dwelling units, and 83 million square feet of commercial space associated with over 240,000 jobs as shown in Exhibit ES-1.

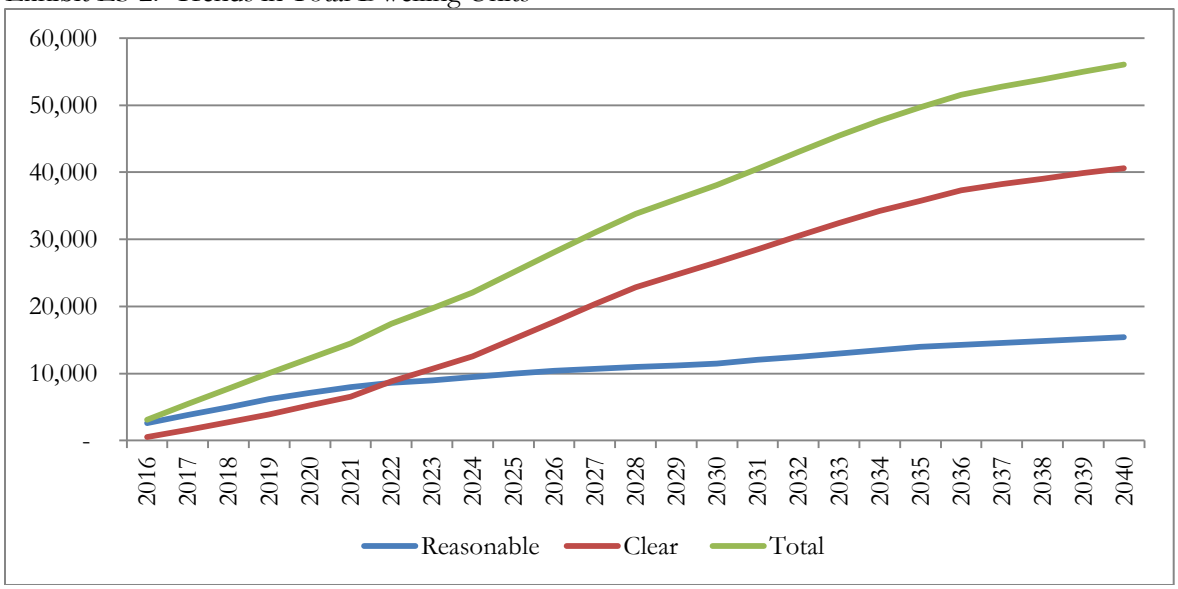
Exhibit ES-1. Total Development Potential

Master Plans	*Dwelling Units*	*Commercial Space (millions of SF)*	*Jobs*
White Oak Science Gateway (formerly the East County Science Center)	8,570	13.4	39,144
Burtonsville Commercial Crossroads Neighborhood Plan	600	1.4	4,200
Bethesda Downtown Plan	3,787	4.5	13,600
White Flint Sector Plan (North Bethesda's Urban Center)	9,800	5.7	17,143
White Flint 2 Sector Plan	1,860	6.3	18,947
Twinbrook Sector Plan	1,000-3,077	4.9	14,737
Shady Grove Sector Plan	12,420	3.3	11,220
Germantown Master Plan	9,941	12.8	38,496
Clarksburg Master Plan & Hyattstown Special Study Area	14,930	9.5	20,000
City of Rockville	8,813	10.6	32,000
Great Seneca Science Corridor Master Plan	5,918	9.0	28,556
Wheaton CBD and vicinity sector plan	4,012	1.0	2,990
Totals	81,651-83,728	82.9	241,033

Sage reviewed this development potential to define what portion of development was clearly or reasonably tied to the RTS. In a few plans, requirements for mass transit were explicit. In others, the links between more mass transit were discussed and the centrality of transit to future development was evident. Based on these plans, roughly half the total housing potential was considered clearly tied and another 20 percent was considered reasonably tied to RTS. Similarly, 40 and 25 percent of commercial space are classified as clearly and reasonably linked to RTS, respectively.

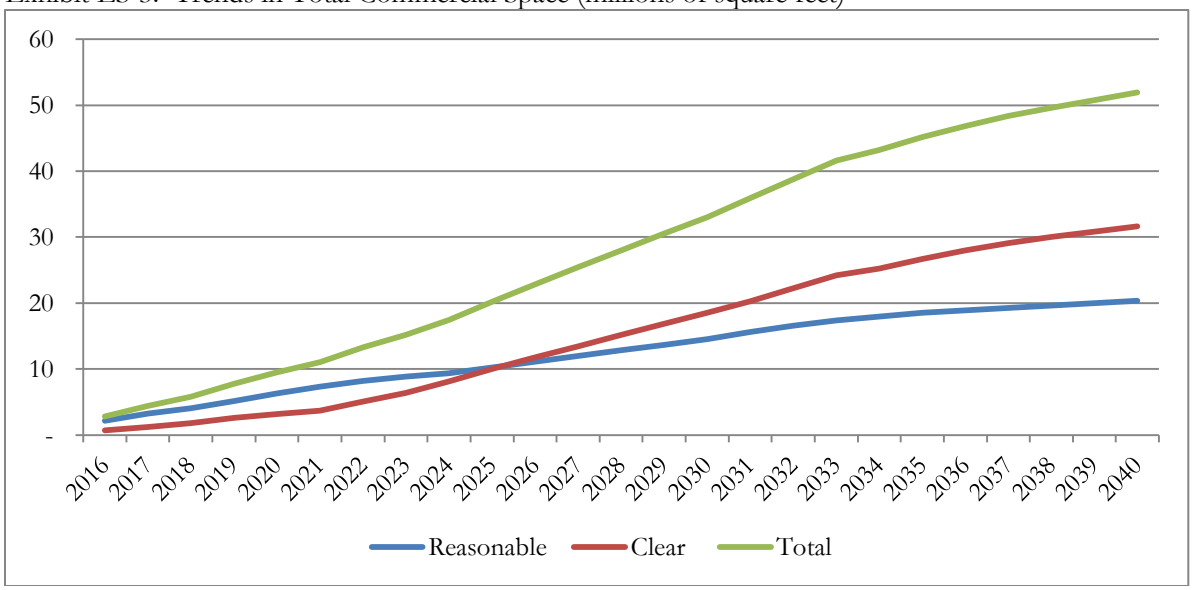
Almost all this development is projected to occur over the next 25 years. Exhibits ES-2 and ES-3 plot the estimated schedules for housing and commercial development. This future development appears to level off in the 2030s. This date, however, marks the end of current efforts to plan for future development, rather than a forecast that new development will stop at that point in time.

Exhibit ES-2. Trends in Total Dwelling Units



Sources. Montgomery County Planning, City of Rockville, Sage

Exhibit ES-3. Trends in Total Commercial Space (millions of square feet)



Sources. Montgomery County Planning, City of Rockville, Sage

The scale of development is substantial. The addition of over 56,000 housing units represents a 15 percent increase over the current housing inventory. Adding 52 million square feet of commercial space will result in 145,000 net new jobs, a 27 percent increase in the County's employment base. While significant, this projected increase in employment is not unprecedented. In the past 25 years, a period that included the Great Recession, one of worst periods of employment growth on record, the County's employment base increased

by roughly one-third. In the 25 years before the Great Recession (i.e. 1980–2005), the number of County-based jobs increased 82 percent.

These increases in County housing and commercial space will give rise to substantial economic benefit for the County. As shown in Exhibit ES-4, the value of all this new development, were it built now, would be worth over $45 billion.

Exhibit ES-4. Value of RTS-linked housing and commercial space (2016 dollars)

	Cumulative Number in 2040	*Unit Value*	*Total Value (millions)*	
Dwelling Units: Reasonable	15,415	$497,040	$7,662	
Dwelling Units: Clear	40,634	$501,601	$20,382	
Sub-total	56,049			$28,044
Commercial Space: Reasonable	20.3 (M SF)	$341.5	$6,937	
Commercial Space: Clear	31.6 (M SF)	$341.5	$10,803	
Sub-total	51.9 (M SF)			$17,740
Total				$45,784

The broadest measure of economic activity in Montgomery County is gross county product (GCP), the total value added by all compensation, overhead, return on capital, profit, and related multiplier effects. An important concept underlying GCP is the multiplier effect, the consequences of spending and re-spending monies in the County economy. In 2016, each county job will create over $173,000 in GCP. As summarized in Exhibit 14, the over 144,000 jobs projected from RTS-linked development would create a $25 billion increase in GCP if they were in place in 2016. Because GCP per job is expected to increase in real terms by more than 1 percent annually, this $25 billion estimate underestimates the addition to GCP made by these new jobs as they are created over the next 25 years.

Exhibit ES-5. Value of RTS-linked Montgomery County Gross Product (2016 dollars)

	Cumulative Number in 2040	*Unit Value*	*Total Value (millions)*
Jobs, reasonable	59,335	$173,605	$10,301
Jobs, clear	85,198	$173,605	$14,791
Total	144,534		$25,092

The RTS is a major investment. The expected capital cost is $2.2 billion with annual operating costs exceeding $63 million once the five corridors are fully operational. See Exhibit ES-6.

Exhibit ES-6. Capital and Operating Costs of the Initial Phase of the RTS (millions of 2016 dollars)

Year	*CCT*	*Maintenance Facility*	*Veirs Mill Road*	*MD 355 South*	*US 29*	*MD 355 North*	*Total*
Capital costs							
FY16	57.6		11.1	2.5	2.0	2.5	75.7
FY17	66.9	10.3	19.4	6.2	8.8	3.0	114.6
FY18	170.0	4.9	13.9	17.4	8.8	3.5	218.5
FY19	170.0	5.7	18.1	32.4	5.1	3.5	234.8
FY20	170.0	27.4	106.9	25.8	14.0	22.9	367.0
FY21		27.4	106.9	26.4	80.7	63.2	304.6
FY22				156.1	80.7	54.3	291.1
FY23				156.1		36.4	192.5
FY24						215.1	215.1
FY25						215.1	215.1

Total	634.5	75.6	276.3	422.8	200.0	619.6	2,229.0
Annual operating costs							
Varies	11.8		8.1	11.0	14.7	17.8	63.4

While the RTS is a major investment, the new households and jobs that will be created in areas served by the RTS (and which are clearly or reasonably dependent on the RTS) will generate substantial new streams of County tax revenue. Construction of this new development will also create new County tax streams. Another fiscal benefit will be increased property values in the vicinity of RTS stations, which in turn will lead to increased property tax revenue from existing property.

These new revenues can be compared to the cost of public services the County will provide, everything from public safety to public schools, and to the cost of the RTS itself. Exhibit ES-7 presents estimates for all these benefits and costs. When both County services and the RTS are paid for, the County still realizes a net fiscal benefit from the RTS.

Exhibit ES-7. Net Present Value of Fiscal Impacts on Montgomery County (NPV 2016–2040)

Fiscal Impacts	*Impacts Related to New Households*	*Impacts Related to New Jobs*	*Total*
Property-related, income tax revenues	$4,776	$2,482	$7,259
Impacts fees	$456	$172	$628
Fiscal benefits of construction, increased property value			$925
Total County revenue	$5,233	$2,654	$8,812
Costs of County services	$4,548	$1,358	$5,906
Net County revenue after costs of services	$685	$1,296	$2,906
Cost of RTS			$2,034
Remaining County benefit after costs of RTS			$871

Any analysis trying to project development over a quarter century is subject to many uncertainties. Nevertheless, the conclusion that the RTS is an affordable and desirable investment for the County (and the State) appears sound. Even if projections for future development are substantially optimistic, the finances still work. Moreover, there appear to be several major opportunities for either more development to occur than is anticipated by existing plans or for the County to serve that growth more cost-effectively because of denser development and a likely diminished demand for public schools associated with RTS-linked households.

Montgomery County faces a problem that many jurisdictions would love to face—the prospect of a major influx of new jobs that will place severe pressures on already congested roadways. The mobility provided by the RTS may well be the key to meeting this challenge.

1.0 Introduction

This Sage Policy Group (Sage) report examines the economic and fiscal impacts associated with the initial development of Montgomery County's Rapid Transit System (RTS). The fundamental question addressed by this report is how the net fiscal benefits created by the RTS compare to the costs of its construction and operation.

The proposed RTS is a major countywide transit system. The initial development of the RTS will concentrate on five "corridors" which will serve major concentrations of employment and development: Phase 1 of the Corridor Cities Transitway (CCT), the Route 29 Corridor, the Route 355 South Corridor, the Route 355 North Corridor, and the Veirs Mill Road Corridor. This report focuses on the economic and fiscal impacts associated with the RTS in these specific corridors.

In addition the report reviews:

- The importance and fiscal significance of commercial growth in these corridors.
- The impact of the RTS on the County's competitiveness in the Washington region, particularly with respect to Northern Virginia.
- Other economic benefits and metrics relevant to the creation of the RTS.

1.1 Mobility as the key to economic development

As Sage has noted in earlier studies of mass transit in Montgomery County, over the next quarter century, the County will face a problem many local governments would love to have—the estimated increase of more than 180,000 jobs, a 34 percent increase in employment. This increase is impressive, but not unprecedented. Over the past 25 years, Montgomery County employment has increased 32 percent despite the fact that the Great Recession reduced the job growth in the County to the lowest level since at least 1970. From 1980 to 2005, a period predating the Great Recession, County-based employment increased 82 percent.[1]

Of course, this expected increase in employment represents estimated, not guaranteed, job growth. Nevertheless, one could reasonably ask whether a county that is already heavily gridlocked has the wherewithal to absorb a major increase in net new jobs. The Washington, DC region has been ranked among the most congested metropolitan areas for years. Thus, it strains credulity to assume the County could accommodate the forecasted jobs, associated housing, and commercial development without a substantial upgrade in transit capacity.

The connection between transportation/mobility and economic development has been part of the regional conversation for many years. A 2010 report by George Mason University's Center for Regional Analysis (CRA) stressed the need for more transit capacity to accommodate the roughly 1 million net new jobs expected in the Washington region between 2010 and 2030, as well as the housing demands this employment growth would create. This need was not considered optional. Indeed in the absence of mobility solutions, the CRA assessment concluded that jobs would not be created and economic development would occur

[1] Average annual County-based job growth over 25-year periods has averaged from just over 1 percent to well over 2 percent according to data from the Bureau of Economic Analysis. As noted in the table below, the expected growth in employment between 2015 and 2040 is at the low end of the range of recent historic experience.

