TRAVEL FORECASTING PROCEDURES FOR TRANSIT CORRIDOR STUDIES

Role of Travel Forecasting in Corridor Studies

The analysis of current and future travel behavior and transportation system performance is at the core of a transportation planning study; especially the effects that the various transportation improvements are expected to have on future travel behavior and system performance. The activity that performs this analysis is referred to as travel demand forecasting.

Travel demand forecasting typically involves the use of regional computer models that consider both the demographic characteristics of the population and employment and the operational characteristics of the regional transportation system.

The demographic characteristics include the number and locations of where people live, work, and go to school, shop and participate in other activities that cause people to make trips. Other characteristics might include household size, income, and/or auto ownership which can affect the choice or ability to drive, carpool, or take transit, as well as the choice of where to reside and work. The demographic information is assigned to small geographic areas of the region called traffic analysis zones (TAZs) or just "zones".

The regional transportation system is the roadways, transit lines and stations, and the policies that affect the time and costs of using the system to the make trips. Segments of the roadways (streets, highways, etc.) are represented as links and where those links connect to one another (intersections, interchanges, etc.) is represented as nodes. The characteristics of this network of links and nodes that affect travel performance and costs, such as number of traffic lanes, speed limits, traffic signals, tolls, parking availability and costs, are included in the forecasting model as well. Transit service is similarly represented with rail and bus lines defined as links and stations, terminals, and bus stops as nodes. Factors affecting travel time and costs (fares) are included, particularly for transit services that operate in conditions affected by traffic. Access to transit services from zones is defined by drive and walk links to the station or stop nodes. Parking supply and cost are included, if present.

The travel forecasting model is created by using known information on travel behavior and patterns – how many trips, for what purpose, between what origins and destinations, at what time of day, by what means (auto, carpool, transit, etc.), by what path or route -- for a given time (say 2003) for a set of known demographic characteristics and transportation system characteristics of the same time. Using a set of mathematical algorithms, statistical analyses, and data processing methods, the model is "calibrated" to replicate the known travel behaviors and patterns given the demographic and transportation system characteristics. The model output includes information on trips between various parts of the region, traffic volumes on specific roadway links, comparisons of the assigned traffic volumes to the capacities of the roadways, which produce resulting traffic speeds and levels of service, transit usage on the various bus and rail routes, and system performance such as vehicle miles traveled, person travel times, regional trips by mode, and many other types of information useful for planning and policy analysis.

By knowing how current travel behavior and patterns are created by current demographics and transportation system performance, the travel model can then be applied by using projected changes in the demographics of the regions such as population and employment growth, shifts

population and employment in various parts of the region, and changes in the system facilities (a new highway) or services (a change in transit route) to estimate future changes in travel patterns and system performance. In a typical transportation study, future demographic forecasts for say the year 2030 are applied to the regional future transportation system (i.e., the existing system plus any already committed projects) and the resulting travel patterns and performance forecasted, such as highway volumes, travel speeds, and travel times. This information is used to identify various mobility or transportation problems or needs to be addressed by the study. Then, various transportation improvement alternatives can be tested in the model to forecasts the effect each would have on the system performance. For instance, a new highway would be added into the network or new lanes added to an existing highway, or a new transit line or enhanced bus service added to the transit system network. The effects of these changes can be measured from the standpoint of solving a congestion problem, or improving transit service for certain types of trips. The resulting changes in the performance of the transportation system performance and the effect on travelers can then be compared to the costs and impacts of the alternatives as part of an evaluations process.

In Maryland, there are two primary regional travel forecasting models:

- One for the Washington DC region that includes the District of Columbia, northern Virginia, and most of Maryland. It has been developed and is maintained by the Metropolitan Washington Council of Governments (MWCOG)

- One for the Baltimore region that includes most of Maryland. It has been develop and is maintain by the Baltimore Metropolitan Council (BMC)

Both models have been undergoing a service of improvements and enhancements to meet the latest requirements for use in the FTA News Start process. Each model has to be reviewed and accepted for use by FTA as specific projects enter the New Starts process.

January 28, 2003

Silver Spring Transportation & Pedestrian Safety Committee

Recommendation that the Silver Spring Citizens Advisory Board adopt the following resolution:

Resolution concerning the Purple Line Loop proposal vs. Inner Purple Line proposal

"The SSCAB supports the Inner Purple Line and reaffirms the Board's November 1999 resolution (see below). Furthermore, we recommend that the Purple Line Loop proposal not be pursued for inclusion TEA-3 submissions for the reasons stated in the Jan. 27, 2003 M-NCPPC staff's report Finding of Analysis section."

