WMATA Green Line Extension Feasibility Study

Phase I – Consensus Building

Final Report and Conclusions

November 2007

Maryland Department of Transportation

INTRODUCTION

In Spring 2006 MDOT initiated an effort to identify the opportunities for and to build a consensus around developing an extension of the WMATA Metrorail Green Line from its current terminus at Greenbelt to BWI Thurgood Marshall Airport. This effort was Phase One of a three-part study of the transit extension between Baltimore and Washington, a corridor dubbed the "Baltimore-Washington Investment Corridor". Phase two and three of the study focused on identifying a specific alignment, mode and stations for the transitway; and identifying performance benchmarks for economic development, financial commitments and other factors that would need to occur in order to justify the transit investment, respectively.

The purpose of this report is to summarize the process and results of Phase One. Included is a description of the history of the project, the process undertaken to identify stakeholder interests for the corridor, and a summary of the results obtained through the study process.

Project History and Status

Earlier Effort and Legislative Background

In 2004, the MTA published a feasibility study of extending the WMATA Metrorail Green Line from its current terminus at Greenbelt to BWI Thurgood Marshall Airport. This report studied two alignments that principally ran along the CSX right-of-way on which the MARC Camden Line commuter trains operate as well as CSX freight service. The results demonstrated the feasibility of constructing the project, but estimated the construction cost to be $2.2 billion to $2.9 billion.

Despite the considerable cost projected in the MTA feasibility study for extending the Green Line, interest in the project remained strong through 2006. During the 2006 legislative session of the Maryland General Assembly, $1 million was set aside for a feasibility study of the proposed project. Additionally, the Joint Chairmen of the Maryland General Assembly budget committees issued language in the 2006 Operating Budget that called for the Maryland Transit Administration to complete a feasibility study of the extension to BWI Airport through Columbia, Maryland.

WMATA Green Line Extension Feasibility Study

In response to continued interest expressed by elected leaders, the media, and other stakeholders in a Green Line extension, MDOT initiated an effort to study the feasibility of developing transit in the corridor in partnership with the private sector. MDOT dubbed the corridor the "Baltimore Washington Investment Corridor" to promote the corridor's economic development potential and to create a vision for the corridor with its own unique economic engines or themes such as a national center for security or intelligence, modeled on the success of the I-270 Technology Corridor and taking advantage of existing military resources and anticipated growth associated with BRAC. The intent was to generate private sector interest in investing in transit to service this economic activity through transit-oriented development, value capture contributions, or other means to help offset the costs of project delivery.

This MDOT study was to be conducted in three phases, as described below.

- **Phase One** of the study was initiated by MDOT in mid-2006. The purpose was to facilitate the creation of consensus on the need, opportunities and challenges for improved rail service along the corridor tied to existing, planned, and potential economic growth.
- **Phase Two** focused on definition of transit mode, alignment, and station locations at a conceptual planning level. MTA led this project phase, focused on examining the feasibility of the Green Line extension through Columbia Town Center, as per direction provided by the Joint Chairmen of the Budget Committees.
- **Phase Three** was to establish performance benchmarks in areas such as land use, development, financial commitments, and other factors that would need to occur to justify the State's investment in an extension of heavy rail transit in the corridor.

Phase One of the project was initiated in Spring 2006. Work completed included the collection and review of existing planning and economic development documents, interviews with the leaders of a wide range of public and private sector entities in the corridor, and documentation of case studies demonstrating applications of public-private partnerships in the delivery of transit projects. The results of

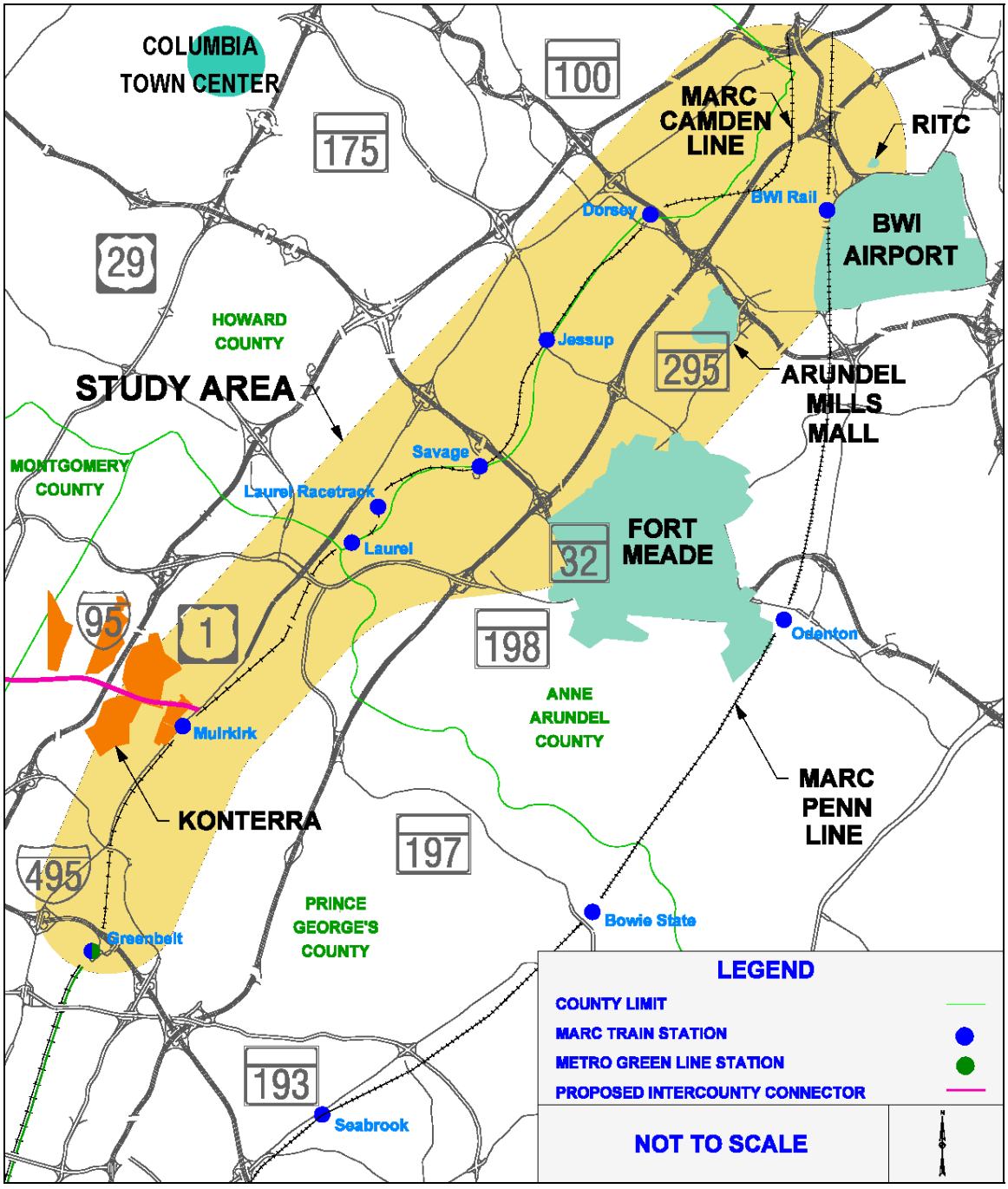
these activities were documented and are discussed in greater detail in this report.