Historic and projected employment in Montgomery County	**1980-2005**	**1985-2010**	**1990-2015**	**2015-2040**
Job growth per 25-year period (thousands)	287.1	210.4	163.9	183.1
Total percentage increase	82%	41%	32%	34%
Compound annual growth rate	2.43%	1.59%	1.12%	1.19%

Source. Bureau of Economic Analysis, "CA25 Total Full-Time and Part-Time Employment by SIC Industry"

elsewhere.[2] A January 2015 presentation by CRA on the economic drivers for the Washington area identified seven high-value added targets of opportunity including three that are directly tied to the County and the RTS: 1) developing the area as a global medical complex; 2) implementing the White Oak Science Gateway Plan; 3) and capitalizing on federal labs and research centers including NIH/FDA/Biotech. One of the requirements for realizing these potentials was investment in local infrastructure, including transit, to strengthen the region's competitiveness.[3]

Master plans in the County have also recognized the need for transit and the RTS specifically. As will be discussed later in this report, a substantial share of approved development in the County is explicitly contingent on the presence of the RTS or on specific and marked increases in mobility that is not based on private vehicles. For those master plans without these specific and quantified transit-based criteria, there is with rare exception a clear reliance on the RTS or transit to enable commercial and residential development.

1.2 The nature of anticipated development

Montgomery County is consistently ranked among the most affluent jurisdictions in the country. It is also the site of some of the country's most significant research and development institutions, including the National Institutes of Health, the National Institute for Science and Technology, the Food and Drug Administration, Bethesda Naval Hospital, major universities, and international corporations. Future employment in the County will be driven in large part by these large research agencies and the private companies that work in concert with them.

As baby boomers age in the County and leave the workforce, many will stay in their homes or relocate within the County. New housing then is not only geared toward workers in high-tech and bioscience agencies and industries, but also to empty-nesters eager to remain in the County.

Much of the new development is likely to be of relatively high value consistent with the professional nature of many of the new employment opportunities and the well compensated workers who will realize those opportunities. Downsizing empty nesters are also likely to create markets for high amenity housing.

1.3 Earlier work related to the impacts of the RTS

This report follows three other reports by Sage that bear directly on the questions this assessment asks. In 2008, Sage conducted research on the economic impacts of the Life Sciences Center (LSC), a major biotech, health care, and academic hub that is one of the major beneficiaries of Phase 1 of the CCT. Four years later, in 2012, Sage undertook an extensive analysis of the proposed countywide rapid transit vehicle (RTV) project, including the CCT. That study assessed the need for mass transit to maintain mobility within Montgomery County while also looking at how economic growth brought about rapid employment growth and subsequent demands for increases in housing stock and commercial development. The study also assessed the potential for mass transit, in and of itself, to generate economic benefits in areas surrounding transit stations. In 2015, Sage evaluated the economic and fiscal benefits of Phase 1 of the CCT. This study updated the findings of earlier work, particularly the impacts related to the LSC, and also identified other development potential that will be supported by Phase 1 of the CCT.

[2] Stephen S. Fuller, "The Future of the Washington Metropolitan Area Economy: Alternative Growth Scenarios and Their Regional Implications," Center for Regional Analysis, George Mason University, April 2010.
[3] Stephen S. Fuller, "What will drive growth in the Washington area going forward?" Center for Regional Analysis, George Mason University, January 15, 2015

1.4 Limitations and uncertainties

Much of the analysis for this report involves interpreting county Master Plans and other documents. Four key questions apply to these materials: (1) what volume of development is anticipated by these plans, (2) how is the RTS related to this potential development, (3) when will the development occur, and (4) what value should be placed on this development.

Some, but not all, planning documents provide data on the volume of development and its relationship to the availability to transit. For those that do not provide specific quantification of commercial and residential development, Sage has no basis for estimating potential development. For example, several plans discuss rezoning land without quantifying the development implications of rezoning. In cases where planning documents do not quantify potential development, Sage does not attempt to provide estimates of the development potential. For those plans that do not specifically link anticipated development and the RTS, Sage reviewed the density of proposed development, proximity of RTS stations, and other factors to estimate the dependence of development on the RTS.

Most planning documents indicate a time frame, typically 20 years. In some cases, longer time periods for development are identified. When development will occur within these periods of 20 years or more is not specified in plans. Alternative sources provided some guidance for some planning areas.

Plans do not place values on housing or commercial space that is anticipated nor on the jobs that will be created in the commercial space. Data used in earlier Sage studies provide some answers, as do Census and other standard data sources. Additionally, individuals in the development community in the County have provided additional insights.

The upshot of these limits and uncertainties is a number of known unknowns. Some likely development potential is not captured, most obviously in planning areas where development potential is not quantified. The ties between the RTS and potential development are necessarily often matters of professional judgment. The timing and value of development, critical to economic and fiscal impacts, are subject to future market forces. In light of these uncertainties and limits, there is a deliberate attempt to be conservative about the benefits that the RTS will bring to the County.

2.0 The RTS System

The entire proposed RTS is a roughly 150-mile bus rapid transit (BRT) system that will provide mass transit throughout Montgomery County as shown in Exhibit 1. The RTS is both an extension of and complement to existing transit, particularly Metrorail, and to proposed transit such as the Purple Line.

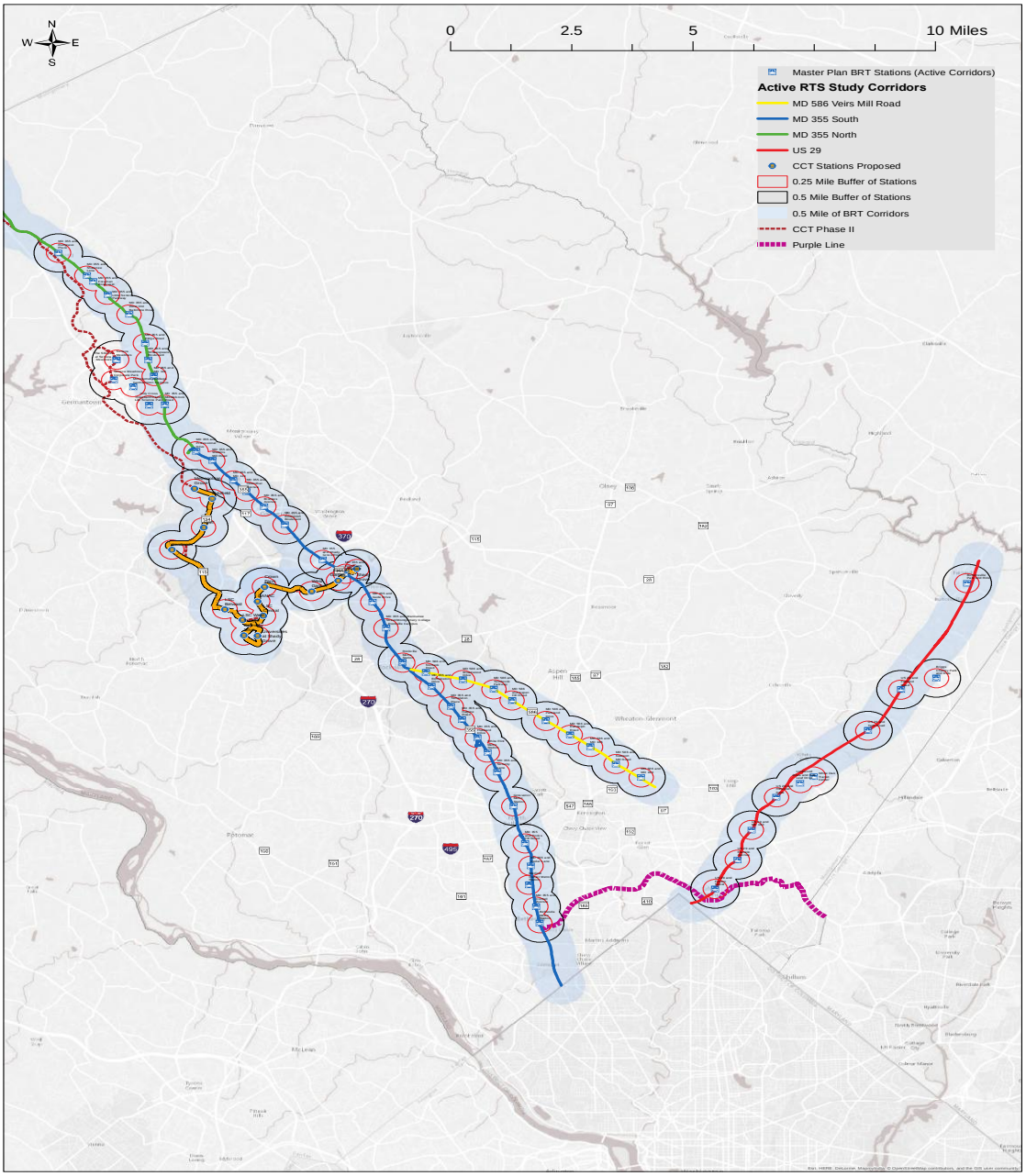
BRT has sometimes been characterized as a "light rail on rubber tires." The system uses articulated buses and frequently relies on dedicated rights-of-way lanes to provide rapid and efficient transportation. Because the system uses buses and paved roadways, the expenses of laying down rail lines, constructing overhead power systems, and purchasing rail cars are avoided.

Exhibit 1. The Proposed RTS System

Construction of the RTS will occur in phases. The initial phase is a roughly 50-mile segment comprising the MD Route 355 corridors, the Route 29 corridor, Phase 1 of the CCT, and the Veirs Mill Road corridor. These corridors serve most of the major economic anchor institutions of the County including the National Institutes of Health, the Food and Drug Administration, the Life Science Center, the National Institute for Science and Technology, many major private employers, and the principle urbanized communities within the County.

A major feature of the RTS is that stations placed no more than a mile apart. These stations function like Metrorail stations, providing pre-boarding ticketing and platforms allowing direct access to RTS vehicles. Exhibit 2 provides a preliminary mapping of stations along the corridors examined for this analysis.

Exhibit 2. Initial Phase of Development for the RTS



Active RTS/BRT Corridors in Montgomery County
1/2 and 1/4 Mile Buffered Station Analysis

The current estimated cost of the initial phase of the RTS is $2.2 billion. This cost includes five corridors as shown in Exhibit 3 and a maintenance facility for the entire system. Construction activities are expected to begin in FY16 with the CCT being the most likely first corridor for construction. Construction activities

would continue through FY25 with the completion of the Maryland Route 355 North corridor. Estimated annual operating costs for each corridor are also listed in Exhibit 3. These are total operating costs and do not reflect the impact of fare box collections.

Exhibit 3. Capital and Operating Costs of the Initial Phase of the RTS (millions of 2016 dollars)

Year	*CCT*	*Maintenance Facility*	*Veirs Mill Road*	*MD 355 South*	*US 29*	*MD 355 North*	*Total*
Capital costs							
FY16	57.6		11.1	2.5	2.0	2.5	75.7
FY17	66.9	10.3	19.4	6.2	8.8	3.0	114.6
FY18	170.0	4.9	13.9	17.4	8.8	3.5	218.5
FY19	170.0	5.7	18.1	32.4	5.1	3.5	234.8
FY20	170.0	27.4	106.9	25.8	14.0	22.9	367.0
FY21		27.4	106.9	26.4	80.7	63.2	304.6
FY22				156.1	80.7	54.3	291.1
FY23				156.1		36.4	192.5
FY24						215.1	215.1
FY25						215.1	215.1
Total	634.5	75.6	276.3	422.8	200.0	619.6	2,229.0
Annual operating costs							
Varies	11.8		8.1	11.0	14.7	17.8	63.4

Source: Public Financial Management, Inc.

3.0 Master Plans Related to the Initial RTS Corridors and Development Potential

Within Montgomery County, there are dozens of planning areas with documented plans, covering the entire county. In estimating the development potential linked to the RTS and the corridors of interest, a substantial number of these plans were reviewed. Exhibit 4 lists these planning documents, indicating when they were approved and which corridor or corridors serve the planning areas. In some cases (Bethesda downtown, White Flint 2, City of Rockville), planning is in process and the documents are in draft form or the County has not formally approved them.

Exhibit 4. RTS Corridors and Montgomery County Planning

Master Plans	*Date Approved, Amended*	*RTS Corridor*
Silver Spring CBD Sector Plan	March 2001	US 29
Four Corners	November 1996	US 29 and Veirs Mills
White Oak Science Gateway	July 2014	US 29
Burtonsville Commercial Crossroads Neighborhood Plan	December 2012	US 29
Bethesda Downtown Plan	May 2015 (draft)	MD 355 South
White Flint Sector Plan	April 2010	MD 355 South
White Flint 2 Sector Plan	In process, due 2017	MD 355 South
Twinbrook Sector Plan	January 2009	MD 355 South
Shady Grove Sector Plan	January 2006	MD 355 South
Gaithersburg Vicinity Master Plan	1990	MD 355 South
Germantown Master Plan	October 2009	MD 355 North
Clarksburg Master Plan & Hyattstown Special Study Area	1994, Amendment July 2011	MD 355 North
City of Rockville	Transportation Scan, June 2015	MD 355 South
City of Gaithersburg	2011	CCT
Great Seneca Science Corridor Master Plan	May 2010	CCT
Wheaton CBD and vicinity sector plan	January 2012	Veirs Mills
Sources. Montgomery County Planning, City of Gaithersburg, City of Rockville		

3.1 Quantifying the volume of future development

Most of these plans attempt to quantify the development potential within their planning boundaries in terms of dwelling units, commercial space, and/or employment. Generally these development potentials are defined within the 20-year period typically encompassed by plans. A few plans (e.g., White Flint, Clarksburg) either indicate that the quantified development may occur over a period of more than 20 years or do not stipulate a timeline for reaching the quantified development potential.

Exhibit 5 summarizes the total development potential described in each of these planning documents. As shown some documents do not quantify development potential. All of the plans that quantify development potential provide some estimate of residential development in terms of dwelling units. Commercial development is described either in terms of square feet of commercial space or jobs. In a few cases plans include estimates of both commercial square footage and employment. These plans agree on a basic relationship of about 3,000 jobs per million square feet of commercial space. For those plans providing only employment estimates, the ratio of jobs to commercial square footage has been used to estimate the commercial space included in the plans' development potential.

Exhibit 5 quantifies the development potential for all plans served by the initially developed RTS corridors. In total, for the plans that provide quantitative data, forecasts anticipate over 80,000 dwelling units and almost 83 million square feet of commercial space. Estimated employment in this commercial space exceeds 240,000. White Oak, White Flint, Shady Grove, Clarksburg, and Rockville each account for 10 percent or more of the residential development. Major concentrations of commercial development are proposed in plans for White Oak, Germantown, Clarksburg, Rockville, and Great Seneca.