Inner Purple Line Resolution
November 1999, Citizens Advisory Board

"WHEREAS the Redevelopment Strategy for Downtown Silver Spring is centered around expanded use of transit, and
WHEREAS inner suburban areas that do not embrace such a transit oriented development strategy risk suffering negative community impacts from traffic congestion, noise and pollution, and
WHEREAS excellent examples exist in the United States of communities that have healthy economies based on compact, transit-oriented development, and
WHEREAS the Georgetown Branch light rail trolley and trail project has been recommended for a Final Environmental Impact Statement with the strong support of the Silver Spring business and civic communities and
WHEREAS support is growing for a longer light rail connection that would extend between Bethesda, Silver Spring, College Park and New Carrollton, and
WHEREAS such a line would be a significant investment and with major benefit to smart growth areas of the two most populous jurisdictions in the State of Maryland, and
WHEREAS such a connector provides a meaningful alternative to the beltway, thus providing relief for many commuters, and

BE IT THEREFORE RESOLVED

THAT the Silver Spring Regional Advisory Board go on record in support of the Inner Purple Rail Transit Line connecting Bethesda, Silver Spring, College Park and New Carrollton, and in light of the current transportation crises that the planning process by expedited,

THAT the Board convey its support to the Montgomery County Planning Board, County Council, County Executive, Maryland Department of Transportation, and Governor, and

THAT the Board specifically recommend that the Planning Board open bi-county

negotiations with Prince George's County to develop a transit oriented, smart growth development strategy centered around the Purple Line connector and redevelopment (including high technology) within the town centers along the line and connecting Metrorail lines in both Counties, and

THAT future transportation analysis include analysis of the implications of various choices on redevelopment in areas within and near the county considered at risk of decline, such as Langley Park and Long Branch, and

THAT the Planning Board insist on completion of the TPR 2050 integrated land use and transportation study in order to more fully examine the impacts of the proposed automobile oriented development strategy as compared to one that emphasizes transit and transit oriented development over the longer study period, and

THAT the Planning Board insist on a comprehensive environmental assessment of the impacts of the proposed automobile oriented development strategy as compared to one that emphasizes transit and transit oriented development."

M-NCPPC

MONTGOMERY COUNTY DEPARTMENT OF PARK AND PLANNING

THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION

8787 Georgia Avenue
Silver Spring, Maryland 20910-3760

Revised 1-31-03

MEMORANDUM

TO: Montgomery County Planning Board

VIA: Charles R. Loehr, Director
Department of Park and Planning

FROM: County-wide Planning Division

SUBJECT: Review of Proposal by County Executive for Metrorail Purple Line Loop from Silver Spring to Medical Center Metrorail Stations

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RECOMMENDATION

Based on staff analysis of the information available concerning the Purple Line Loop (PLL) proposal, staff recommends that the proposal not be carried forward for further detailed study. This conclusion was arrived at based on the findings shown below, with considerable weight given toward the need to move an approvable project ahead in the project planning process. We find the Inner Purple Line (IPL) is the project that should be advanced.

These recommendations are based on technical data and staff research on the planning and implementation process for Federally-funded projects. The findings regarding a two-year or four-year delay for incorporation of the PLL into the current Purple Line study process are estimates but reflect known procedural time frames. Not having heard the community comments that will be presented at the Board hearing, staff has not attempted to evaluate the community acceptance of the PLL proposal.

In developing our recommendation not to study the Executive's Metrorail proposal further, staff is aware of the lack of Montgomery County political consensus on constructing the Inner Purple Line. Our recommendations are made on the basis of technical thought processes. We leave for others to determine what is necessary to overcome that lack of consensus.

The following sections are found in this memorandum:

I. FINDINGS OF ANALYSIS

Staff finds three distinct advantages to the Purple Line Loop proposal:

- It addresses several known problems with the Inner Purple Line, such as adverse impacts to adjacent property owners, a degraded trail experience, and space constraints associated with adding tracks in the Silver Spring CBD.

- The PLL attracts more new riders than the IPL because it reduces transfers in the Metrorail system and is a faster ride between Silver Spring and Bethesda than the proposed Inner Purple Line light rail.

  Council staff comments: ***Actually, the IPL provides a faster ride between Silver Spring and Bethesda, and for several other pairs of origins and destinations. (See Table 2A, below).***

- The PLL would improve Metrorail operations flexibility and efficiency. Switches and tunnels would allow for several operating configurations between Shady Grove and Glenmont by connecting the Medical Center and Silver Spring Metrorail stations. It also provides redundancy in the Metrorail system that is not now available.

However, the Purple Line Loop raises several grave concerns as well:

- To continue study on the PLL, bringing it to the point where fully-informed decisions can be made about cost, environmental impacts, and all the other needed aspects that go into a Draft Environmental Impact Statement, is likely to take at least two years and possibly longer.