In the face of a change in leadership at MDOT and a lack of clear consensus coming from the region's stakeholders for the project, MDOT terminated work on the project in early 2007.

Phase Two of the project was also initiated in Spring 2006 under the direction of the Maryland Transit Administration. This study resulted in the completion of a conceptual planning level feasibility study of the previously studied extension of the WMATA Green Line from Greenbelt through Columbia Town Center. The MTA studied several alternative alignments and service plans for serving Columbia. A report was submitted to the Joint Chairmen of the Operating Budget Committees on June 30, 2007 as required in 2006 legislative budget language.

Phase Three was never initiated. However, as a result of continued interest in the project by several elected officials, the media, and selected representatives of the business community, MDOT has reinitiated study of transit opportunities for the corridor. MTA and MDOT are coordinating on a project to conduct a transit market assessment for the Baltimore-Washington Investment Corridor in which trip distribution and land use data will be examined to identify specific transit markets that could be served by improvements to one or more transit modes serving the corridor or under study for the corridor including but not limited to commuter bus, commuter rail, local bus, light rail, heavy rail, or high speed rail. This study will be closely coordinated with ongoing related studies, including an effort to identify transit strategies to address anticipated BRAC growth and the MTA MARC Investment and Growth Plan.

Metrorail Green Line Extension Study Map



Study Approach

Phase One of the project was initiated as a means to create consensus around the Baltimore-Washington corridor as a major economic development opportunity, oriented around one or more industries with established industrial roots on the corridor such as intelligence, homeland security, or education, and as a corridor in need of transportation investment, particularly in mass transit.

The original Phase One project scope of services included the following tasks:

- Corridor Data Review –collect and review available documents, studies and plans for the corridor, addressing land use, economic development, and transportation. The purpose is to identify policies and plans for growth and development that would support or benefit from transit service, particularly high capacity or premium transit service, such as heavy rail.
- Identify Study Boundary – using information collected from corridor data and stakeholder interviews, define a study boundary for the project.
- Conduct Case Studies – document three examples of transit projects from throughout the country that were developed using public-private partnerships. The emphasis of these case studies would be on the form of the public-private partnerships for transit development and offer models and lessons learned to follow, as appropriate.
- Develop Project Purpose and Need – develop a paper that articulates a purpose and need for the project as provided by previous tasks. This was not intended to be a full documentation of project purpose and need as provided in a typical NEPA environmental document.
- Prepare Communications Strategy – construct a communications strategy built around a core message or vision for the corridor. The strategy would use facts about economic growth, traffic congestion and projected travel demand to create a case for transit investment. Opportunities for private development and public-private partnerships would be set forth as well.
- Conduct Outreach – conduct interviews with key leaders of major organizations and agencies in the corridor. The purpose of the interviews would be to determine the level of interest and support for an extension of the Green Line as well as future investment in and economic opportunities for the corridor.

Study Results

As noted earlier, Phase One was initiated but work terminated in advance of completion. The purpose of this section is to describe work completed and the results of that work.

Several tasks were ongoing simultaneously to determine the opportunities for consensus on a project for the corridor and to identify one or more champions that MDOT could work with as partners to bring forth the project and "sell" the corridor as one of the State's premier economic generators. This includes tasks to conduct a corridor data review, complete case studies, conduct outreach, and begin to form a project purpose and need. From this information, MDOT hoped to develop a firm study boundary and communications strategy that would put forth the message of the Baltimore-Washington Corridor as an "investment corridor" that would in turn generate widespread private sector and institutional support for a transit investment to serve the corridor.

Corridor Data Review

The majority of this task consisted of collecting and reviewing published documents describing the planning and development environment of the Baltimore-Washington corridor. The following lists the documents collected and reviewed.

Topic Area	Document Title
Economic Development - BRAC	D4 – 1st quarter Market Analysis newsletter
	D4 – 2nd quarter Market Analysis newsletter
	New and Expanding businesses, FY 2006, Howard County
	Select 2006 New, Expanding, Relocating Businesses, Anne Arundel County
	Fort Meade Enhanced Use Leasing Opportunity
Transportation Needs - BRAC	Regional Transportation Implications of BRAC, BMC
	MD Department of Planning BRAC Report, Transportation Chapter
Green Line Feasibility Studies	Green Line Extension to BWI Airport, Preliminary Feasibility Study, August 2004
	Feasibility Study: Metrorail Green Line Extension – Greenbelt to BWI Airport, December 20, 2004 (RK&K review of above)

	Green Line Extension Value Capture Analysis, January 20, 2006
Transportation and Land Use Assessment	Central Maryland Mobility Study, October 3, 2002
Transportation and Land Use Plans –	MWCOG and BMC long range transportation plans Proposed Changes to Howard Transit, MTA Draft Columbia Downtown Master Plan, 2/27/06 Odenton Town Center Plan Prince George's County General Plan Subregion 1: Route 1 Corridor, Poster Charrette Summary, October 2006

Many economic development documents were collected and reviewed. These documents focused on a range of issues and needs along the corridor, focused principally on the locations of growth centers as well as the potential impacts and opportunities of BRAC-related growth in the corridor. Fort Meade, the principal center of BRAC job relocations, is also the site of a proposed mixed-use facility to be developed on Fort Meade property thorough an Enhanced Use Lease.

Some of the documents call for increased transportation investments to support anticipated growth. Bob Priest, publisher of the *Quarterly Market Analysis* electronic newsletter targeting Western Anne Arundel and Howard Counties, called for increased investment in transit and highways to support anticipated growth and identified centers of growth. Transportation planning documents discussing BRAC, such as the analysis produced by the Baltimore Metropolitan Council, focused almost entirely on improvements already in some stage of planning or development. The Maryland Department of Planning report on BRAC specifically called for the State to consider an extension of the WMATA Green Line as well as investments in parking at the Odenton MARC station and the development of a Central Maryland Transit Facility adjacent to Fort Meade to facilitate the distribution of transit patrons into Fort Meade and the surrounding area.

Three documents focused on the feasibility of constructing and operating an extension of the WMATA Green Line from Greenbelt, the current railway terminus, to Baltimore-Washington International Thurgood Marshall Airport. Two alignments were examined in the original feasibility study, published in 2004. Both alignments predominantly operate on the CSX corridor where MARC commuter service and CSX freight service currently operate. One alignment deviated from the CSX right-of-way to provide service to Fort Meade.