Exhibit 5. Total Development Potential

Master Plans	*Dwelling Units*	*Commercial Space (millions of SF)*	*Jobs*
Silver Spring CBD Sector Plan	Not quantified		
Four Corners	Not quantified		
White Oak Science Gateway	8,570	13.4	39,144
Burtonsville Commercial Crossroads Neighborhood Plan	600	1.4	4,200
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Clarksburg Master Plan & Hyattstown Special Study Area	14,930	9.5	20,000
City of Rockville (1)	8,813	10.6	32,000
City of Gaithersburg	Not quantified		
Great Seneca Science Corridor Master Plan	5,918	9.0	28,556
Wheaton CBD and vicinity sector plan (1)	4,012	1.0	2,990
Totals	81,651–83,728	82.9	241,033

Notes. (1) Commercial space estimated on the basis of jobs quantified in plan. Ratio of space to jobs estimated from data in White Oak, Burtonsville, and Shady Grove plans that quantified both commercial space and jobs.
(2) Jobs estimated on the basis of commercial space quantified in plan. Ratio of space to jobs estimated from data in White Oak, Burtonsville, and Shady Grove plans that quantified both commercial space and jobs.
Sources. Montgomery County Planning, City of Gaithersburg, City of Rockville

These are ambitious plans. The Metropolitan Washington Council of Governments regularly forecasts growth in population, households, and employment for the region's jurisdictions. The most recent forecast estimates that Montgomery County will experience an increase of almost 83,000 households and 183,000 jobs between 2015 and 2040.[4] That 25-year time period overlaps imprecisely with the time frames for the plans summarized in Exhibit 5. Nevertheless, the planning areas served by the initial phase of the RTS clearly encompass the areas of the County most likely to experience significant development in the next 20 to 25 years. This is entirely consistent with the fact that, with the exception of the US Route 29 corridor, the initial stage of RTS development will focus on the I-270 corridor, which accounts for the great majority of expected growth in the County both in terms of employment and population.

A substantial proportion of the development potential quantified in Exhibit 5 can be tied to the development of the RTS. In some cases, plans specifically indicate that development cannot occur without the provision of transit. In other cases, the presence of the RTS can be reasonably assumed to enhance and support

[4] Washington Metropolitan Council of Governments, "Summary of Intermediate Employment Forecasts, Washington COG Final Round 8.3 Summary Tables " http://www.mwcog.org/publications/

development that might not otherwise occur. These linkages between the RTS development can also be seen as dependent of the development of the existence of the RTS. While it is not possible to determine what development would occur in the absence of the RTS, it is quite clear or reasonably clear that much of the development potential that is served by the proposed RTS could not be realized without the expansion of mass transit capacity that the RTS represents. These ties are important because they present the opportunity to assess the economic and fiscal benefits associated with the RTS-dependent development. These benefits can in turn be compared to the costs of developing and operating the RTS.

Exhibit 6 summarizes the development that is either clearly or reasonably linked to the RTS. In total the clearly linked development encompasses over 41,000 dwelling units and 32 million square feet of commercial space. This amounts to roughly half of the dwelling units and 40 percent of the commercial space quantified in the master plans. Another almost 17,000 dwelling units and 22 million square feet of commercial space are reasonably dependent upon the existence of the RTS. This potential, which is reasonably tied to the RTS, constitutes over 20 percent of the residential development and over 25 percent of the commercial development quantified in the plans.

- White Oak Science Gateway. Although planning documents do not specify a link between development and the RTS, the absence of transit alternatives and existing congestion clearly indicate a need for transit to enable and support intensive development and redevelopment described in the plans. The development associated with the LifeSci Village is categorized as being clearly linked to the RTS while other development along US Route 29 is considered reasonably linked to the RTS.
- Bethesda Downtown. Planning materials do not specify a link between development and the RTS. Given current densities, it is assumed that all development is reasonably tied to the development of the RTS.
- White Flint Sector. The plan specifies three phases of development and increasingly stringent targets for non-auto-based travel within the sector. The first phase of development is considered reasonably tied to the RTS while the second and third phases are even more clearly linked to the RTS.
- White Flint 2 Sector. The plan does not provide specific links to the RTS. One third of development potential is considered clearly tied to the RTS while another third is considered reasonably tied to the RTS.
- Shady Grove Sector. The plan includes requirements for Traffic Mitigation Agreements for most of the anticipated development. These agreements are to result in 50 percent mitigation for residential-related trips and 65 percent mitigation for non-residential-related trips. All development is considered clearly linked to RTS.
- Germantown. The plan emphasizes clustering the highest density development around transit stations. All residential development and a substantial share of commercial development are considered clearly tied to the RTS.
- Clarksburg. One area within the planning district is clearly identified as transit oriented development.
- Rockville. Transit is part of the current planning process and half of the development is considered reasonably tied to the RCS.
- Great Seneca Science. The plan is explicit about development of the Life Science Center and the CCT. Other development along the CCT right-of-way is considered reasonably tied to the development of the CCT.

Exhibit 6. Development Potential Clearly or Reasonably Linked to the RTS System

Master Plans	*Clearly linked to RTS*		*Reasonably linked to RTS*	
	Dwelling Units	*Commercial Space (millions of SF)*	*Dwelling Units*	*Commercial Space (millions of SF)*
White Oak Science Gateway	5,360	7.0	2,353	5.1
Bethesda Downtown Plan (1)			3,787	4.5
White Flint Sector Plan (2)	6,800	3.7	3,000	2.0
White Flint 2 Sector Plan (2)	620	2.1	620	2.1
Shady Grove Sector Plan	12,420	3.3		
Germantown Master Plan (2)	9,941	5.6		
Clarksburg Master Plan & Hyattstown Special Study Area	2,790	4.3		
City of Rockville (1)			4,406	5.3
Great Seneca Science Corridor Master Plan	3,200	6.4	2,718	3.1
Totals	41,131	32.3	16,884	22.1

Sources. Montgomery County Planning, City of Gaithersburg, City of Rockville

Over a quarter of the residential development and roughly one third of the commercial space identified in these master plans either cannot be clearly or reasonably tied to the RTS or does not appear to have any dependence whatsoever on that system. The development potential with an unknown relationship to the RTS is summarized in Exhibit 7.

- White Oak Science Gateway. A significant proportion of the development potential identified is not proximate to the US Route 29 corridor; however, it will be served by the proposed New Hampshire Avenue corridor of the RTS.
- Burtonsville. This plan appears to have identified relatively modest development potential. While the US Route 29 corridor will include a station in Burtonsville, there is no indication in the plan that development is linked to this station.
- White Flint 2. Some proportion of potential development (estimated at one third) may be sufficiently distant from RTS stations not to be necessarily dependent upon this transit option.
- Twinbrook. It was unclear whether stations associated with either the MD Route 355 or Veirs Mills Road corridors would be close enough to future development in the Twinbrook planning area to justify a linkage to the RTS.
- Germantown. It is unclear whether a significant share of the commercial development anticipated in the Germantown plan is proximate to or likely to be dependent upon the RTS.
- Clarksburg. Most of the development described in the Clarksburg plan is outside of the area within the plan that is clearly designated for transit-oriented development.
- Rockville. The ties between future development of Rockville and the RTS are not articulated. It is therefore assumed that half of the development cannot be clearly or reasonably tied to this transit.
- Wheaton. While the area would be served by the Veirs Mills Road corridor, the plan does not provide a strong basis for linking anticipated development with the RTS.

Exhibit 7. Development Potential with an Unknown Link to the RTS

Master Plans	*Dwelling Units*	*Commercial Space (millions of SF)*	*Jobs*
White Oak Science Gateway	857	1.3	3,914
Burtonsville Commercial Crossroads Neighborhood Plan	600	1.4	4,200
White Flint 2 Sector Plan (2)	620	2.1	6,316
Twinbrook Sector Plan (2)	1000-3,077	4.9	14,737
Germantown Master Plan (2)		7.2	21,799
Clarksburg Master Plan & Hyattstown Special Study Area	12,140	5.2	15,639
City of Rockville (1)	4,406	5.3	16,000
Wheaton CBD and vicinity sector plan (1)	4,012	1.0	2,990
Totals	23,635-25,712	28.5	85,595

Notes. (1) Commercial space estimated on the basis of jobs quantified in plan. Ratio of space to jobs estimated from data in White Oak, Burtonsville, and Shady Grove plans that quantified both commercial space and jobs.
(2) Jobs estimated on the basis of commercial space quantified in plan. Ratio of space to jobs estimated from data in White Oak, Burtonsville, and Shady Grove plans that quantified both commercial space and jobs.
Sources. Montgomery County Planning, City of Rockville

Most plans are assumed to unroll over a period of 20 years. Three are assumed to take longer. White Flint and Rockville are projected to take 30 years. Great Seneca Science Corridor is assumed to take 25 years. In the absence of more specific information development was assumed to occur at a steady pace over whatever period of time applied to a given plan. In addition, development that is reasonably linked to the RTS is assumed to occur before the development that is deemed to be clearly tied to the RTS, as shown in Exhibit 8.

Exhibit 8. Estimated Scheduling and Annual Rates of Development Potential Reasonably Linked to the RTS

Master Plans	*Dwelling Units*	*Timing*	*Commercial Space (millions of SF)*	*Timing*
White Oak Science Gateway	429	2017-2022	0.3	2017-2033
Bethesda Downtown Plan (1)	189	2016-2035	0.2	2016-2035
White Flint Sector Plan (2)	327	2011-2020	0.22	2011-2021
White Flint 2 Sector Plan (2)	93	2024-2031	0.32	2025-2031
City of Rockville (1)	294	2031-2045	0.35	2031-2045
Great Seneca Science Corridor Master Plan	237	2015-2026	0.38	2015-2023

Sources: Montgomery County Planning, City of Rockville, Sage

Exhibit 9 summarizes the scheduling and annual rate of development that is most clearly tied to the RTS. For this development, there are two exceptions to the general assumption on the timing and pace of development. In the case of development associated with the Life Science Center along the CCT right-of-way, Sage developed a detailed annual estimate of the commercial potential of the LSC based in large part on work done by Parsons Brinckerhoff.[5] The development schedule for the LifeSci Village was based on information from the developer.[6]

Exhibit 9. Estimated Scheduling of Development Potential Clearly Linked to the RTS

Master Plans	*Dwelling Units*	*Timing*	*Commercial Space (millions of SF)*	*Timing*

[5] Sage Policy Group, Inc., "The CCT as Economic Development Catalyst," April 2015; Parsons Brinckerhoff, "Corridor Cities Transitway Project Economic and Tax Impact Analysis," October 2011
[6] Personal communication from Jonathan Genn, Percontee, Inc. to John Duberg, Sage Policy Group, August 11, 2015

White Oak Science Gateway	429	2022-2034	0.4	2022-2041
White Flint Sector Plan (2)	327	2020-2040	0.2	2022-2041
White Flint 2 Sector Plan (2)	93	2031-2037	0.3	2031-2038
Shady Grove Sector Plan	621	2017-2036	0.2	2017-2036
Germantown Master Plan (2)	497	2022-2040	0.3	2022-2041
Clarksburg Master Plan & Hyattstown Special Study Area	747	2025-2028	0.5	2025-2033
Great Seneca Science Corridor Master Plan	237	2026-2040	0.3	2014-2035

Sources. Montgomery County Planning, City of Gaithersburg, City of Rockville, Sage

Exhibit 10 summarizes all the potential development that is reasonably or clearly linked to the RTS. This table presents data at five-year intervals; a year-by-year listing of this information is presented in the Appendix to this report (see Exhibit A-10).

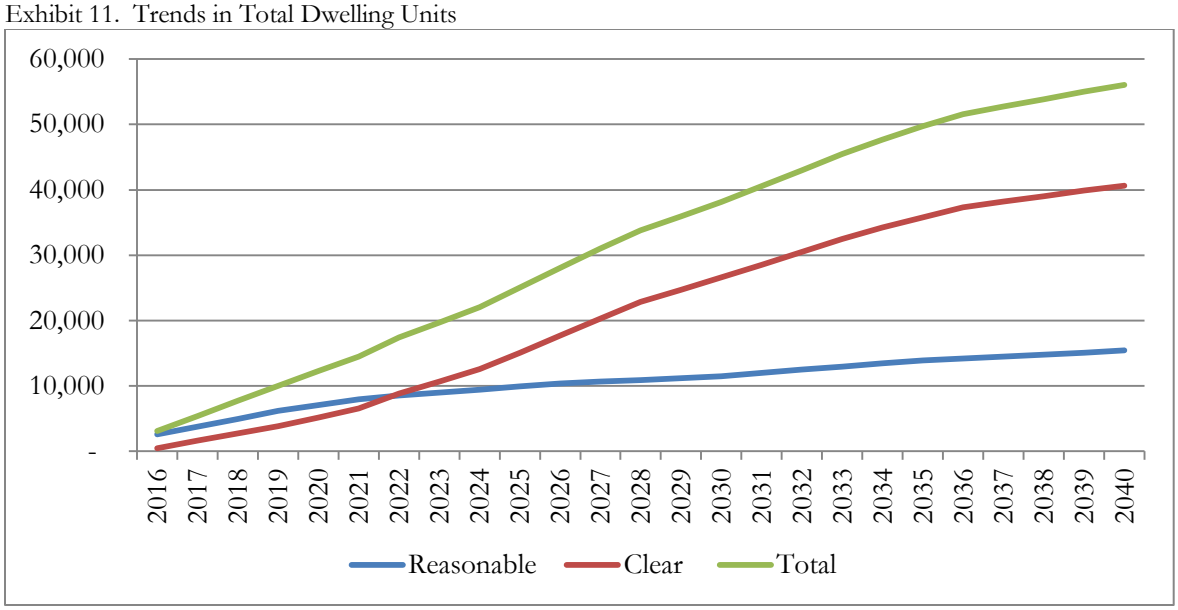
Exhibit 10. Cumulative Total Dwelling Units and Commercial Space, Selected Years

Year	*Cumulative Total Dwelling Units*			*Cumulative Total Commercial Space (M of SF)*		
	Reasonable Link to RTS	*Clearly Linked to RTS*	*Total*	*Reasonable Link to RTS*	*Clearly Linked to RTS*	*Total*
2016	2,623	500	3,123	2.1	0.7	2.8
2020	7,081	5,211	12,292	6.3	3.2	9.5
2025	9,974	15,087	25,061	10.2	10.0	20.2
2030	11,500	26,607	38,107	14.5	18.5	33.0
2035	13,947	35,768	49,715	18.5	26.7	45.2
2040	15,415	40,634	56,049	20.3	31.6	51.9

Sources. Montgomery County Planning, City of Rockville, Sage

Trends for the development of total dwelling units are presented in Exhibit 11. As shown the cumulative levels of development flatten out in the mid-to-late 2030s. This is a direct result of the time horizons of the master plans and other documents reviewed for this analysis. These plans tend to address 20-year periods; thus, even those in draft form now are unlikely to project growth past the mid-to-late 2030s. This by no means should be taken as a limit on subsequent growth. Indeed, based on evidence of growth along other mass transit corridors in the Washington area, the presence of the RTS can be reasonably expected to spur growth and development for many decades.