- The PLL costs approximately twice as much as the IPL. Costs of the PLL are very preliminary and would be subject to significant modification due to the very sketch-level nature of the planning to this point. WMATA staff's cost estimate is $616 million. Staff finds that this should be at least $746 million. This estimate is shown in detail in this memorandum. The IPL cost estimate is $371 million. The increase in project cost for the PLL is greater than the proportional increase in ridership.

  Council staff comments: ***Based on a review of contingency cost estimates, the differential in cost between the PLL and the IPL is likely $50-100 million more than what the Planning staff has estimated.***

- The cost effectiveness of the PLL, based on Park and Planning staff estimates of capital costs, is lower than that of the IPL.

- Some assumptions of the design are critical and, if they must be changed, additional problems could arise. The center-to-center offset between the PLL

trains and CSX trains is 18 feet in the designs, although recent designs for the IPL have had to use 25 feet based on CSX guidance. WMATA feels their agreement with CSX allows the lower number.

- The completion of the Capital Crescent Trail will be necessary as a separate project with the PLL, and will have some cost associated with it that has not been determined. Completing the trail is included in the costs for the IPL. Similarly, no new south entrance to the Bethesda Metrorail station would be created with the PLL, eliminating one of the benefits of the IPL design.

  Council staff comments: ***If the PLL is selected, ultimately an additional $51 million will be needed to complete the Capital Crescent Trail and the southern entrance to the Bethesda Metrorail Station.***

- Environmental issues can play a major role in the ability of this project to be approved for Federal funding. The PLL impacts substantially more wetlands, floodplains, and forest than the IPL.

- Community impacts such as visual effects, potential noise, vibration, and other aspects have not been well defined due to time constraints and the sketch-level nature of the planning. These impacts will be somewhat dependent upon the types of structure used to support the Metrorail tracks, their heights, and other variables.

- It does not seem that there are appropriate Metrorail station locations on the proposed alignment between Medical Center and Silver Spring, with the possible exception of the Seminary Road/Linden Lane area near the CSX tracks. However, a station there would require significant changes to the land use and adjacent roadway network to be cost-effective.

- The PLL will reduce the future available Metrorail service capacity for stations north of the Medical Center and Silver Spring stations, perpetuating the need for "turn back" service.

Finally, two findings do not affect the relative value of PLL and IPL:

- PLL is feasible to construct from an engineering perspective using the WMATA staff assumptions. The design uses some unusual structures, but there is public land or land from CSX that would allow for construction, and there are no physical constrains that could not be overcome. The DEIS has already resulted in the same finding for the IPL.

- A future rail extension from Silver Spring to Langley Park, College Park and New Carrollton could be constructed with connections to either a Metrorail loop or the Inner Purple Line light rail. There are costs and benefits associated with all combinations of light rail and Metrorail for the sections east and west of Silver Spring.

<u>Council staff comments</u>: ***The potential for the Inner Purple Line extension is lessened with the PLL. There is more potential for rail extensions from the IPL than from the PLL.***

II. PURPOSE AND BACKGROUND

In mid-January 2003, County Executive Duncan sent to the Montgomery County Council a proposal to link the two sides of the Metrorail Red Line. This link would allow Metrorail trains to travel directly between the Medical Center and Silver Spring stations, creating a loop as well as extension possibilities. Council President Michael Subin sent this proposal to the Planning Board, asking for their review and recommendations to the Council by January 31.

In this paper, the County Executive's proposal is referred to as the Purple Line Loop (PLL) to differentiate it from the Inner Purple Line (IPL). The proposed Inner Purple Line is light rail that would run from the Bethesda Metrorail station via the Georgetown Branch right-of-way to Silver Spring. A continuation being studied from Silver Spring to Langley Park, College Park and to the New Carrollton Metrorail station is described in this memo as the Inner Purple Line East.

The basic question being asked of the staff and Board is:

- **Is this new Purple Line Loop feasible enough to recommend that Maryland DOT and Montgomery County spend time and money on further detailed study?**

- **How does this new proposal compare against the Inner Purple Line?**

For this analysis, most comparisons are done against the transit lines between Bethesda or Medical Center, and Silver Spring. This is the section where most detailed information is available about the two lines and where they are most comparable. Each could be linked to a line that would extend east of Silver Spring; ridership and other benefits, as well as costs, are shown in this paper. However, the planning for the eastern section is of a very sketch-level nature at this time.

The need to complete the decision-making about further study for this project is closely related to the time schedule of the Federal Surface Transportation bill reauthorization. U.S Congress House members must have their projects to the House Transportation and Infrastructure Committee by February 28, 2003. The Board was briefed on the Federal reauthorization process recently, and a summary of relevant information is included as an attachment to this memorandum.