As noted earlier, the Green Line was determined to be feasible from a highly conceptual planning analysis, however, it was estimated to be very costly to construct. A subsequent review of the initial Green Line study recommended consideration of transit-oriented development as a tool for maximizing the benefits of the transitway, potentially generating income to support construction or operations, and supporting sustainable economic development in the region that would continue to be served by transit investments. A third study analyzed the revenue potential of a variety of value capture mechanisms against the projected construction costs of the system. This study showed the revenue potential of a variety of value capture mechanisms and how they could be applied towards the cost of constructing the Green Line extension. Value capture mechanisms were tested against both corridor-wide and station specific areas. They included adjustments in property taxes, imposition of impact fees, real estate transfer fees, tax increment financing districts, increases in payroll taxes and sales taxes at varying rates.

A third type of document collected was transportation and land use assessments. A study conducted in 2002, *the Central Maryland Mobility Study*, identified the corridor's economic activity centers and analyzed land use and land use policy. This document contains a through review of local policies and demographics and argues that the jobs-to-housing ratios in the counties are unbalanced and will continue to be unbalanced, with an emphasis on office and commercial development over housing development. Both demographic trends and projections and land use policies that limit housing development using Adequate Public Facilities Ordinances and other land use controls were cited as evidence of these trends. The trends, the authors noted, would lead to continued needs for longer distance commuting which in turn would affect transportation system performance.

Assorted land use plans and policy documents demonstrate local efforts to develop more transit supportive mixed-use environments in targeted areas. For example, the Odenton Town Center Plan establishes new zoning sub-areas and provides development design standards for transit-oriented mixed-use development around the Odenton MARC station. The Draft Columbia Town Center Master Plan does not include specific plans for a mass transit investment, such as an extension of Metrorail, but does produce a plan for a pedestrian-friendly mixed-use development pattern that could reduce longer distance commuter trips and support local bus and similar shorter distance transit services. This document has since been revised and

may have integrated plans for a transit station or facility as a way to improve non-auto access to and from the town center. The recently completed Joint Chairmen's Report, which studies the feasibility of extending the proposed extension of the Green Line from Greenbelt to the Airport to Columbia, shows that service extension to be cumbersome and fairly expensive to accommodate. The Joint Chairman's Report is provided as an appendix to this study, since it was completed after the MDOT Phase One study was done.

The City of Laurel also has a revitalization overlay ordinance affecting specific areas that provides incentives for specific types of land use, design and the provision of amenities. Several types of overlays apply, all of which support a greater intensity of land uses in several specified areas within the City, including a transit-oriented development overlay to be applied near the Laurel Track MARC station. Lastly, Prince George's County identified several areas in the corridor as targets of higher intensity redevelopment that could potentially support transit investments. This includes Konterra and the Muirkirk MARC Station. Muirkirk is identified as a "regional center" with anticipated transit oriented development.

Stakeholder Interviews

Over thirty individuals representing private sector economic and growth consultants, private developers, leaders of major institutions, and local government agencies were interviewed to determine their support for an extension of the Green Line from Greenbelt to the Airport. Additionally, interviewees were asked their opinions regarding the economic future of the Baltimore-Washington Investment Corridor, and the nature of a potential "vision" for the corridor.

The one conclusion that can be drawn from these interviews is there is tremendous economic opportunity in that corridor. Another common viewpoint that was expressed is that I-95 will not be able to handle the growth in travel demand alone. However, there lacks consistency of opinion regarding the viability of a Green Line extension or other transit investments as means to support future economic development. Several individuals saw tremendous opportunity for public-private partnerships, particularly in the form of transit-oriented development at station areas. Others were less "bullish" and felt the private sector would need to see evidence of the potential value of their investments first, particularly in light of existing and planned land use. Land use policy changes would have to be in place to support the transitway. And, some people called for the Green Line to serve

Downtown Baltimore instead of relying on a transfer to the Baltimore light rail system. Others voiced support for Mag Lev instead of the Green Line and substantial calls were made for improvement to the State's investments in MARC commuter rail.

Interviewed Institutions:

Private Sector Economic / Growth Consultants
Sage Policy Group
George Mason University Center for Regional Analysis
Delta Associates
Bay Area Economics
Basile Baumann Prost & Associates
Major Private Developers
Bozzuto Homes
Konterra
Corporate Office Properties Trust
Petrie Ventures
Michael T. Rose Family of Companies
Archstone-Smith
Jackson Shaw Company
Other Private Sector Institutions and Groups
M&T Bank
Heffner & Webber Companies
Anne Arundel Economic Development Corporation
Annapolis and Anne Arundel County Chamber of Commerce
BWI Business Partnership
Greater Baltimore Committee
Public Institutions
Fort Meade
University of Maryland, College Park
University of Maryland, Baltimore Campus
Howard County Department of Planning and Zoning
Maryland Department of Business and Economic Development
Prince George's County Planning Department, M-NCPPC
Anne Arundel County Office of Planning and Zoning
City of Laurel Department of Planning and Zoning

Case Studies in Public-Private Partnerships in Transit

In an effort to better understand the possibilities of public-private partnerships in transit development, the consultants developed three case studies. These included projects in Portland, Oregon; the Dulles extension of the WMATA Metrorail system; and the development of an infill station on the Red Line of the Metrorail.

The case studies show considerable variation in mechanisms for public-private partnerships in transit development. The Portland, Oregon case was an example of a private company submitting an unsolicited proposal for shared financing of an extension of light rail to the Portland airport with exclusive rights to design and build the project as well as develop a 120-acre parcel near a proposed transit station. The second case study described early arrangements between a private sector group known as Dulles Transit Partners LLP, a consortium consisting of Washington Group International and Bechtel Corporation, and local and regional governments. This was to be the first ever application of the Virginia Public-Private Transportation Act of 1995 on a transit project. A final case study described the role of the private sector in contributing funds towards the development of the New York Avenue station of the Red Line, based on the perceived value of the land around the station. These case studies were presented to MDOT as drafts. Given that the proposed extension of the Green Line to the Airport did not generate considerable private sector support at the feasibility study stage, these case studies were not fully discussed.

Conclusions and Next Steps

The review of data, plans and other documents, and stakeholder input demonstrates a lack of clear consensus on the value of an extension of the WMATA Green Line from Greenbelt to the BWI Thurgood Marshall Airport. The following are major themes that arose during the course of the study:

- **There is a positive overall economic outlook for the Baltimore-Washington Investment Corridor.** BRAC and the anticipated 45,000 new jobs predicted to come with it creates a positive outlook for the Baltimore-Washington Investment Corridor.
- **Inconsistent support exists for a Green Line extension.** All jurisdictions verbally stated their support for an extension of the Green Line, particularly with direct service to Fort Meade and an extension directly into Baltimore City. However, local governments

are generally not following up that support with changes to land use that would make the investment cost-effective. Fort Meade is a strong advocate for a Green Line extension. The private sector sees merit in extending the Green Line to BWI Airport and to Baltimore, but expresses doubts about the probability of it happening.