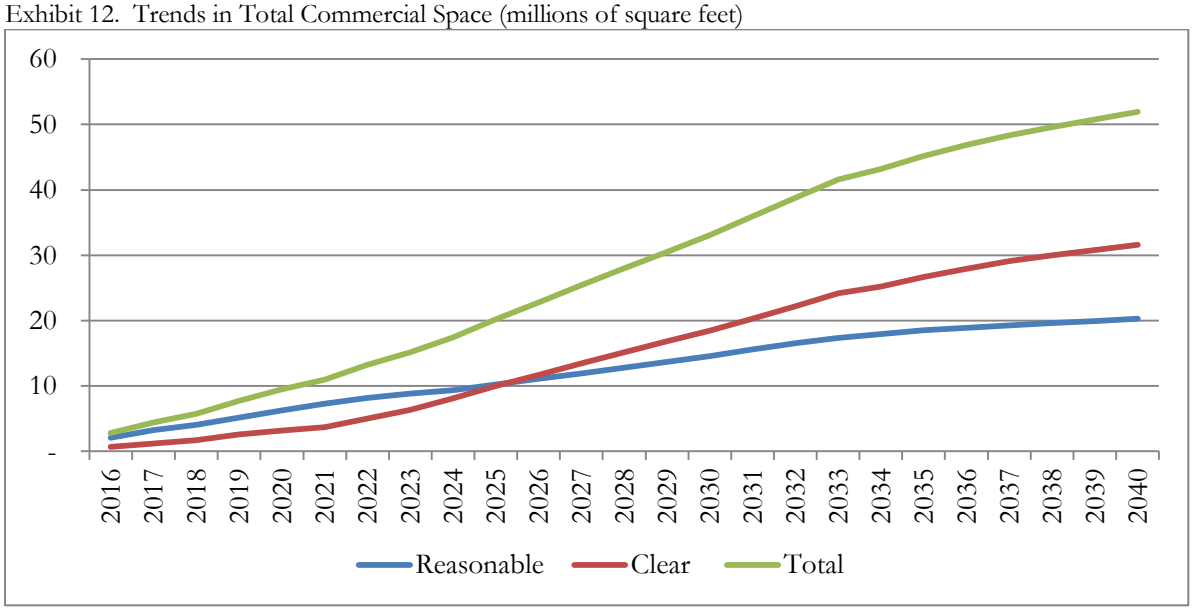
Exhibit 11. Trends in Total Dwelling Units



Sources: Montgomery County Planning, City of Rockville, Sage

Exhibit 12 graphs trends in commercial space development in the planning documents reviewed for this analysis. As is the case in housing development, future commercial development appears to level off in the 2030s. This date, however, marks the end of current efforts to plan for future development, rather than a forecast that new development will stop at that point in time.

Exhibit 12. Trends in Total Commercial Space (millions of square feet)



Sources: Montgomery County Planning, City of Rockville, Sage

3.2 The Value of Prospective Development

The development discussed here is projected to occur over the next quarter century from 2016 to 2040. The scale of this development is substantial. The addition of over 56,000 housing units represents a 15 percent increase over the current housing inventory. Adding 52 million square feet of commercial space will result in 145,000 net new jobs, a 27 percent increase in the County's employment base. These events will give rise to substantial economic benefit for the County.

The construction of this new housing and commercial space will occur over many years. Given the inflation in housing and commercial property values over time, the value of that development will depend significantly on when development occurs. To provide one perspective on the value of this new development, Exhibit 13 estimates the value of this development at current valuations. The 56,000 housing units would be worth over $28 billion if it were built now. In addition the almost 52 million square feet of commercial space would be worth almost $18 billion. In total, this development would be worth almost $46 billion.

Exhibit 13. Value of RTS-linked Housing and Commercial Space (2016 dollars)

	Cumulative Number in 2040	*Unit Value*	*Total Value (millions)*	
Dwelling Units: Reasonable	15,415	$497,040	$7,662	
Dwelling Units: Clear	40,634	$501,601	$20,382	
Sub-total	56,049			$28,044
Commercial Space: Reasonable	20.3 (M SF)	$341.5	$6,937	
Commercial Space: Clear	31.6 (M SF)	$341.5	$10,803	
Sub-total	51.9 (M SF)			$17,740
Total				$45,784

Source: Sage

The broadest measure of economic activity in Montgomery County is gross county product (GCP), the total value added by all compensation, overhead, return on capital, profit, and related multiplier effects. An important concept underlying GCP is the multiplier effect, the consequences of spending and re-spending monies in the County economy. For example, when a County resident spends money at a county restaurant, the restaurant in turn will buy some goods and services (e.g., supplies, payroll services) from county-based businesses. These suppliers in turn will use some of these business revenues to purchase other goods and services from other county-based businesses. The totality of value added through these transactions between County-based businesses contributes to the GCP.

In 2016, each county job will create over $173,000 in GCP.[7] As summarized in Exhibit 14, the over 144,000 jobs projected from RTS-linked development would create a $25 billion increase in GCP if they were in place in 2016. Because GCP per job is expected to increase in real terms by more than 1 percent annually, this estimate underestimates the addition to GCP made by these jobs as they are created over the next 25 years.

Exhibit 14. Value of RTS-linked Montgomery County Gross Product (2016 dollars)

	Cumulative Number in 2040	*Unit Value*	*Total Value (millions)*
Jobs, reasonable	59,335	$173,605	$10,301
Jobs, clear	85,198	$173,605	$14,791
Total	144,534		$25,092

Source: Sage

[7] As discussed in Sage's 2012 report on the RTV, the 2010 value GCP per job was estimated at $146,082 (in 2010 dollars) and projected to increase in real terms at 1.23 percent between 2010 and 2030. Adjusting this value to 2016 and converting 2010 dollars to estimate 2016 dollars yields a GCP value per job in 2016 of $173,605 in 2016 dollars. Sage Policy Group, Inc., April 12, 2012.

4.0 County Government Costs for New Residents and New Employment

New residents and new employment will place demands on County government for services. To estimate the cost of these demands, the current cost of County services per household and per County-based job was calculated. Exhibit 15 allocates the FY16 County budget between services generally provided to residents and those provided to workers. The great majority of services are targeted to residents with public schools dominating these costs. These allocated expenses were then calculated on a per household and per worker basis using estimates of 2015 County households and employment included in the most recent Washington COG forecast.[8]

Exhibit 15. Allocation of FY16 Montgomery County Budget

	Total (millions)	Residential Share (millions)	Commercial Share (millions)	Expense Per Household	Expense Per Job
Libraries, Culture, Recreation	$72.3	$61.5	$10.8	$163	$20
Transportation	$167.3	$142.2	$25.1	$377	$47
Health & Human Services	$205.8	$174.9	$30.9	$463	$58
Public Safety	$617.2	$524.6	$92.6	$1,390	$174
General Government	$191.7	$162.9	$28.8	$432	$54
Debt Service	$357.3	$0.0	$357.3	$0	$672
Environment	$2.1	$1.8	$0.3	$5	$1
M-NCPPC	$120.9	$102.8	$18.1	$272	$34
Non-Departmental	$256.1	$217.7	$38.4	$577	$72
Montgomery College	$248.5	$211.2	$37.3	$560	$70
Montgomery County Public Schools	$2,168.8	$2,168.8	$0.0	$5,745	$0
Total	$4,408.0	$3,768.4	$639.6	$9,982	$1,202

Sources: Montgomery County budget, Washington COG, Sage

County government uses a wide range of revenue sources to cover expenses. While tax revenue accounts for the majority of County government revenue, it is not the only source. As shown in Exhibit 16, recent and prospective County budgets assume that property-related, income, and transfer/recordation taxes account for almost 73 percent of total revenue. This analysis assumes that future residents and workers will need to cover a similar share of County revenue needs with the property-related, income, and transfer/recordation taxes they generate.

Exhibit 16. Projected Sources of General Tax Revenues

Type of Tax	FY15	FY16	FY17	FY18	FY19	FY20	FY21	Total	Share of total revenue
Property	$1,539	$1,583	$1,624	$1,670	$1,720	$1,777	$1,831	$11,744	35.3%
County Income	$1,341	$1,443	$1,525	$1,614	$1,693	$1,758	$1,819	$11,192	33.6%
Transfer/Recordation	$161	$154	$176	$186	$198	$205	$215	$1,294	3.9%
Total revenue	$4,318	$4,443	$4,607	$4,762	$4,912	$5,050	$5,187	$33,278	72.8%

Source: FY16 County Budget

Exhibit 17 presents the number of new households and newly created jobs that are clearly or reasonably tied to the RTS and the cost of County services related to those households and jobs. The cost of services presented in this exhibit is that share of total County expenses that are supported by property-related and income tax revenues.

[8] Op. cit., Washington Metropolitan Council of Governments

These data are presented for each year from 2016 to 2040, a 25-year period of time that encompasses the 10-year construction period of the RTS and the first 15 years of the period over which construction costs would be financed. Values are presented in current dollars, which reflect the effects of inflation over time. The cost of County services is assumed to increase at a general annual rate of 3.68 percent based on County budgets for the years 2005 and 2014.[9] Given this long period of time, the net present value of this stream of costs is also presented. The net present value of the cost of County services for new households and new jobs is $5.9 billion. This cost is that proportion of all County expenses that are covered by property related and income taxes.

Exhibit 17. RTS Development and Cost of County Services Supported by Property Taxes (current)

Year	*RTS-dependent Development*		*Cost of County Services Related to RTS-dependent Development*		
	Households	Jobs	Households	Jobs	Total
NPV 2016-2040			$4,548	$1,358	$5,906
2016	3,123	8,514	$23	$7	$30
2017	5,425	13,253	$41	$12	$53
2018	7,727	17,397	$60	$16	$77
2019	10,030	23,408	$81	$23	$104
2020	12,292	28,514	$103	$29	$132
2021	14,494	33,103	$126	$35	$161
2022	17,404	39,296	$157	$43	$200
2023	19,703	44,556	$184	$50	$235
2024	22,033	50,983	$214	$60	$273
2025	25,061	58,695	$252	$71	$323
2026	28,077	65,882	$293	$83	$376
2027	30,979	73,067	$335	$95	$430
2028	33,796	80,249	$379	$108	$488
2029	35,952	87,154	$418	$122	$540
2030	38,107	94,075	$460	$137	$596
2031	40,557	102,032	$507	$154	$661
2032	43,006	109,989	$558	$172	$729
2033	45,455	117,771	$611	$191	$802
2034	47,694	121,860	$665	$205	$869
2035	49,715	127,275	$718	$222	$940
2036	51,547	131,617	$772	$238	$1,010
2037	52,757	135,470	$820	$253	$1,073
2038	53,874	138,667	$868	$269	$1,137
2039	54,992	141,600	$919	$285	$1,203
2040	56,049	144,534	$971	$301	$1,272

It is possible, even likely, that the costs of services presented here overestimate the costs of serving the new residents and workers linked to the RTS. Development linked to the RTS will be denser and more compact than existing development in the County. As a result, many services can be provided more efficiently and less expensively than is true of existing development. A simple example is the cost of water and sewer lines in communities with half-acre lots versus the cost for these lines provided to high-rise housing. The second significant factor is the likelihood of multifamily housing being the dominant housing type. Such housing generates fewer demands for public schools compared to single-family housing. Public schools are largest county expense, accounting for over half the cost of services to new households.

[9] Montgomery County Maryland, "Comprehensive Annual Financial Report: Fiscal Year 2014"

5.0 County Revenue Generated by the RTS

The realization of the development potential of County master plans that is spurred by the RTS will result in several important streams of revenue. Most of these are tax revenues associated with new residents, new employment, and new commercial and residential properties. The construction of new residential and commercial properties as well as of the RTS itself creates significant economic activities, which in turn provide sources of County tax revenue. Yet another source is property taxes associated with enhanced values of existing County properties proximate to proposed RTS stations.

5.1 Revenue from property-related and income taxes

The primary source of revenues to the County is property-related taxes and the local share of Maryland's income tax. In addition to property and income taxes, the county levies impact fees on many different types of new development to support the schools and transportation infrastructure that new development requires.

Property tax rates are applied to both real and personal property. Real property includes both the new residences that would be built in response to the RTS as well as commercial properties. Fixtures, furnishings, and equipment of businesses are classified as personal property and subject to higher tax rates than is real property. Exhibit 18 lists the rates for these property taxes used in this analysis. They are based on rates published in the County's most recent budget.

Exhibit 18. County Property Tax Rates per $100 of Assessed Value

Type of Tax	*Real*	*Personal*
County	0.723	1.808
Mass transit	0.060	0.150
Fire	0.116	0.290
Recreation	0.023	0.058
Storm drainage	0.003	0.008
M-NCPPC	0.073	0.183
Total	0.998	2.495

Source. Montgomery County FY16 budget

Income of County residents generates a significant stream of tax revenue. Based on data from the Maryland Comptroller's office, the average effective county income tax rate is 2.648 percent of Maryland adjusted gross income. This effective income tax rate is applied to all County-based household income estimated in this analysis. Taxable household income is derived from new residents who occupy housing developed in response to the RTS. Additional taxable income is derived from County residents who work in new commercial space developed in response to the RTS, but who do not live in housing developed in response to the RTS.

The determination of whether new jobs created in the new commercial space dependent upon the RTS would be held by County residents was based on commuting patterns of current County residents and County workers. For example, 36 percent of those who work in the County commute in from other jurisdictions, while 41 percent of Montgomery County residents commute to work outside the County.[10] The analysis assumes that new households in Montgomery County comprise of 1.5 workers. Therefore, each household includes 0.89 workers who work in the County and 0.61 workers who out-commute. The analysis assumes that jobs created in new commercial dependent on the RTS that are filled by Montgomery County residents will first be filled by new residents in the residential development created as a result of the RTS. Income

[10] Table 1. Residence County to Workplace County Flows for the United States and Puerto Rico Sorted by Residence Geography: 2006-2010, U.S. Census, American Community Survey

associated with these jobs is part of the household income of these new residents of the County. Income associated with new jobs in the commercial space dependent upon the RTS filled by County residents who do not live in the new residential development created because of the RTS is accounted for separately under the heading "Jobs."

The sale of real property generates transfer and recordation taxes for Montgomery County. For this analysis it is assumed that all new property is subject to transfer and recordation taxes. It is also assumed that owner occupied residential property will be occupied on average 13 years and then sold.[11] The resale of residential properties developed in response to the RTS will generate transfer and recordation taxes. Given the 25-year timeframe of this analysis, this turnover in housing generates a significant amount of tax revenue associated with the sale/transfer of these properties.

Current County impact fees are listed in Exhibit 19. These fees were used to estimate impact fees associated with new residential development, which generate both school and transportation impact fees, and impact fees associated with commercial development, which generates only transportation impact fees. Various assumptions were made in applying these fees. For example it was assumed that two-thirds of residential development associated with the RTS would be high-rise, multifamily while one-third would be other multifamily structures. Commercial development was assumed to be of a mixed use. From the previous Sage study of the Life Science Center, a prototypical mix of uses was created for commercial development. This means use was dominated by general office space (47 percent) and bioscience office or laboratory space (47 percent) with retail, lodging and other uses. Impact fees associated with this weighted average of commercial uses were developed for new space in each of the three categories of commercial space noted in Exhibit 17, namely, development around Metro stations, development in the Clarksburg area, and other development.

Exhibit 19. County Impact Fees as of July 1, 2015

School impact fees			
Multifamily, except high-rise	$12,765		
Multifamily high-rise	$5,412		
Transportation Impact fees			
Location	Metro Station	Clarksburg	General
Multifamily, except high-rise	$4,443.00	$13,330.00	$8,886.00
Multifamily high-rise	$3,174.00	$9,522.00	$6,347.00
Office (per SF)	$6.35	$15.30	$12.75
Bioscience (per SF)	$0.00	$0.00	$0.00
Retail (per SF)	$5.70	$13.70	$11.40
Social service agency (per SF)	$0.00	$0.00	$0.00
Other nonresidential (per SF)	$3.20	$7.60	$6.35

Source. Montgomery County government

Exhibit 20 presents the property-related and income tax revenues for the County from 2016 through 2040. As with the cost of County services presented in Exhibit 15, these revenues are presented in current dollars, which are adjusted for projected inflation rates over the 25-year timeframe shown in the exhibit. Income for households and jobholders is increased annually at 3.03 percent, the average compound growth rate for Montgomery County median household income between 1984 and 2013. Residential values are increased at an annual rate of 3.65 percent based on the compound annual growth rate of median house values in Montgomery County from 1979 to 2013.[12] Commercial property values are inflated at an annual rate of 3.57 percent, based on the Bureau of Economic Analysis Implicit Price Deflator for nonresidential structures, for the period 1985-2014. School and transportation impact fees are increased at an annual rate of 3.6 percent

[11] Paul Emarth, "Latest study shows average buyer expected to stay in a home 13 years," January 3, 2014. http://eyeonhousing.org/2013/01/

[12] US Bureau of the Census, American Community Survey

based on the compound annual growth rate of these fees from 2007 to 2015.[13] As shown, the net present value of property-related and income tax revenue is $7.3 billion while impact fees generate an additional $628 million in net present value.

Exhibit 20. County Revenue from Property-related Taxes (current dollars)

Year	*Revenue from Property, Income, Transfer, Recordation Taxes*			*Revenue from Impact Fees*			
	Households	Jobs	Total	Residential School	Residential Transportation	Commercial Transportation	Total
NPV 2016-2040	$4,776	$2,482	$7,259	$248	$209	$172	$628
2016	$27	$21	$48	$10	$8	$5	$23
2017	$54	$34	$89	$18	$15	$9	$42
2018	$74	$40	$114	$18	$15	$8	$41
2019	$95	$56	$151	$18	$15	$12	$45
2020	$117	$65	$182	$18	$14	$10	$42
2021	$141	$73	$214	$17	$14	$9	$41
2022	$180	$92	$272	$23	$19	$14	$56
2023	$202	$105	$307	$18	$15	$14	$47
2024	$232	$127	$359	$18	$15	$18	$52
2025	$278	$145	$424	$24	$22	$17	$63
2026	$319	$164	$483	$24	$23	$16	$62
2027	$360	$184	$544	$23	$22	$16	$61
2028	$402	$206	$608	$22	$21	$16	$59
2029	$442	$229	$671	$17	$14	$16	$46
2030	$491	$254	$744	$17	$14	$16	$46
2031	$540	$285	$825	$19	$15	$17	$52
2032	$588	$315	$903	$19	$15	$17	$52
2033	$638	$345	$983	$19	$15	$17	$52
2034	$685	$349	$1,034	$18	$14	$9	$40
2035	$738	$377	$1,114	$16	$12	$11	$39
2036	$779	$393	$1,172	$14	$11	$9	$35
2037	$812	$413	$1,224	$10	$8	$8	$26
2038	$861	$430	$1,291	$9	$7	$7	$23
2039	$907	$449	$1,356	$9	$7	$7	$23
2040	$951	$470	$1,421	$8	$7	$7	$22

Source: Montgomery County government, Sage

5.2 Revenue from construction activities and increases in existing property values

The development of new residential commercial space will create a demand for construction activities valued in the tens of billions of dollars. This construction will take place over decades. A sense of the scale of the development of new housing and commercial space can be derived from estimating the value of this development in today's dollars.

Ultimately this analysis estimates that the development that is reasonably or clearly linked to the RTS encompasses over 58,000 housing units and over 54 million square feet of commercial space. If all of this construction activity were completed today, the value of this housing and commercial space would exceed $47 billion, as shown in Exhibit 21.

[13] Montgomery County Government.

Exhibit 21. Value of New Residential and Commercial Development in Today's Dollars

Type of Development	*Unit Price*	*Number*	*Value (millions)*	*Value (millions)*
Dwelling Units: Reasonable	$497,000	16,884	$8,392	
Dwelling Units: Clear	$497,000-$550,000	41,131	$20,629	
Sub-total				$29,021
Commercial: Reasonable (millions of SF)	$341.5	22.1	$7,543	
Commercial: Clear (millions of SF)	$341.5	32.3	$11,048	
Sub total				$18,591
Total				$47,612

Source. Sage

This demand for construction generates employment opportunities in Montgomery County and the state of Maryland and new business for County and state contractors. Exhibit 22 provides estimates of the total years of work associated with constructing not only the new housing and commercial space but also the RTS itself. Over the next several decades all of this construction activity is likely to create over 630,000 years of work in the County with $33 billion in associated income and over 750,000 years of work statewide with $38 billion in associated income. New business sales in the County exceed $81 billion and exceed $96 billion statewide. These values are presented in current dollar values over the decades of construction activity.

Exhibit 22. Economic Impacts of Construction (millions of current dollars)

Type of Impact	*Montgomery County*	*Maryland*
Total years of work	633,863	751,194
Total income	$32,912	$37,824
Total business sales	$81,377	$96,795

Sources. IMPLAN, Sage

Mass transit has a demonstrated capacity to increase the value of property within roughly one-half mile of transit stations. This benefit is tied solely to increased mobility and is independent of any new development that might be spurred by the availability of mass transit.

In a 2012 study of the proposed countywide rapid transit vehicle system, Sage addressed this potential benefit and found a well-documented history of mass transit increasing property values.[14] Of particular relevance was a study that conducted a parcel-level analysis of the impact of the Washington region's Metrorail system on property values within one-quarter and one-half mile of all system stations.[15] That analysis determined that property values within one-half mile of stations were increased an average of 6.8 percent for residential properties, 9.4 percent for multifamily properties, and 8.9 percent for commercial properties.

The majority of the added property value increases in these half-mile circles was associated with properties within one-quarter mile of the stations. These average increases applied to all Metrorail stations, from those that had spurred major development to those that had little or no impact on the pace of development in surrounding areas. In estimating the impact of the RTS on properties surrounding stations, Sage estimated that the effect of the proposed system would have would range somewhere between 10 and 100 percent of the impact of the Metrorail system. This is based on the limited evidence that fixed-rail systems have had greater impacts than bus rapid transit.

[14] Sage Policy Group, Inc., April 12, 2012

[15] AECOM, "WMATA regional benefits of transit," WMATAA, November 2011 http://www.wmata.com/pdfs/planning/WMATA%20Making%20the%20Case%20for%20Transit%20Final%20Report%20Jan-2012.pdf

The properties within one-half mile of RTS stations were identified by the contractor providing financial analysis support to the Transit Task Force.[16] Exhibit 23 lists the countywide property tax base and the property tax within one-half mile of RTS corridors. Because most RTS stations are three-quarters to one mile apart, virtually all property within one half mile of the RTS corridor or is also within one half-mile of an RTS station. As shown, almost 15 percent of the entire County property base is along the RTS corridors. This property is also increasing in value at a rate of 4.2 percent annually. The exhibit lists the increased property values that would likely result from the availability of mass transit at the RTS stations. In 2016, this increased value ranges from a low of $2.3 million (0.9 percent increase) to $23 million (9.0 percent increase). The midpoint estimate of increased property value is $12.7 million. This benefit would be in addition to the new development that would be spurred by the presence of the RTS. As property values rise over time, this added property value near RTS stations would also rise.

Exhibit 23. Methodology for Estimating RTS Impact on Existing Property Values (millions of current dollars)

	2016	**2017**	**2018**	**2019**	**2020**
County Property Tax Base	173,134.4	179,909.2	188,430.1	194,805.6	201,586.3
Corridor Property Tax Base -- Half Mile	25,640.7	26,717.6	27,839.7	29,009.0	30,227.4
Annual rate of increase					
County Property Tax Base		3.9%	4.7%	3.4%	3.5%
Corridor Property Tax Base -- Half Mile		4.2%	4.2%	4.2%	4.2%
Corridor as Share of County	14.81%	14.85%	14.77%	14.89%	14.99%
Property tax revenue (M)					
Co. Property Tax Base	1,727.9	1,795.5	1,880.5	1,944.2	2,011.8
Corridor Property Tax Base -- Half Mile	255.9	266.6	277.8	289.5	301.7
Boost from RTS					
Maximum	23.0	24.0	25.0	26.1	27.2
Minimum	2.3	2.4	2.5	2.6	2.7
Midpoint	12.7	13.2	13.8	14.3	14.9

Both construction activities and existing properties ultimately produce new fiscal benefits for the County. The income to County residents involved in construction activities is a source of County income tax revenue. Increased property values near RTS stations generate increased property taxes. Exhibit 24 summarizes these fiscal benefits for the County over the period from 2016 to 2040. The net present values of the fiscal benefits of construction activities and increased property values are $649 million and $276 million, respectively.

[16] Public Financial Management, Inc., Scenario 1A, Updated Scenarios_8-5-2015.pdf

Exhibit 24. County Fiscal Benefits from Construction and Increased Values of Existing Property

	Fiscal Impacts, Construction	*Property Value Increases*
NPV 2016–2040	$649	$276
2016	$17	$13
2017	$31	$13
2018	$33	$14
2019	$39	$14
2020	$40	$15
2021	$38	$16
2022	$52	$16
2023	$45	$17
2024	$53	$18
2025	$61	$18
2026	$58	$19
2027	$58	$20
2028	$59	$21
2029	$52	$22
2030	$54	$23
2031	$64	$23
2032	$66	$24
2033	$68	$25
2034	$53	$27
2035	$56	$28
2036	$51	$29
2037	$40	$30
2038	$37	$31
2039	$37	$33
2040	$37	$34

Source: Montgomery County government, Sage

6.0 Fiscal Benefits for the State of Maryland

This analysis has concentrated on the fiscal benefits that accrue to Montgomery County from the development unlocked by the RTS. That development also creates fiscal benefits for the State of Maryland. These benefits parallel those that are available to the County and include income, sales, and property tax revenue associated with new residents and new employment, income and sales tax revenue from construction activities, and property tax associated with increases in the value of existing property.

Over the period of time from 2016 to 2040, the state will collect additional tax revenues with a net present value of $12.7 billion. The great bulk of this is from income, sales, and property taxes related to new residents in Montgomery County and new jobs Montgomery County. Fiscal benefits for the state from construction account for about 15 percent of the total benefit.

This estimate, shown in Exhibit 25, underestimates total state tax collections. Some individuals filling new jobs in Montgomery County will commute in from other locations in Maryland. These workers will pay income, sales, and property taxes to Maryland; however, estimates of these tax revenues are not included in the value shown in Exhibit 26.

Exhibit 25. Net Present Value of Gross Fiscal Benefits for the State of Maryland (millions of 2016 dollars)

Type of Tax	*Net Present Value*
Income, sales, and property taxes related to new residents and new employment	$10,823
Income and sales taxes related to construction activities	$1,807
Property tax related to increases in the values of existing properties	$47
Total	$12,677

The State of Maryland will use these new revenues to meet the demand for services that these new residents and jobs will create. Compared to the County budget, the State of Maryland budget is more complex and less dependent on property-related and income taxes, so no attempt has been made to determine the cost of services provided by the State of Maryland by the new residents and workers generating these fiscal benefits.

Nevertheless, the RTS is likely to create a significant net fiscal benefit for the State of Maryland. The new RTS-linked households created in the County will be more affluent than the average Maryland household and will occupy significantly more valuable real property. As a result, the State will collect significantly more tax revenue from these households than it does from the average Maryland household. As presented in Exhibit 26, the additional tax revenue for the State from these new households will average $900 in 2016.

Exhibit 26. Potential Net Revenue from Households

Type of Tax	*Maryland Average Income/Property Value per Household*	*Montgomery County Average Income/Property Value per Household*	*Increased Value for RTS Households*	*Effective Tax Rate*	*Tax Receipts per Household*
Income tax	$97,820	$107,409	$9,588	3.924%	$376
Sales tax	$97,820	$107,409	$9,588	2.093%	$201
Property tax	$208,744	$497,040	$288,296	0.112%	$323
Total					$900

Jobs created by the RTS-linked development will also be tied to more value than the average Maryland job. For RTS-linked jobs held by Maryland residents, income per job for these new jobs will generate almost $600 more in income and sales taxes than the average Maryland job. The value of commercial property associated with these RTS-linked jobs will be almost triple the average assessed value of commercial property per

current Maryland job. Consequently, each RTS-linked job will generate $90 more in State property tax revenue than the average current Maryland job. Exhibit 27 provides more detail.