- **A spur to Columbia has weak support.** At the time that the data was collected, only the City of Laurel expressed support for a Green Line extension directly to Columbia. The Draft Columbia Downtown Master Plan showed no major transit facilities and Howard County shows more interest in improving transit service along the US 1 corridor.
- **Terminus at BWI Airport is in question.** Several stakeholders questioned the terminus at BWI Airport rather than to Baltimore City. A transfer to the Baltimore light rail was seen as a major disadvantage and that either that service would need to be improved, or the rail line should continue on to Baltimore City and connect with either Camden Yards or at a station on the proposed Red Line.
- **County land use development pipeline is not transit supportive**. Although the counties are preparing for BRAC, few jurisdictions are providing development with densities and orientation supportive of major rail investments. No new station areas pop out. MARC station areas are planned for TOD redevelopment. The US 1 corridor in Howard County is the focus of redevelopment, but not in a manner supportive of rail transit.
- **No consensus exists on a station location in the southern portion of the study area**. The City of Laurel is a strong advocate of a stop at the Konterra development. Prince George's County supports a stop at Muirkirk, already at MARC transit station and the terminus of the Intercounty Connector. The county has a planned intermodal transit station and regional development center identified in their Subregion 1 Master Plan update.
- **No consensus exists on alignment**. There is general recognition of the Camden Line corridor as potentially the location of a future Green Line extension. However, there are concerns about the availability of right-of-way, community and environmental impacts with that corridor.
- **MARC service improvements are needed**. There is substantial support for improving MARC service between Baltimore and Washington, including increasing the number of trips, hours and days of operation.
- **Transit improvements should be phased**. Many of those interviewed view the improvement of the MARC system as a shorter

range solution with a possible long-range goal of developing an extension of the Green Line or a similar premium transit investment as a longer term goal.

- **Corridor vision is needed**. A long term Baltimore-Washington Corridor land use and transportation vision is needed. Local governments see the need for higher density development but residents often oppose it so they are not making it available.
- **Local or private sector financial participation in transit is unlikely.** Local governments do not have or do not expect to have sufficient funds to help pay for major transit improvements. The private sector will not participate unless there is a predictable return on their investment.

In November 2006, Maryland elected a new Governor. Without a clear mandate for studying a Green Line extension coming from Annapolis, local officials, or the private sector, MDOT decided to terminate the study. MDOT later reconvened its study team and recommended a revised approach to the study that provides continued focus on the transit service potential for the Baltimore-Washington Investment Corridor, but which remains open on the types of investments that might be made.

A new scope of services for the study was recently developed to identify transit markets using trip distribution and demographic data. A work session with local officials will be held to reaffirm the transit needs identified and to strategize on investment recommendations. Both short term and long term investments could be suggested. Any range of service types could be recommended to meet the needs from local and express bus to commuter bus, commuter rail, high speed rail, and extensions of light rail and heavy rail systems. This approach would inform the Department's efforts to proactively address the potential of the corridor, particularly in light of BRAC growth, in a cost-effective manner with maximum support of local governments, businesses, citizens, and other institutions.

Appendix

A Report to the Maryland General Assembly

Senate Budget and Taxation Committee

and

House Appropriations Committee

regarding

Green Line Feasibility Study
(2006 Joint Chairmen's Report, Page 74)

June 2007

The Maryland Department of Transportation

INTRODUCTION

This report was prepared at the request of the Maryland General Assembly in the 2006 Joint Chairman's Report. The language of the Joint Chairman's Report requiring this analysis is as follows:

> *"The committees are interested in the proposed Green Line feasibility study to the Baltimore/Washington International Thurgood Marshall Airport being undertaken by the Maryland Transit Administration (MTA). As part of the feasibility study, the committees request that MTA submit a preliminary report analyzing the line traveling through the Columbia Town Center."*

EXECUTIVE SUMMARY

The analysis investigated five concepts that would provide service to Columbia from Greenbelt and then on to Baltimore/Washington Thurgood Marshall (BWI) Airport (Figure 1). The first three concepts would extend the Washington Metropolitan Area Transit Authority (WMATA) Metrorail Green Line from Greenbelt to BWI Airport through Columbia Town Center. The other two concepts require a transfer off of a Green Line Extension to another line that would go to Columbia Town Center. Although assessed as rail transit in this report, the transfers could be provided by another modes such as express bus. These alignments were named:

- Concept A - Columbia Line via MD 32
- Concept B - Columbia Line via Fort Meade
- Concept C - Columbia Line via Konterra
- Concept D - Columbia Spur
- Concept E - Columbia Loop

This report provides more detailed descriptions of these lines, which include length of alignment, travel times, environmental impacts, and costs.

Providing rail service directly to Columbia will cost approximately $1.3 to $4.3 billion more than a Green Line Extension only to BWI Airport, which has an estimated cost that ranges from $2.2 to $2.9 billion. Travel times from Greenbelt via Columbia to BWI Airport would increase by approximately 15 to 35 minutes when compared to a Green Line Extension that travels directly to BWI Airport. A comparison of travel times and costs can be seen in Table 1.

All of the concepts result in impacts to the environment. Minimizing environmental impacts may require modifying alignment locations which may lead to either longer travel times, bypassing of certain market areas, or additional costs to build underground tunnels.