Exhibit 27. Potential Net Revenue from Commercial Space and Jobs

Type of Tax	*Maryland Average Income/Property Value per Job*	*Montgomery County Average Income/Property Value per Job*	*Increased Value for RTS Jobs*	*Effective Tax Rate*	*Tax Receipts per Job*
Income tax	$61,902	$71,606	$9,703	3.924%	$381
Sales tax	$61,902	$71,606	$9,703	2.093%	$203
Property tax	$42,562	$122,738	$80,177	0.112%	$90
Total					$674

These incrementally greater revenues associated with RTS-linked households and jobs can be seen as net revenue that would be available to the State of Maryland. The net present value of this State net tax revenue is summarized in Exhibit 28. Households are expected to generate $563 million in net revenue while jobs held by Marylanders (excluding those held by those living in RTS-linked housing) will add another $320 million. This estimate of job-related income and sales tax revenue is adjusted to reflect the fact that persons commuting from outside Maryland will hold an estimated 20 percent of these new jobs. Finally, property taxes on new commercial property will contribute $139 million to the total estimated net revenue of over $1 billion.

Exhibit 28. Estimated State of Maryland Net Revenue (millions of 2016 dollars)

	Households: Sales, Income, Property Tax	*Jobs: Sales and Income Tax*	*Commercial: Property Tax*	*Total*
NPV 2015-2040	$563	$320	$139	$1,022

This $1 billion in net revenue to the State of Maryland is analogous to the net County revenue after cost of County services. Assuming RTS-linked residents and jobs increase State of Maryland expenses at a rate equivalent to the current average expenses, then State tax revenue generated by these RTS-linked households and jobs that exceeds current averages for Maryland households and jobs should create net revenue for the State.

7.0 Fiscal Benefits, Costs of Service, and Financing the RTS

It is clear that the creation of the RTS paves the way for a substantial increase in residential and commercial development in Montgomery County. The question is whether the benefits to the County in terms of new taxes and other revenues pay for not only the cost of services that need to be provided to new residents and new employees in the County, but also pay for the RTS itself.

7.1 Fiscal Benefits versus Cost of Service

Exhibit 29 compares the total cost of County services provided to new residents and new workers to total revenue generated by those new residents and new workers. As shown, the net present value of all revenues over the 25-year period is $8.8 billion, while the net present value of the total cost of services is $5.9 billion. In terms of net present value then, revenues exceed costs by $2.9 billion.

Exhibit 29. Total Costs of County Services and Total Revenues

	Total Costs of Service	*Total Revenue*	*Net Revenue*
NPV 2016-2040	$5,906	$8,812	$2,906
2016	$30	$101	$71
2017	$53	$176	$123
2018	$77	$202	$125
2019	$104	$249	$145
2020	$132	$280	$148
2021	$161	$309	$148
2022	$200	$396	$196
2023	$235	$416	$181
2024	$273	$481	$208
2025	$323	$566	$243
2026	$376	$622	$246
2027	$430	$683	$253
2028	$488	$748	$260
2029	$540	$791	$250
2030	$596	$867	$271
2031	$661	$965	$304
2032	$729	$1,046	$317
2033	$802	$1,128	$327
2034	$869	$1,154	$284
2035	$940	$1,238	$298
2036	$1,010	$1,287	$277
2037	$1,073	$1,320	$247
2038	$1,137	$1,383	$246
2039	$1,203	$1,448	$245
2040	$1,272	$1,514	$242

Source: Montgomery County government, Sage

Expressed as current dollars, revenues exceed total cost of service for each year in the 2016 to 2040 period. From 2016 to 2033, net revenue increases steadily. From 2033 onward net revenue begins to decline.

The net benefit of revenue exceeding costs of services can be attributed to the substantial portion of development that is committed to commercial uses. As shown earlier, new workers create relatively little demand for County services while generating significant new County revenues. The net present value of the

cost of County services for new jobs created in the County as a result of the RTS is estimated at $2.6 billion (see Exhibit 15), while the net present value of the property-related and income tax revenue generated by these new jobs is estimated $4.2 billion (see Exhibit 18). Even without taking into consideration other revenue that new workers generate for the County, property-related and income tax revenue creates a substantial surplus. In contrast, new households are estimated to generate a demand for $8.6 billion of County services while these new households are estimated to generate $8.5 billion in property related and income tax revenue (again, see Exhibits 15 and 18).

In 2034, total cost of service and total revenue begin to converge and the gap between costs and revenues narrows. This declining net revenue is largely explained by the time frames addressed by the master plans in Montgomery County. Typically these plans look 20 years into the future. A few plans acknowledge that the development discussed within the plans may take longer periods of time. The schedules of development discussed earlier in this report, however, have generally run their course by 2033 or 2034. Exhibits 11 and 12, which provide trend lines of residential and commercial development, both show the volume of development contemplated by the master plans leveling out after 20 years.

As a consequence the time horizon for new development stops in the mid-2030s. After that time, no significant new sources of revenue from either new housing development or new commercial space are captured in this analysis. Nevertheless, the analysis assumes the cost of services provided by the County continues to increase with inflation.

Experience in the Washington area with transit-oriented development strongly suggests that development can occur for decades after transit is made available. Metrorail began operating in the Roslyn-Ballston corridor in late 1979. Decades later new development has continued along this corridor, resulting in significant increases in population and employment. That kind of long-term, multi-decade development is beyond the scope of County master plans, but is likely to be experienced as a result of the RTS in Montgomery County. The Sage report on Phase 1 of the CCT, for example, included an assessment of the potential for the redevelopment of the Kentlands commercial district once transit was available. This redevelopment is not incorporated in existing plans, but is a highly plausible consequence of increased mobility. The inability of this analysis to capture or anticipate these long-term development potentials ultimately underestimates the value that the RTS can bring to the County and likely underestimates the net revenues the County would garner because of the RTS.

7.2 Financing the RTS

A basic plan for RTS financing was developed by Public Financial Management as part of its work for the Transit Task Force. This plan comprises five key elements.

- Pay-go. A portion of the costs of constructing the RTS is paid as they are incurred.
- Debt service. The majority of the capital costs of constructing the RTS are financed through bonds. The debt service for these bonds increases throughout the construction period as more of the construction expenses are rolled into this financing mechanism.
- Operating and maintenance net fare box collections. Fare revenues for the RTS cover only a modest amount of the expenses of operating and maintaining the system. Those operation and maintenance costs not covered become part of the financing plan.
- Capital reserve. During the construction period a reserve fund is developed for capital expenses.
- Operating and maintenance reserve. Once the RTS becomes operational a reserve fund is established for these expenses.

Exhibit 24 lists the expenses associated with this financing plan for the 25-year time frame used for this analysis. Once all construction and other capital costs have been financed through bonds, it is assumed that debt service payments are constant in current dollars. On the other hand, operating and maintenance costs as well as the operating and maintenance reserve fund are assumed to increase annually in current dollars at a rate of 3.3 percent. This rate was based on a forecast included in one of the financial scenarios developed by Public Financial Management.

As shown in Exhibit 30, the net present value of all these expenses over the period from 2016 to 2040 is a $2.0 billion. Roughly half of this net present value is attributable to debt service ($1.0 billion). The next largest expense is the cost of operation and maintenance at $575 million.

Exhibit 30. Financing Requirement of the RTS (millions of current dollars)

	Pay-Go	*Debt service*	*O&M net fare box*	*Capital reserve*	*O&M reserve*	*Total*
NPV 2016–2040	$254	$1,019	$575	$168	$18	$2,034
2016	$0	$0	$0	$7	$0	$7
2017	$2	$0	$0	$9	$0	$11
2018	$36	$1	$0	$22	$0	$58
2019	$36	$13	$0	$22	$0	$71
2020	$41	$25	$0	$25	$0	$90
2021	$33	$39	$11	$20	$4	$106
2022	$51	$50	$11	$31	$0	$144
2023	$49	$68	$19	$30	$3	$169
2024	$33	$85	$34	$20	$5	$176
2025	$37	$96	$46	$22	$4	$205
2026	$37	$108	$47	$22	$0	$215
2027		$121	$68		$7	$196
2028		$121	$70		$1	$191
2029		$121	$72		$1	$194
2030		$121	$74		$1	$196
2031		$121	$77		$1	$198
2032		$121	$79		$1	$201
2033		$121	$81		$1	$203
2034		$121	$84		$1	$205
2035		$121	$86		$1	$208
2036		$121	$89		$1	$211
2037		$121	$91		$1	$213
2038		$121	$94		$1	$216
2039		$121	$97		$1	$219
2040		$121	$100		$1	$222

Sources: Public Financial Management, Sage

The final question is whether revenues available to the County after covering all costs of service provided by the County are sufficient to pay the cost of the RTS. Exhibit 31 compares the net revenue to the County after all cost of services have been paid (see Exhibit 23) to the financing requirements for the RTS. County revenues more than cover the costs of RTS financing from 2016 to 2040. In 2041, revenues available to the County match financing needs of the RTS. Thereafter, the financing requirements of the RTS exceed net revenues available from the County in those years. The surplus available in earlier years, however, more than make up for the annual deficits that would begin in 2042. Indeed, in terms of net present value, the County amasses a revenue surplus of $871 million between 2016 and 2040.

Exhibit 31. Revenue Available to Finance the RTS

	RTS Financing Requirements	*County Revenue after Cost of Services*	*County Revenue after Meeting RTS Financing Requirements*
NPV 2016–2040	$2,034	$2,906	$871
2016	$7	$71	$63
2017	$11	$123	$112
2018	$58	$125	$67
2019	$71	$145	$74
2020	$90	$148	$57
2021	$106	$148	$41
2022	$144	$196	$53
2023	$169	$181	$12
2024	$176	$208	$32
2025	$205	$243	$38
2026	$215	$246	$31
2027	$196	$253	$57
2028	$191	$260	$69
2029	$194	$250	$57
2030	$196	$271	$75
2031	$198	$304	$106
2032	$201	$317	$116
2033	$203	$327	$124
2034	$205	$284	$79
2035	$208	$298	$90
2036	$211	$277	$67
2037	$213	$247	$34
2038	$216	$246	$30
2039	$219	$245	$26
2040	$222	$242	$20

8.0 Other benefits

The RTS will be a substantial and robust addition to the transit and transportation infrastructure of Montgomery County. As such it will create a set of transportation benefits in addition to the fiscal benefits discussed above.

Within the Washington area, Montgomery County competes with other jurisdictions particularly those in Northern Virginia for economic development opportunities. Transit is increasingly a key factor in the quality of life and competitive advantages that Washington area jurisdictions offer to prospective employers and new residents.

8.1 Transportation-related benefits

In a 2012 analysis of the proposed Montgomery County wide rapid transit vehicle (RTV) system, Sage identified a number of transportation related benefits that would accrue to a new mass transit option in the County. These benefits were based on an analysis that Metrorail conducted which asked the question: What transportation infrastructure and activities would be required in the absence of Metrorail?[17] That study provides a thorough review of the types of benefits that transit can provide. The proposed RTV system should be able to create the same types of benefits for its passengers and for the county as a whole.

WMATA modeled several scenarios to estimate the impacts of Metro service. Each scenario eliminated Metro and all other transit service from the regional transportation and then tested the resulting demands placed on roadways and commuters. In the absence of transit, one scenario examined the expansion of the road system that would be needed to absorb the 925,000 added one-way weekday auto trips and keep travel patterns and travel speeds at current levels. Another scenario looked at the consequent travel time and congestion from adding those travel demands to the current road system (i.e. without expanding the capacity of the road system). Given the nature of these scenarios, the benefits they estimate -- savings from less roadway construction and savings from reduced congestion -- are mutually exclusive, not additive.

Preliminary estimates of daily boardings for the RTS corridors analyzed for this report indicate that roughly 100,000 riders would board at stations served by these RTS corridors. The estimates of ridership for these individual corridors range from 12,300 to 35,900 daily boarders.[18]

The transportation-related benefits are derived from reducing the need for automobile-based transportation. Using the conservative assumption that RTS trips create half the benefits of Metro trips[19] and that the volume of service provided by the proposed RTS system would be 90,000 to 110,000 daily boardings, low and high estimates of RTS benefits can be calculated.

These benefits are summarized in Exhibit 32. The RTV system is estimated to avoid 23 to 28 lane miles valued at $174 million to $213 million. The number of avoided vehicle miles traveled on an annual basis would range from 39 million to 48 million. By avoiding this travel, the value of commuters' time saved ranges from $26 million to $31 million while the avoided costs of operating private vehicles, parking, and tolls

[17] AECOM, "WMATA regional benefits of transit: Executive summary," WMATA, November, 2011 http://planitmetro.com/wp-content/uploads/2011/12/WMATA-Regional-Benefits-of-Transit-11.28.2011.pdf

[18] Personal communications from Gary Erenrich, Montgomery County Department of Transportation, to John Duberg, Sage Policy Group, August 24 and 25, 2015. Daily boardings for the corridors for 2020 were: MD 355 South, 20,300; MD 355 North, 27,100; Veirs Mill Road, 12,300; and Route 29, 13,500. In 2035, the CCT is expected to have 35,900 trips per day.

[19] Functionally, a rider on the RTV system is the equivalent of a Metrorail or Metrobus rider and would generate equivalent benefits to those riders. To err on the side of caution, this analysis chooses to discount the benefits identified by WMATA by 50 percent.

total another $11 million to $13 million. The elimination of more vehicles on the road system would reduce the number of vehicle accidents, thereby saving lives and reducing injuries, as shown in the exhibit. Fuel savings for commuters would total at least 1.3 million gallons of fuel. Because of this reduction in fuel use, emissions of volatile organic compounds (VOC), particulate matter, and CO_2 would be significant and would be valued at $0.3 million to $0.4 million annually. The savings in avoided investment in roadways and the savings from reduced congestion are alternative benefits and mutually exclusive.

Exhibit 32. Estimated Value of Benefits Attributable to RTS System (values in 2016 dollars)

Factor	*Unit*	*Low estimate*	*High estimate*	*Midpoint estimate*
Daily boardings		90,000	110,000	100,000
Lane miles avoided		23	28	26
Lane miles avoided, value	Millions	$174	$213	$193
Vehicle miles traveled, avoided	Millions	39	48	44
Value of time	Millions	$26	$31	$28
Cost of travel	Millions	$11	$13	$12
Fatalities avoided		0.5	0.7	0.6
Critical/severe injuries avoided		0.5	0.6	0.5
Serious/moderate avoided		4.8	5.8	5.3
Fuel savings, gallons	Millions	1.3	1.6	1.5
Emission value	Millions	$0.3	$0.4	$0.4
VOC	Tons	8.3	10.1	9.2
Particulate matter	Tons	0.7	0.9	0.8
CO_2	Tons	16,071	19,643	17,857

Source: WMATA, PB, Sage

Another estimate of the value of avoided congestion is derived from the Texas Transportation Institute estimates of the Washington, D.C. regional 2015 congestion costs. As shown in Exhibit 33, the costs of congestion average 82 hours of delay and 35 gallons of fuel annually. Based on the expected average hourly earnings of net new workers and current prices for gasoline, the total annual cost of congestion exceeds $2, 900 per auto commuter.