Figure 1 - Alignment Concepts

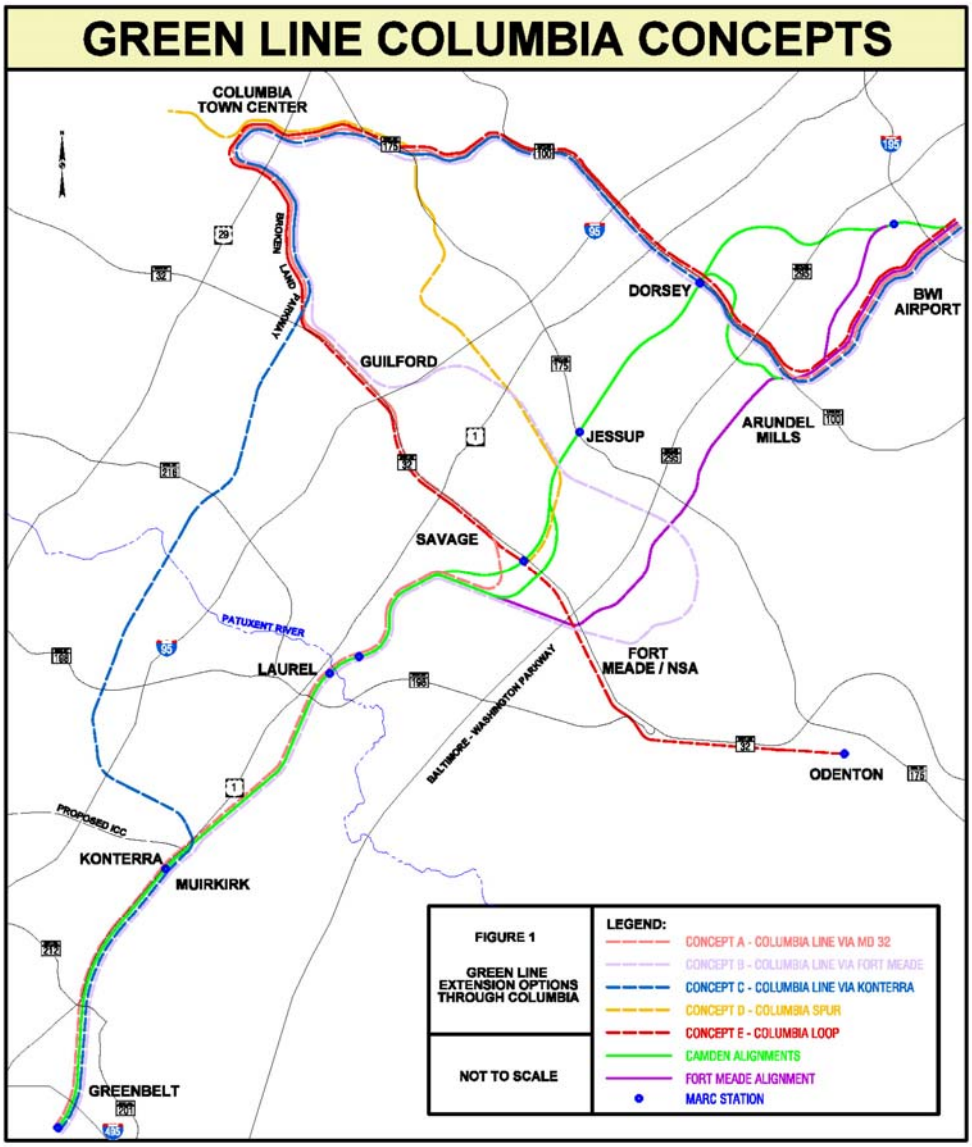


Table 1 – Comparison of Travel Times and Costs

Alignment	Total Alignment Length (miles)	Total Cost (Billions)	Time from Greenbelt to BWI Airport (min)	Time from Greenbelt to Columbia (min)	Time from Columbia to BWI Airport (min)
2004 Green Line Extension Study	20 - 23	$2.2 - $2.9	30 – 35	N/A	N/A
Concept A - Columbia Line via MD 32	31.5	$4.3 - $4.9	56	33	23
Concept B - Columbia Line via Fort Meade	37.5	$5.3 - $5.9	64	42	22
Concept C - Columbia Line via Konterra	29.5	$4.3 - $4.9	50	28	22
Concept D - Columbia Spur*	20.5+10.5= 31	$4.2 - $4.8	32	41	38
Concept E - Columbia Loop*	26+17= 43	$5.9 - $6.5	37	37	22

* For both Concepts C and D, passengers would not go through Columbia to arrive at BWI Airport

BACKGROUND

In August 2004, the Maryland Transit Administration (MTA) completed a feasibility study that explored extending the WMATA Green Line Metrorail from Greenbelt to BWI Airport. The study looked at two potential alignments: the Camden Alignment and the Fort Meade Alignment (Figure 1). The Camden Alignment traveled adjacent to the MARC Camden Line from Greenbelt to Hanover and then crossed over MD 170 to BWI Airport. The Fort Meade Alignment followed the Camden Alignment to Savage, then traveled east to Fort Meade and from there continued north to BWI Airport. The study concluded that both alignments were feasible and that further detailed study would be justified. These alignments are referred to as the 2004 Green Line Extension throughout this report.

In 2006, the Maryland General Assembly requested a preliminary report analyzing a Washington Metropolitan Area Transit Authority (WMATA) Green Line extension traveling through the Columbia Town Center to BWI Airport. As part of this report, previous studies that proposed connecting Columbia to BWI Airport were identified. One such study was the August 2002 Baltimore Region Rail System Plan (Figure 2). This plan proposed to extend the light rail Yellow Line from BWI Airport to Columbia Town Center. A feasibility study was conducted to extend the Yellow Line to Arundel Mills, but planning activities have not moved forward beyond its initial phase.

Figure 2 – Baltimore Region Rail System Plan Map

METHODOLOGY

Five alignments were developed to provide rail access from Columbia to BWI Airport. Three of these potential alignments go from Greenbelt through Columbia Town Center to BWI Airport. All three of these alignments used the 2004 Metrorail Green Line Extension Feasibility Study alignment as the starting basis for the alternatives. Each alignment was developed with the goal of creating a potential feasible alignment to Columbia Town Center and then BWI Airport. The alignments included serving destinations that would potentially attract riders as suggested in other studies (i.e. 2002 Baltimore Regional Rail System Plan, 2004 WMATA Green Line Metrorail Extension), while trying to minimize the time to travel along the alignment.

Two alignments were developed that seek to reduce costs, travel time, and/or environmental impacts while allowing rail transit access to Columbia and BWI Airport from the existing Metrorail. Separate spur and loop routes were investigated, using the 2004 Green Line Extension with a separate new line for the service to Columbia. All proposed alignments can be seen in Figure 1.

The study travel times were calculated based on the WMATA Metrorail schedules. Existing travel times between stations outside the downtown area were examined along with the distance between the stations. Then proposed locations of stations were assigned on each concept and the distance between each proposed station was estimated. A travel time value was then given between each proposed station based on the existing system. These travel times were totaled along each concept to give travel times between Columbia and BWI Airport. For simplicity, if a transfer was needed, an additional four minutes was added.

Preliminary costs are “order of magnitude” costs, calculated based on a cost per mile estimate of a WMATA Metrorail. Assumptions were made as to where the alignment would be elevated, at-grade, or underground and costs were calculated per mile based on those assumptions. Other preliminary costs that were added were based on assumptions for stations, electric supply, parking facilities, maintenance shops, right of way costs, and bridges. A contingency for planning and construction were also added in the costs.

Potential environmental impacts were determined from Geographic Information System (GIS) data. A buffer range of 75 to 200 feet (37.5 to 100 feet on each side of the alignment) was utilized when calculating impacts. While this method provides a basis of comparison among alternatives, alignment adjustments could either reduce or increase environmental impacts.