Exhibit 33. Estimated Annual Value of Avoided Congestion per RTS Passenger

	Units	*Number*	*Unit Value*	*Total Value*
Delay/year	Hours	82	$34.43	$2,823
Excess fuel consumption/year	Gallons	35	$2.72	$95
Total				$2,918

Sources: TTI, CRA, washingtondcgasprices.com

The projected ridership of the RTS system is likely to be dominated by commuters, that is, individuals who might otherwise be wasting over $2, 900 annually stuck in traffic.[20] Using this alternative estimate of RTS benefits, the total annual avoided costs of congestion generated by RTS commuters ranges from $102 million to $125 million as shown in Exhibit 34.

[20] An estimated 73 percent to 83 percent of all RTS riders would be commuting to work. Parsons Brinckerhoff, "Countywide Bus Rapid Transit (BRT) Study," April 26, 2011.

Exhibit 34. Estimated Total Annual Value of Avoided Congestion for all RTS Passengers
(millions of 2016 dollars)

	Low Estimate	*High Estimate*	*Midpoint Estimate*
Daily boardings	90,000	110,000	100,000
Daily round trips	45,000	55,000	50,000
Commuter trips @ 78%	35,100	42,900	39,000
Total congestion cost avoided	$102	$125	$114

Sources: TTI, CRA, washingtondcgasprices.com

All of these benefits are in addition to the other economic and fiscal values estimated in this report. Under the assumptions used here, the RTS system would save government major investments in roadways. Alternatively, commuters would save at least $84 million to as much as $103 million annually in the value of time and the cost of operating private vehicles to commute. In addition, consumers and others would enjoy significant environmental benefits.

Finally, these calculations may under represent the benefits created by the RTS. As noted above, estimated benefits related to avoided roadways and avoided vehicle miles traveled are based on half of the value of similar benefits created by WMATA. Ridership estimates for the RTS are for 2020, a relatively early year in the existence of the system. Ridership could increase over time as the benefits or convenience of the RTS became clearer to prospective commuters and others.

8.2 Staying Competitive in the Washington Area

More jobs are located in Montgomery County than in any other jurisdiction in Maryland. Employment within the I-270 Corridor, served by the Maryland Route 355 and CCT corridors of the RTS, dominates the Montgomery County job picture. Although Montgomery County is clearly critical to employment in the state of Maryland, the County also forms a significant part of the Washington, D.C. region. Fairfax County is the Montgomery County of Northern Virginia and also a leading competitor for jobs and population.

As indicated in Exhibit 30, forecasts generated by the Washington Metropolitan Council of Governments project that Montgomery County would add 183,000 jobs between 2015 and 2040. Although impressive, the 34.4 percent increase in employment is outstripped by many other jurisdictions in the region. The growth pattern for the County shows resilience in the later years of this forecast, particularly after 2030 and 2035.[21] This later growth coincides with the full implementation of the five RTS corridors reviewed in this analysis and may reflect the County catching up with the transit amenities that other jurisdictions, particularly in Northern Virginia, established ahead of the RTS implementation schedule.

So many new jobs have been and will be created in the Washington, D.C. region that mobility and access to workplaces have become a major challenge. The region has the dubious distinction of being the most congested metropolitan area in the country, a distinction it has held for many years.[22] The I-270 Corridor is emblematic of this congestion and the need for solutions. At a recent meeting of elected officials from Frederick County and Montgomery County, "[e]veryone in attendance appeared to agree that traffic on the I-270 corridor is a serious problem that affects quality of life and economic development."[23]

[21] Washington Metropolitan Council of Governments, "Summary of Intermediate Employment Forecasts, Washington COG Final Round 8.3 Summary Tables " http://www.mwcog.org/publications
[22] Texas A&M Transportation Institute, "TTI's 2012 Urban Mobility Report: Powered by INRIX Traffic Data," December 2012.
[23] Kelsi Loos, "I-270 Leaders discuss I-270 corridor strategy," Frederick News Post, December 20, 2014 http://www.fredericknewspost.com/news/politics_and_government/governmental_and_political_topics/transportation/leaders-discuss-i--corridor-strategy

Exhibit 35. Employment Growth in the Washington, D.C. Region

Jurisdiction	*2015*	*2020*	*2025*	*2030*	*2035*	*2040*	*Change 2010 - 2030*	
							No.	Percent
District of Columbia	815.0	861.8	905.8	944.1	973.0	1,001.8	186.9	22.9%
Arlington County	247.5	276.3	292.1	303.0	306.0	308.8	61.4	24.8%
City of Alexandria	110.2	116.8	131.2	149.6	157.4	167.6	57.4	52.0%
Central Jurisdictions	1,172.7	1,254.9	1,329.1	1,396.7	1,436.3	1,478.2	305.6	26.1%
Prince George's County	357.0	377.9	403.1	427.5	457.3	497.7	140.7	39.4%
Montgomery County	**532.0**	**564.4**	**598.8**	**635.3**	**674.0**	**715.1**	**183.1**	**34.4%**
Fairfax County (1)	693.8	758.3	814.7	866.7	900.1	930.7	236.9	34.1%
Other Inner Suburbs	389.7	414.1	442.1	468.8	499.9	541.6	151.8	39.0%
Inner Suburbs Total	1,582.8	1,700.5	1,816.7	1,929.5	2,031.3	2,143.4	560.7	35.4%
Washington, DC MSA	3,346.9	3,619.7	3,872.5	4,114.5	4,307.2	4,519.9	1,173.0	35.0%

Note. 1. Includes the independent cities of Fairfax and Falls Church.

Source: Washington Metropolitan Council of Governments

Transit is an obvious part of the solution to this congestion. As evidenced by the jurisdictions with the highest projected employment growth rates, mass transit is also a competitive advantage in the Washington, D.C. region. Opening in July 2014, the Silver Line of the Washington Metro (with five new stations exclusive to this line all located in Fairfax County) is the latest example of mass transit as a competitive advantage. These stations constitute Phase 1 of the Dulles Corridor Metrorail Project, which will, after Phase 2, extend the line to Dulles Airport and beyond to Loudon County.[24] The Silver Line serves Tysons Corner as well as the Dulles Access Road, both major concentrations of employment and job growth in Fairfax County. For Fairfax County, the Silver Line serves a similar purpose to that of the RTS in Montgomery County.

As additional reinforcement of the need for more robust mass transit in Montgomery County, in March 2015, the head of Marriott Corporation announced that the company would look for a new site for its headquarters, located since 1955 in Montgomery County. Among the key site selection criteria are access to mass transit. These criteria reflect the company's long-term interest in its workforce. As CEO Arne M. Sorenson noted "our younger folks are more inclined to be Metro-accessible and more urban."[25] The RTS can be a key selling point for Montgomery County by extending the County's mass transit system to the heart of the County's growth areas along the critical I-270 corridor (including the CCT) and the Route 29 corridor. The RTS can meet the central concerns of Marriott Corporation as it considers new locations and tend to minimize the disruptions to the existing Marriott headquarters workforce who commute to a nearby Montgomery County location.

[24] "Dulles Corridor Metrorail Project: Phase 2"
http://www.dullesmetro.com/documents/_June2014/14JULY_Phase2FactSheet.pdf Accessed January 9, 2015
[25] Jonathan O'Connell, " Marriott CEO: We will move our headquarters," Washington Post, March 1, 2015
http://www.washingtonpost.com/news/digger/wp/2015/03/01/marriott-ceo-we-will-move-our-headquarters/
Accessed April 9, 2015

9.0 Findings and Conclusions

Montgomery County anticipates a major increase in development over the next quarter century. For that development to occur, however, fundamental problems with mobility must be solved. Continued, unabated reliance on private vehicles for commuting and other transportation needs would result in virtual gridlock and make impossible much, likely most, of the anticipated new housing and commercial development.

Estimates of quantified development potential were available in 12 master plans and similar documents for areas served by the initial phase of RTS implementation. These plans encompass up to 84,000 dwelling units and 83 million square feet of commercial space. The majority of this residential development is either clearly (50 percent) or reasonably (20 percent) dependent on the RTS. Similarly a majority of commercial development is either clearly (40 percent) or reasonably (25 percent) dependent on the RTS.

By 2040, this analysis estimates that over 56,000 new dwelling units and almost 52 million square feet of commercial space would be development that is clearly or reasonably tied to the RTS. This new construction would be worth almost $46 billion if it were built today. The commercial space would support over 144,000 jobs, which will contribute more than $25 billion the gross County product.

Given the typical time frame of these planning documents, the development potential after 2035 or 2040 is largely undetermined. Consequently, this analysis runs from 2016 to 2040.

The development spurred by the RTS will create increased demands for County services. Based on current County finances, these demands will likely cost roughly $10,000 per new County household and $1,200 per new County-based job in today's dollars. Almost 73 percent of these costs would likely be covered by property-related and income taxes paid by County residents.

New housing and new commercial space developed as a result of the mobility unlocked by the RTS would be valued in tens of billions of dollars. Over the next quarter century when this construction occurs, county construction workers will earn tens of billions of dollars building these new residences and businesses. From this income they will pay a steady stream of income taxes to the County.

Property adjacent to RTS stations can be expected to increase in value as mobility and access to transit are expanded. This increase in value will in turn create County property tax revenue that would not be available if not for the RTS.

These fiscal impacts are summarized in Exhibit 36. As shown, fiscal benefits exceed costs of services and the cost of the RTS. After all these expenses are addressed, the County has a net benefit of half a billion dollars.

Exhibit 36. Net Present Value of Fiscal Impacts on Montgomery County (NPV 2016-2040)

Fiscal Impacts	*Impacts Related to New Households*	*Impacts Related to New Jobs*	*Total*
Property-related, income tax revenues	$4,776	$2,482	$7,259
Impacts fees	$456	$172	$628
Fiscal benefits of construction, increased property value			$925
Total County revenue	$5,233	$2,654	$8,812
Costs of County services	$4,548	$1,358	$5,906
Net County revenue after costs of services	$685	$1,296	$2,906
Cost of RTS			$2,034
Remaining County benefit after costs of RTS			$871
Note. Totals may not add due to rounding.			

Source: Sage

The fiscal impacts presented in Exhibit 36 are exclusive to the County. The State of Maryland will also enjoy new streams of tax revenue from the housing and employment linked to the RTS. The net present value of these new state tax revenues is $12.7 billion. While a major portion of these will go to the provision of public services, RTS will create surplus revenue for state government estimated at over $1 billion in net present value.

The fundamental purpose of the RTS is to create new capacity for mobility within the County. The use of RTS by definition reduces the use of private vehicles. Reducing trips in private vehicles creates more fiscal and environmental benefits for the County and its residents from the elimination of new roadways to reduced pollution. Transit use also creates benefits for individuals who would otherwise be wasting time and fuel stuck in traffic.

Finally, increasing the capacity of the County's transit system helps the County remain competitive with other jurisdictions in the Washington area. Northern Virginia in particular has benefited from transit-oriented development. Future competitiveness will depend to a significant degree on creating urbanized, transit-oriented communities. RTS is a major step forward in insuring the County can stay competitive for the foreseeable future.

9.1 Sensitivity tests for fiscal impacts

Given the lingering slowdown in real estate after the Great Recession, some may consider the development potential described in master plans created over the past decade to be optimistic. Exhibit 37 presents the results of an assumption that the volume of development tied to the RTS is 25 percent less than that considered in this report. That is, instead of developing roughly 56,000 dwelling units over the next quarter century, roughly 42,000 dwelling units would be developed as a result of the RTS. Similarly, instead of creating almost 52 million square feet of commercial space and 144,000 jobs, the RTS would be linked to 39 million square feet of commercial space and 108,000 jobs. This reduction in new households and new employment would also result in fewer demands for expanded County services; however, the cost of the RTS would be unchanged. As shown, this substantial reduction in development potential significantly reduces County revenue available after the cost of services is paid, but still creates more than enough County revenue to support the RTS.

Exhibit 37. Net present Value of Fiscal Impacts on Montgomery County: 25 Percent Reduction in Volume of Development (NPV 2016-2040)

Fiscal Impacts	*Impacts Related to New Households*	*Impacts Related to New Jobs*	*Total*
Property-related, income tax revenues	$3,582	$1,862	$5,444
Impacts fees	$342	$129	$471
Fiscal benefits of construction, increased property value			$693
Total County revenue	$3,925	$1,991	$6,609
Costs of County services	$3,411	$1,019	$4,430
Net County revenue after costs of services	$513	$972	$2,179
Cost of RTS			$2,034
Remaining County benefit after costs of RTS			$145

Note. Totals may not add due to rounding.
Source. Sage

All of the fiscal analysis relative to paying for the RTS has assumed that the County would bear all capital and operating costs. The State of Maryland, however, is a major beneficiary of the tax revenue that RTS-linked development would create. Exhibit 38 considers the impact of the State of Maryland assuming 25 percent of the capital cost of the RTS is financed with bonds. As was true of the scenario presented in the previous

exhibit, this scenario also assumes a 25 percent reduction in the development potential used in the baseline analysis. Under these assumptions, the County benefit after paying its share of the RTS would be $400 million (net present value in 2016 dollars).

Exhibit 38. Net Present Value of Fiscal Impacts on Montgomery County: 25 Percent Reduction in Volume of Development and State of Maryland Pays 25 Percent of Capital Costs (NPV 2016-2040)

Fiscal Impacts	*Impacts Related to New Households*	*Impacts Related to New Jobs*	*Total*
Property-related, income tax revenues	$3,582	$1,862	$5,444
Impacts fees	$342	$129	$471
Fiscal benefits of construction, increased property value			$693
Total County revenue	$3,925	$1,991	$6,609
Costs of County services	$3,411	$1,019	$4,430
Net County revenue after costs of services	$513	$972	$2,179
Cost of RTS			$1,779
Remaining County benefit after costs of RTS			$400
Note. Totals may not add due to rounding.			

Source: Sage

9.2 Opportunities not considered in the analysis

This analysis relies on existing County master plans to define development potential that could be linked to the RTS. This choice excludes several types of opportunities for development that are well beyond the scope of this analysis.