EXISTING SERVICES

There are currently several transit options that connect Columbia with Washington, D.C. or BWI Airport, including:

- **Connecting Columbia with Washington, D.C.**

  The Maryland Transit Administration (MTA) provides two commuter bus lines that connect Columbia and Washington D.C., the No. 915 and No. 995. Both routes have multiple stops in Columbia and Washington. The travel time from the last stop in Columbia to the first stop in Washington for each line varies between 35 to 55 minutes depending on the time of day and traffic.

  Corridor Transportation Corporation manages Howard Transit (Howard County based) and Connect-A-Ride (Laurel/Anne Arundel based) transit services. Connections to Columbia can also be made from these two systems in combination with other transit systems. From Greenbelt, WMATA offers three bus lines to Laurel, the No. 87, 88, and 89. Once in Laurel, a transfer can be made to the Connect-A-Ride E Route, which goes from Laurel to Columbia. With the transfers and limited service time, it could take more than 2 hours to get from Washington to Columbia via Greenbelt and Laurel.

  MARC trains can be used from Washington to access Columbia via the Camden Line. Three times a day, the Howard Transit Blue Route leaves from the Savage MARC Station and arrives at the Columbia Town Center. Likewise, three times a day, the Blue Route arrives at Savage Station. Including transfer wait times, the whole trip from Columbia to Washington ranges from approximately 80 to 110 minutes. A transfer in the afternoon is not possible.

  From the Dorsey MARC Station, the Howard Transit Silver (formerly Red Express) Route can be used to travel directly to Columbia. The complete travel time including transfer delays between Washington and Columbia ranges from 86 minutes to 139 minutes.

- **Connecting Columbia with BWI Airport**

  Howard Transit Silver Route also provides service from Columbia to BWI Airport. This route leaves every hour from Columbia Mall from 6 AM to 10 PM and arrives at BWI Airport in approximately 80 minutes. From BWI Airport, the route leaves every hour starting at approximately 6:30 AM, with the last route leaving the airport at 9:30 PM.
- **Connecting Columbia with Washington, D.C via BWI Airport**

  Once reaching BWI Airport using the Howard Transit Silver Route, WMATA's B30 bus (Greenbelt-BWI Airport Express Line) can be used to

access WMATA's Greenbelt station. Service is provided approximately every 40 minutes with a travel time of approximately 35 minutes.

ALIGNMENT DESCRIPTION

Five alignments were evaluated in this feasibility study (Figure 1):

- *Concept A – Columbia Line via MD 32*
- *Concept B – Columbia Line via Fort Meade*
- *Concept C – Columbia Line via Konterra*
- *Concept D – Columbia Spur Line*
- *Concept E – Columbia Loop Line*

The first three alignments, Concepts A, B, and C, use the 2004 Green Line Extension alignment as their starting point and then vary from that alignment at different locations in order to reach Columbia. The main difference among the first three alignments is the route from Greenbelt to Columbia Town Center. The segments of the alignments that connect Columbia to BWI Airport are the same for each of these three concepts.

Concept D uses the 2004 Green Line Extension alignment in its entirety and adds an independent alignment to make the connection to Columbia. Concepts E uses the 2004 Green Line Extension alignment from Greenbelt to Dorsey and adds an independent alignment to make the connection to Columbia.

All of the concepts were assumed to have exclusive right-of-way. Unless noted otherwise, all proposed alignments were assumed at-grade where feasible. Where this was not feasible, e.g. like at roadway intersections, the alignment would be on an elevated structure. These concepts include:

- **CONCEPT A – COLUMBIA LINE via MD 32**

  Concept A follows the Camden Alignment along the CSX right-of-way from Greenbelt to Savage using the Savage East Option from the 2004 Green Line Extension feasibility report. From Savage, the alignment curves through the Savage industrial area to head westbound in the wide median of MD 32. West of I-95, the alignment would run on the north side of the westbound MD 32 lanes until Broken Land Parkway where the alignment would follow the off-ramp to curve north on to Broken Land Parkway. At this point, the alignment would follow Broken Land Parkway to Columbia Town Center and then to BWI Airport as described further below in the Columbia to BWI Airport section.

In total, a Columbia Line via MD 32 would require approximately 19 miles of new line from Greenbelt to Columbia Town Center and an additional 12.5 miles to BWI Airport. The total length of a Columbia Line via MD 32 is approximately 31.5 miles of new alignment.

- **CONCEPT B – COLUMBIA LINE via FORT MEADE**

  Concept B follows the Camden Alignment along the CSX right-of-way from Greenbelt to Savage using the Savage East Option from the 2004 Green Line Extension feasibility report. From the Savage station, the alignment continues east to Fort Meade. The line then curves north and into Fort Meade, before curving west towards Jessup. The alignment in Fort Meade would potentially be underground to reduce impacts and shorten the travel time needed to travel in this area.

  The alignment continues west to I-95 before heading south alongside I-95 to the MD 32 interchange. The alignment will follow the ramp and then run alongside westbound MD 32 to Broken Land Parkway where the alignment would follow the off-ramp to curve north on to Broken Land Parkway. At this point, the alignment follows Broken Land Parkway to Columbia Town Center and then to BWI Airport as described further below.

  In total, Concept B would require approximately 25 miles of new line from Greenbelt to Columbia Town Center and an additional 12.5 miles to BWI Airport. The total length of the Columbia Line via MD 32 alignment is approximately 37.5 miles.

- **CONCEPT C – COLUMBIA LINE via KONTERRA**

  Concept C follows the Camden Alignment along the CSX right-of-way from Greenbelt to Muirkirk from the 2004 Green Line Extension report. After the Muirkirk station, the alignment curves to the west, crossing US 1 and I-95. The alignment would then curve north to run parallel to the BGE high-tension power lines.

  The alignment would continue north along the power lines before crossing over the Patuxent River. On the other side of the Patuxent River, the alignment would then line up with the southern end of Broken Land Parkway and then follow Broken Land Parkway to the MD 32 interchange. After the interchange at MD 32, the alignment would follow Broken Land Parkway to Columbia Town Center and then to BWI Airport as described below.

  In total, Concept C would require approximately 17 miles of new line from Greenbelt to Columbia Town Center and an additional 12.5 miles to BWI Airport. The total length of the Columbia Line via MD 32 is approximately 29.5 miles of new alignment.

- **COLUMBIA TO BWI AIRPORT (Concepts A, B, C, and E)**

  From the Broken Land Parkway / MD 32 interchange, the alignments continue north along Broken Land Parkway to Columbia Town Center. After the Columbia Town Center station, the alignment curves east to the southern end of the Lake in Columbia and crosses over US 29 to the Oakland Mills Village Center. The alignment then continues east in Oakland Mills, briefly entering a local park, and then joins MD 175, where the alignment runs along on the eastbound side.

  The alignment then passes through the Long Reach Village Center and continues north alongside Snowden River Parkway to MD 100, where the alignment enters the median. The median appears to be wide enough to allow an at-grade alignment in the median.

  The alignment then continues in the median of MD 100 to Arundel Mills. At the Arundel Mills area, the alignment would head north through the Baltimore Commons industrial area and then to BWI Airport.

- **CONCEPT D – COLUMBIA SPUR LINE**

  Concept D includes a transfer line that begins at the Savage Station. North of the station, the alignment curves west and follows alongside spur tracks from the existing CSX tracks that lead to an industrial area in Jessup. Continuing west, the alignment enters the Columbia Gateway area and the Snowden River shopping area before heading to MD 175.

  The alignment is parallel to MD 175 until it reaches the Oakland Mills area. The Spur Line then curves towards the Oakland Mills Village Center and crosses US 29 to reach the southern side of the Columbia Town Center. The spur terminates near the Howard Community College and Howard County General Hospital.
  In total, Concept D adds approximately 10.5 miles of new line from Savage to Columbia. This is in addition to a Green Line Extension that is approximately 20.5 miles of new alignment from Greenbelt to BWI Airport. A total of 31 miles of new alignment is required for Concept D.

- **CONCEPT E – COLUMBIA LOOP LINE**

  Concept E is a completely separate line with two transfer stations to the Green Line extension.

  The alignment begins at the Odenton MARC Station. The alignment then travels west until reaching MD 32 by Tipton Airport, located adjacent to Fort Meade. The alignment then continues along MD 32 until Broken Land

Parkway, at which point Concept E follows the Columbia lines through Columbia and to BWI Airport, refer to COLUMBIA TO BWI AIRPORT (Concepts A, B, C, and E). For the purpose of this report, the Columbia Loop assumes that the Green Line Extension terminates at a transfer station near Dorsey, allowing for the travel time from Columbia to BWI Airport to remain the priority and the potential for a future extension toward Baltimore.

In total, Concept E adds approximately 26.5 miles of new line from Odenton to Fort Meade to Columbia to BWI Airport. This is in addition to a Green Line Extension that is approximately 16.5 miles of new alignment from Greenbelt to Dorsey. The total length of new alignment is approximately 43 miles.

FINDINGS

All of these alignments, Concepts A, B, C, D, and E, will be compared in the following tables to the 2004 Green Line Extension alignments and options that are discussed in the 2004 Green Line Extension Feasibility Study, which connect Greenbelt to BWI Airport without a detour to Columbia. The 2004 Green Line Extension alignments ranged between 30 to 35 minutes in travel time and 20 to 23 miles in length from Greenbelt to BWI Airport. Concepts D and E were developed to reduce overall travel times between Greenbelt and BWI Airport while still providing service to Columbia.

Travel Times

Table 2 shows the travel times between Greenbelt, Columbia and BWI Airport by alignment.

Note that Concept D adds nearly 20 additional minutes to a trip from Columbia to BWI Airport compared to the other concepts. The additional time is due to the need to travel down the spur to Savage and then transfer to a 2004 Green Line Extension alignment that goes to the airport. Also, transfers are required for Concepts D and E when traveling to Columbia from Greenbelt.

Table 2 – Travel times between Columbia, BWI Airport, and Greenbelt

Alignments	Travel Time to Columbia (min)	Travel Times to BWI Airport (min)	
	From Greenbelt	From Greenbelt	From Columbia
2004 Green Line Extension	n/a	31 - 35	n/a
Concept A – Columbia Line via MD 32	33	56	22
Concept B – Columbia Line via Ft. Meade	42	64	22
Concept C – Columbia Line via Konterra	28	50	22
Concept D – Columbia Spur	17 (Greenbelt to Savage) +4 (transfer time) +20 (Savage to Columbia) =41	32	20 (Columbia to Savage) +4 (transfer time) +14 (Savage to BWI) =38
Concept E – Columbia Loop	17 (Greenbelt to Savage) +4 (transfer time) +16 (Savage to Columbia) =37	37	22

Table 3 shows how much new alignment is needed for each concept to be built.

Table 3 – Length of Alignment Needed

Alignments	Total Length Needed
2004 Green Line Extension	20.0 – 22.5 miles
Concept A – Columbia Line via MD 32	31.5 miles
Concept B – Columbia Line via Ft. Meade	37.5 miles
Concept C – Columbia Line via Konterra	29.5 miles
Concept D – Columbia Spur	10.5 miles for Spur + 20.5 miles for Ft. Meade Alignment = 31.0 miles
Concept E – Columbia Loop	26 miles for Loop + 16.5 miles for Camden Line (Greenbelt to Dorsey) = 42.5 miles

Estimated Costs

Table 4 shows the preliminary cost estimates for each alignment. Estimates were based on the assumption that all alignments would be WMATA Metrorail. For the Columbia Loop and Columbia Spur, the Total Cost includes the Green Line Extension to BWI, which would need to be built in conjunction with those lines. The table shows that any line that involves a destination to Columbia would cost anywhere from $1.3 to $4.3 billion in addition to the $2.2 to $2.9 billion projected for the Green Line Extension to BWI Airport.

Table 4 – Costs for each alignment

Alignment	Total Alignment Length (miles)	Total Cost (Billions)
2004 Green Line Extension - Camden or Fort Meade Alignment	20.0 – 22.5	$2.2 - $2.9
Concept A – Columbia Line via MD 32	31.5	$4.3 - $4.9
Concept B – Columbia Line via Fort Meade	37.5	$5.3 - $5.9
Concept C – Columbia Line via Konterra	29.5	$4.3 - $4.9
Concept D – Columbia Spur	31.0	$4.2 - $4.8
Concept E – Columbia Loop	42.5	$5.9 - $6.5

Environmental Concerns

Table 5 compares the potential environmental impacts of each option. Table 6 provides a description of terms used in Table 5. Impacts were determined using available map data and no field assessments were conducted. Concept D – Spur and Concept E - Loop options were calculated separately from the Green Line Extension to BWI Airport, which would need to be constructed for the Loop or Spur line to function. There would be environmental impacts for each line. When compared to a direct connection from Greenbelt to BWI Airport, the Columbia alignments generally have more potential impacts. To determine the total amount of environmental impacts for Concept D and E, you must add the impacts from the 2004 Green Line Extension. Further minimization of environmental impacts would likely lead to longer travel times, higher costs, and/or avoidance of certain areas.