- Plans with unquantified development. Not all plans for areas served by the RTS provided quantified estimates of development potential. Silver Spring is an example. Any development in the Silver Spring planning area that could be linked to the RTS is in addition to what is analyzed in this report.
- Development unanticipated by existing plans. The expansion of mass transit that RTS will create is likely to encourage property owners to reconsider their options for development. As noted, one estimate of the development at Kentlands that could be unlocked by mass transit would eventually result in an expansion of that commercial district from 700,000 square feet to roughly 5 million square feet.
- Plans for the Washington area. Several assessments have argued that the Washington area may be on the cusp of fundamental economic change. A "roadmap" for the area presented by the Center for Regional Analysis described the transformation of Washington from a "company town" dominated by the federal government to a global business center with an export-oriented economy based on, among other things, scientific and technical services, higher education and health services, manufacturing, and direct foreign investment.[26] A recent op-ed piece argued that with "more than 800 life sciences companies, 70 federal labs, regulatory agencies such as the U.S. Food and Drug Administration (FDA), and elite academic, medical and research" capacities, Maryland should aspire to be one of the top three bioscience centers in the U.S.[27] Either of these proposals plays to the strengths of Montgomery County and the development potential that the RTS seeks to unlock.
- New demands for services may be more cost-effective. This analysis implicitly assumes that future demands for County services will look like current demands. Yet proposed development is likely to be much more urban and denser in nature providing opportunities to lower costs of public services. Moreover, the new households living in RTS-linked development are highly likely to be in high-rise apartments or, at least, highly unlikely to be in single-family detached housing. High-rise housing generates much lower demands for public schools than does single-family detached housing. For

[26] Op. cit., Stephen S. Fuller, January 15, 2015

[27] Reg Seeto et al, "Can the Maryland region become a top biotech hub by 2023?" Baltimore Sun, August 16, 2015

these reasons, the costs of meeting these demands for public services are likely to be less expensive per household and per job than are current costs.

Any analysis trying to project development over a quarter century is subject to many uncertainties. Nevertheless, the conclusion that the RTS is an affordable and desirable investment for the County (and the State) appears sound. Even if projections for future development are substantially optimistic, the finances still work. Moreover, there appear to be several major opportunities for either more development to occur or for the County to serve that growth more cost-effectively.

Appendix

At the heart of this study is an estimation of the course of future development in much of Montgomery County. The basic guidance for this estimation was published master plans and other documents available at the website of Montgomery County's Planning Department. Those documents frequently contain specific quantities of housing and commercial development that are anticipated over the time frame of a given plan.

On the following pages are a series of tables presenting the estimates that are used in this analysis for the nine areas of the County for which master plans and other documents gave quantitative estimates of development potential. In the absence of other data the basic assumption was that development would occur at a steady pace over the time frame considered by the plan. In a few cases, for example, the Life Science Center within the Great Seneca Science Corridor and the LifeSci Village in the White Oak Science Gateway, data were available from individuals familiar with these projects to provide a more nuanced understanding of the schedule of development.

A crucial question is the extent to which any of this development is tied to, dependent upon, or supported by the proposed RTS. Some planning documents, for example those related to the Great Seneca Science Corridor, Shady Grove, and White Flint, provided information which clearly indicated that development was contingent upon the RTS. These ties might be specific requirements that segments of the RTS be funded or operational or, alternatively, some plans required increases in non-automobile-based commuting. In the latter case, the only plausible way to meet such a goal would be to increase transit capacity substantially and thereby reduce reliance on automobiles. The only reasonable way to increase transit capacity would be to develop and operate the RTS.

If planning documents did not have specific requirements for either the RTS or increased transit capacity, they typically had language to the effect that future development was transit-oriented. Frequently these plans would indicate that the RTS or the CCT was a central feature of the plan that the development of transit was essential to the realization of the plan's goals. In the case of the LifeSci Village, while no specific requirements for mass transit were articulated, the plan not only presumed that an RTS station was adjacent to the project, but also that a transit loop from the RTS station passing through the LifeSci Village would facilitate use of the RTS. In these cases, the presence of clear or reasonable ties between future development and the RTS was evident.

If there were no data in master plans or other documents to link the RTS to potential development that proportion of residential or commercial development was placed in a category of "unknown" ties to the RTS. This was the case for a significant share of potential development in a significant number of plans. Roughly 30 percent of potential residential development and 35 percent of potential commercial development fell into this category.

Exhibit A-1. Estimated Schedule of Development for White Oak

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015	429			0.3		
2016	857			0.6		
2017	857	429		1.0	0.3	
2018	857	857		1.3	0.3	
2019	857	1,286		1.3	0.6	
2020	857	1,714		1.3	1.0	
2021	857	2,143		1.3	1.3	
2022	857	2,353	429	1.3	1.6	0.4

2023	857	2,353	857	1.3	1.9	0.7
2024	857	2,353	1,286	1.3	2.2	1.1
2025	857	2,353	1,714	1.3	2.6	1.4
2026	857	2,353	2,143	1.3	2.9	1.8
2027	857	2,353	2,571	1.3	3.2	2.1
2028	857	2,353	3,000	1.3	3.5	2.5
2029	857	2,353	3,428	1.3	3.8	2.8
2030	857	2,353	3,857	1.3	4.2	3.2
2031	857	2,353	4,285	1.3	4.5	3.5
2032	857	2,353	4,714	1.3	4.8	3.9
2033	857	2,353	5,142	1.3	5.1	4.2
2034	857	2,353	5,360	1.3	5.1	4.6
2035	857	2,353	5,360	1.3	5.1	4.9
2036	857	2,353	5,360	1.3	5.1	5.3
2037	857	2,353	5,360	1.3	5.1	5.6
2038	857	2,353	5,360	1.3	5.1	6.0
2039	857	2,353	5,360	1.3	5.1	6.3
2040	857	2,353	5,360	1.3	5.1	6.7

Exhibit A-2. Estimated Schedule of Development for Bethesda Downtown

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015						
2016		189			0.2	
2017		379			0.5	
2018		568			0.7	
2019		757			0.9	
2020		947			1.1	
2021		1,136			1.4	
2022		1,325			1.6	
2023		1,515			1.8	
2024		1,704			2.0	
2025		1,894			2.3	
2026		2,083			2.5	
2027		2,272			2.7	
2028		2,462			2.9	
2029		2,651			3.2	
2030		2,840			3.4	
2031		3,030			3.6	
2032		3,219			3.8	
2033		3,408			4.1	
2034		3,598			4.3	
2035		3,787			4.5	
2036		3,787			4.5	
2037		3,787			4.5	
2038		3,787			4.5	
2039		3,787			4.5	
2040		3,787			4.5	

Exhibit A-3. Estimated Schedule of Development for White Flint

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015		1,633			1.0	
2016		1,960			1.1	
2017		2,287			1.3	
2018		2,613			1.5	
2019		2,940			1.7	
2020		3,000	327		1.9	
2021		3,000	653		2.0	
2022		3,000	980		2.0	0.2
2023		3,000	1,307		2.0	0.4
2024		3,000	1,633		2.0	0.6
2025		3,000	1,960		2.0	0.8
2026		3,000	2,287		2.0	1.0
2027		3,000	2,613		2.0	1.1
2028		3,000	2,940		2.0	1.3
2029		3,000	3,267		2.0	1.5
2030		3,000	3,593		2.0	1.7
2031		3,000	3,920		2.0	1.9
2032		3,000	4,247		2.0	2.1
2033		3,000	4,573		2.0	2.3
2034		3,000	4,900		2.0	2.5
2035		3,000	5,227		2.0	2.7
2036		3,000	5,553		2.0	2.9
2037		3,000	5,880		2.0	3.0
2038		3,000	6,207		2.0	3.2
2039		3,000	6,533		2.0	3.4
2040		3,000	6,800		2.0	3.6

Exhibit A-4. Estimated Schedule of Development for White Flint 2

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015						
2016						
2017						
2018	93			0.3		
2019	186			0.6		
2020	279			0.9		
2021	372			1.3		
2022	465			1.6		
2023	558			1.9		
2024	620	31		2.1		
2025	620	124		2.1	0.3	
2026	620	217		2.1	0.6	
2027	620	310		2.1	0.9	
2028	620	403		2.1	1.3	
2029	620	496		2.1	1.6	
2030	620	589		2.1	1.9	
2031	620	620	62	2.1	2.1	0.1
2032	620	620	155	2.1	2.1	0.4
2033	620	620	248	2.1	2.1	0.8
2034	620	620	341	2.1	2.1	1.1
2035	620	620	434	2.1	2.1	1.4
2036	620	620	527	2.1	2.1	1.7
2037	620	620	620	2.1	2.1	2.0
2038	620	620	620	2.1	2.1	2.1
2039	620	620	620	2.1	2.1	2.1
2040	620	620	620	2.1	2.1	2.1

Exhibit A-5. Estimated Schedule of Development for Shady Grove

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015						
2016						
2017			621			0.2
2018			1,242			0.3
2019			1,863			0.5
2020			2,484			0.7
2021			3,105			0.8
2022			3,726			1.0
2023			4,347			1.2
2024			4,968			1.3
2025			5,589			1.5
2026			6,210			1.7
2027			6,831			1.8
2028			7,452			2.0
2029			8,073			2.2
2030			8,694			2.3
2031			9,315			2.5
2032			9,936			2.7
2033			10,557			2.8
2034			11,178			3.0
2035			11,799			3.2
2036			12,420			3.3
2037			12,420			3.3
2038			12,420			3.3
2039			12,420			3.3
2040			12,420			3.3

Exhibit A-6. Estimated Schedule of Development for Germantown

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015						
2016						
2017						
2018						
2019						
2020						
2021						
2022			497			0.3
2023			994			0.6
2024			1,491			0.8
2025			1,988			1.1
2026			2,485			1.4
2027			2,982			1.7
2028			3,479			1.9
2029			3,976			2.2
2030			4,473			2.5
2031			4,971			2.8
2032			5,468			3.1
2033			5,965			3.3
2034			6,462			3.6
2035			6,959			3.9
2036			7,456			4.2
2037			7,953			4.4
2038			8,450			4.7
2039			8,947			5.0
2040			9,444			5.3

Exhibit A-7. Estimated Schedule of Development for Clarksburg

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015	10,562					
2016	10,562					
2017	10,562					
2018	10,562					
2019	10,562					
2020	10,562					
2021	10,562					
2022	10,562					
2023	10,562					
2024	10,562					
2025	10,562		636			0.5
2026	10,562		1,382			0.9
2027	10,562		2,129			1.4
2028	10,562		2,790			1.9
2029	10,562		2,790			2.4
2030	10,562		2,790			2.8
2031	10,562		2,790			3.3
2032	10,562		2,790			3.8
2033	10,562		2,790			4.3
2034	10,562		2,790			4.3
2035	10,562		2,790			4.3
2036	10,562		2,790			4.3
2037	10,562		2,790			4.3
2038	10,562		2,790			4.3
2039	10,562		2,790			4.3
2040	10,562		2,790			4.3

Exhibit A-8. Estimated Schedule of Development for Rockville

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015						
2016	294			0.4		
2017	588			0.7		
2018	881			1.1		
2019	1,175			1.4		
2020	1,469			1.8		
2021	1,763			2.1		
2022	2,056			2.5		
2023	2,350			2.8		
2024	2,644			3.2		
2025	2,938			3.5		
2026	3,231			3.9		
2027	3,525			4.3		
2028	3,819			4.6		
2029	4,113			5.0		
2030	4,406			5.3		
2031	4,406	294		5.3	0.4	
2032	4,406	588		5.3	0.7	
2033	4,406	881		5.3	1.1	
2034	4,406	1,175		5.3	1.4	
2035	4,406	1,469		5.3	1.8	
2036	4,406	1,763		5.3	2.1	
2037	4,406	2,056		5.3	2.5	
2038	4,406	2,350		5.3	2.8	
2039	4,406	2,644		5.3	3.2	
2040	4,406	2,938		5.3	3.5	

Exhibit A-9. Estimated Schedule of Development for Great Seneca Science Corridor/CCT

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015		237			0.4	0.7
2016		473			0.8	0.7
2017		710			1.1	1.0
2018		947			1.5	1.4
2019		1,184			1.9	2.1
2020		1,420			2.3	2.5
2021		1,657			2.7	2.9
2022		1,894			3.0	3.2
2023		2,130			3.1	3.6
2024		2,367			3.1	4.3
2025		2,604			3.1	4.7
2026		2,718	114		3.1	5.0
2027		2,718	351		3.1	5.3
2028		2,718	587		3.1	5.6
2029		2,718	824		3.1	5.8
2030		2,718	1,061		3.1	6.0
2031		2,718	1,298		3.1	6.2
2032		2,718	1,534		3.1	6.4
2033		2,718	1,771		3.1	6.6
2034		2,718	2,008		3.1	6.3
2035		2,718	2,244		3.1	6.4
2036		2,718	2,481		3.1	6.4
2037		2,718	2,718		3.1	6.4
2038		2,718	2,955		3.1	6.4
2039		2,718	3,191		3.1	6.4
2040		2,718	3,200		3.1	6.4

Exhibit A-10. Estimated Schedule of Development for All Plans

	Dwelling Units: Unknown	*Dwelling Units: Reasonable*	*Dwelling Units: Clear*	*Commercial: Unknown*	*Commercial: Reasonable*	*Commercial: Clear*
2015	10,991	1,870	-	0.3	1.3	0.7
2016	11,713	2,623	500	1.0	2.1	0.7
2017	12,007	3,804	1,621	1.7	3.2	1.2
2018	12,393	4,985	2,742	2.7	4.0	1.8
2019	12,780	6,167	3,863	3.3	5.2	2.6
2020	13,167	7,081	5,211	4.0	6.3	3.2
2021	13,554	7,936	6,558	4.7	7.3	3.7
2022	13,940	8,572	8,832	5.3	8.2	5.0
2023	14,327	8,998	10,705	6.0	8.8	6.4
2024	14,683	9,455	12,578	6.6	12.2	8.1
2025	14,977	9,974	15,087	6.9	12.7	10.0
2026	15,270	10,371	17,706	7.3	13.3	11.7
2027	15,564	10,653	20,326	7.6	13.8	13.5
2028	15,858	10,935	22,861	8.0	14.4	15.2
2029	16,152	11,218	24,734	8.4	14.9	16.8
2030	16,445	11,500	26,607	8.7	15.4	18.5
2031	16,445	12,014	28,543	8.7	16.2	20.3
2032	16,445	12,497	30,509	8.7	16.8	22.2
2033	16,445	12,980	32,475	8.7	17.4	24.2
2034	16,445	13,464	34,231	8.7	18.0	25.2
2035	16,445	13,947	35,768	8.7	18.5	26.7
2036	16,445	14,240	37,306	8.7	18.9	28.0
2037	16,445	14,534	38,223	8.7	19.2	29.1
2038	16,445	14,828	39,047	8.7	19.6	30.0
2039	16,445	15,122	39,870	8.7	20.0	30.8
2040	16,445	15,415	40,634	8.7	20.3	31.6

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