Table 5 – Assessed extent of environmental and community/cultural impacts

	Concept A MD 32	Concept B Fort Meade	Concept C Konterra	Concept D Spur	Concept E Loop	2004 Green Line Extension - Camden Alignment
Environmental						
Wetlands from DNR (acres)	6 to 18	12 to 35	4.5 to 15.5	8 to 21	2 to 6.5	4 to 13.5
Wetlands from NWI (acres)	13 to 30.5	23.5 to 61.5	10.5 to 26.5	15 to 43	4.5 to 13	14 to 30
Wetlands of Special State Concern (acres)	0.24 to 0.56	0.24 to 0.56	0.22 to 0.54	none	0.24 to 0.56	0.78 to 1.88
Sensitive Species Review Areas	6	5	3	none	4	5
MD Streams (crossings)	25	31	26	5	20	17
Flood Area from FEMA (acres)	25 to 52	45.5 to 92	18 to 36	19 to 50	11.5 to 29	19.5 to 55.5
Greenways from DNR (miles)	0.53 to 1.17	0.53 to 1.11	0.49 to 1.04	0.02 to 0.05	0.49 to 0.99	0.09 to 0.21
Green Infrastructure (acres)	52.5 to 144.5	89 to 239.5	65 to 176	29 to 78	35.5 to 97	69 to 167.5
Forest Interior Dwelling Species (FIDS) (acres)	21 to 56	44.5 to 117.5	29.5 to 77.5	18 to 47.5	11 to 31	34 to 80
Cultural						
County Parks (acres)	5 to 16	5 to 15	10 to 29	4 to 11.5	5 to 15	0.41 to 1.07
State Parks (acres)	None	none	none	none	none	2 to 5
National Parks (acres)	none	2 to 5	none	none	0.75 to 2	none
Federal Lands (acres)	0.5 to 12	3 to 73.5	0.5 to 11	none	3 to 95	0.5 to 1.1
MD Inventory of Historic Properties (acres)	12.5 to 30	18 to 47.5	8.5 to 24.5	7 to 18.5	0.00 to 1.75	25.5 to 57
MD Historic Trust Preservation Easements (acres)	none	none	none	none	0.00 to 0.06	none
National Register of Historic Places (acres)	0.53	1.81 to 5.36	0.00 to 0.46	none	0.75 to 3.10	0 to 0.12

Table 6 – Description of Terms used in Table 5

GIS Layer	Description
DNR Wetlands	These digital data files are records of wetlands locations and classifications as defined by the U.S. Fish & Wildlife Service National Wetlands Inventory (NWI) program. The wetlands were mapped by Maryland Department of Natural Resources (MD DNR) using Maryland's Digital Orthophoto Quarter Quads, flown over the period 1988 to 1995.
NWI Wetlands	NWI digital data files are records of wetlands locations and classifications as determined by the U.S. Fish & Wildlife Service. The NWI maps do not show all wetlands since the maps are derived from aerial photointerpretation with varying limitations due to scale, photo quality, inventory techniques, and other factors.
Wetlands of Special State Concern	In Maryland, certain wetlands with unique habitat or rare, threatened, or endangered species receive special attention. The Code of Maryland Regulations (COMAR) 26.23.06. 01 & 02 identifies these as Wetlands of Special State Concern (WSSC) and affords them certain protections, including a 100-foot buffer from development. The Maryland Department of the Environment is responsible for identifying and regulating these wetlands. In general, the U.S. Fish and Wildlife Service NWI wetlands provide the basis for identifying these special wetlands. Additional information, determined from field inspections, is used to identify and classify these areas.
Sensitive Species Project Review Areas	This statewide vector file shows buffered areas that contain habitat for rare, threatened, and endangered species and rare natural community types. These include federally listed species, state listed species, and species or natural communities of concern to DNR, but with no official status.
MD Streams	This coverage contains streams from the USGS 1:100,000 DLGs.
FEMA	The Q3 Flood Data are derived from the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA).
Greenways	Greenways are natural corridors set aside to connect larger areas of open space and to provide for the conservation and protection of natural resources, protection of habitat, movement of plants and animals, and to provide opportunities for recreation, alternative transportation, and nature study. In addition to Greenway Corridors, water routes know as Water Trails have been recognized as pathways for recreation and nature study.
Green Infrastructure	Maryland's green infrastructure is a network of undeveloped lands that represents the state's natural support system. Hubs are typically large contiguous areas separated by major roads and/or human land uses. Corridors are linear features connecting hubs together to facilitate animal and plant movement between hubs.
FIDS	Potential habitat area for Forest Interior Dwelling Species (FIDS) in the State of Maryland. These data were generated by a model to depict where FIDS habitat may occur based on certain criteria.
County Parks	The County Parks data layer consists of land areas that are owned and maintained by county and municipal authorities.
National Parks	The National Parks data layer consists of land areas designated as parks that are owned and maintained by the National Park Service.
Federal Lands	The Federal Lands data layer consists of land areas that are owned and maintained by U.S. Governmental authorities.
MD Inventory of Historic Properties	This data layer depicts all historic properties which have been listed on the state inventory as having historic significance or potential historic significance.
MD Historic Trust Preservation Easements	This data layer depicts properties where owners have entered into an easement agreement with the Maryland Historical Trust to protect their property's historic character.

Challenges

There are many challenges with the five concepts that were developed for this feasibility study. The challenges are as follows:

- Even assuming the most expensive estimate for a direct line to BWI Airport compared to the least expensive estimate for any of the concepts that travels to Columbia, the cost for an alignment to Columbia ranges from approximately $1.3 to $4.3 billion more than an alignment that does not go through Columbia.

- Neither Concept A nor C provide service to Fort Meade and the National Security Agency (NSA). When combined, Fort Meade and NSA are the largest employers in the state of Maryland. Fort Meade has a population of approximately 110,000 people and is expecting to grow significantly due to the Base Realignment and Closure Act (BRAC).

- Although Concept C provides the fastest travel time to Columbia, this concept bypasses locations such as Historic Laurel, Laurel Racetrack, and Savage. These locations were all potentially served by any of the alignments in the 2004 Green Line Extension report and have the greatest potential for transit-oriented development and public-private partnerships that will help fund and attract riders to the project.

- Concept B's circuitous route to nearly every major population center in between Greenbelt and BWI Airport adds over $3 billion to the cost of a direct alignment from Greenbelt to BWI Airport, and $1 billion more than an alignment that goes through Columbia. The Columbia alignment also adds approximately one half hour more travel time to BWI Airport than a direct extension.

- Concept D compares similarly in costs to Concept A and C, while still providing service to the Fort Meade area. Using the same comparison however, travel times increase by about 8 to 13 minutes from Greenbelt to Columbia and about 15 minutes from Columbia to BWI Airport.

- Concept E has the flexibility to add other station locations such as Odenton, that none of the other concepts can reasonably provide. A loop line would need approximately 26 miles for its separate alignment, which would be more than one and a half times longer than a direct Green Line Extension to BWI Airport from Greenbelt and would cost significantly more than any other concept.

- For all the concepts, there are several potential environmental challenges to consider. Reducing the environmental impacts for any concept could potentially increase the length of the alignment and therefore travel time due to possible shifts in the alignment.

- Minimization of environmental impacts could increase capital costs if it was determined that an underground alignment or an extended elevated structure is necessary.

- The project length and travel time may affect the ability to attract the ridership needed to have a viable project.