Status of Related Projects

Several other projects related to the PLL proposal are in varying stages of study:

- The Inner Purple Line for its entire length from Bethesda to New Carrollton is in an initial Project Planning stage by the Maryland Transit Administration (MTA). The section from Silver Spring to New Carrollton is in a very early stage of analysis, with an alignment still to be determined. However, the western section, from Silver Spring to Bethesda, is well along in a Supplemental Draft Environmental Impact Statement (SDEIS). A draft EIS was published in 1996 on this section. The SDEIS was initiated in 2001, identifying the impacts of double-tracking the section and updating other information. The SDEIS and Final EIS are expected to be completed in 2003.

- The Corridor Cities Transitway is a planned transitway from the Shady Grove Metrorail station, north to Clarksburg. This line is being evaluated as either a busway or light rail. A Draft Environmental Impact Statement was published in the spring of 2002, and is in the review process now. A decision on mode and other design alternatives is expected in fall of 2003, with a final EIS in 2004. That would allow for final design to begin.

- SHA is studying the addition of HOV lanes to the Capital Beltway from the American Legion Bridge to the Woodrow Wilson Bridge. This concept, developed in the same inter-modal corridor study that identified the “P6” rail alignment for IPL and IPL East, will be documented in a Draft Environmental Impact Statement likely to be completed during 2004. The concept is supported in the Planning Board’s Transportation Policy Report and a Public Hearing Draft of a Master Plan amendment was released in January 2003 that would add the portion west of I-270 to the Master Plan of Highways. Due to anticipated environmental and community impacts between I-270 and the Prince George’s County line, the County Council has decided to await further information from the SHA study before proposing an HOV lane addition to I-495 east of I-270 in the Master Plan of Highways.

III. DESCRIPTION OF PURPLE LINE LOOP

Operating Methods and Headways

The 4.7-mile[1] PLL would connect the Silver Spring and Medical Center stations on the Red Line using heavy rail cars like those found throughout the rest of the Metrorail system. The PLL would operate initially with a peak hour headway of 6 minutes (10 six-car trains per hour) and could operate with a peak hour headway of 5 minutes (12 eight-car trains per hour)[2] during the year 2025 without acquiring any additional rail cars beyond those WMATA is already planning to purchase in order to meet their year 2025 service goals. The PLL would operate as a true loop, such that Red Line trains that currently terminate at the Grosvenor and Silver Spring stations would instead continue clockwise along the loop from Medical Center and counterclockwise along the loop from Silver Spring.

Physical Alignment

The section numbers indicated in the description of the physical alignment refer to the section illustrations located in the 11" x 17" color overview map. All section illustrations are looking to either the south or east. The sections were provided by WMATA staff.

***Silver Spring Station to 16th Street (MD 390): Section 1-1*:** In the area between the Silver Spring station and 16th Street, the outbound and inbound PLL tracks are separated to provide a more economical engineering solution. From the existing Silver Spring station, the area currently occupied by the pocket/turnaround tracks just north of the station would be converted into a 1000-foot-long retained cut[3] for single track. Beyond the existing station, the outbound (toward Medical Center) track would descend below the grade of the CSX tracks and main Red Line, into the retained cut and then into a 400-foot-long cut-and-cover tunnel to pass underneath the CSX tracks and Spring Street before entering a 1200-foot section of mined tunnel to pass back underneath the Red Line and an 800-foot-long cut-and-cover tunnel to pass underneath 16th Street. The track would emerge on the east side of the CSX tracks northwest of 16th Street, and would be on top of the stacked box configuration shown in Section 2-2.

Beginning northwest of 16th Street, the inbound tracks (toward Silver Spring) are shown at the bottom of the stacked box configuration in Section 2-2. The inbound tracks would remain below grade and break into the existing Red Line tunnel beneath 16th Street, where they would join up with the existing track and proceed along the remainder of the current Red Line route to Silver Spring.

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[1] Length of new construction

[2] The maximum headway for the PLL is 4.6 minutes (13 trains/hour), but has been rounded to the nearest whole number.

[3] A retained cut is basically a cut and cover tunnel without the cover. Sections of the Red Line between Grosvenor and Rockville are in a retained cut.

***16th Street to south of Talbot Street: Section 2-2*:** After emerging from the portals near 16th Street, the line proceeds in a retained cut on the east side of the CSX tracks in a stacked box configuration, outbound tracks on top, inbound tracks on the bottom.

***Transition From South of Talbot Street to North of Talbot Street: Section 3-3*:** The line transitions from the stacked box configuration to a more typical side-by-side double track alignment and passes under the Talbot Street bridge over CSX on the east side of the CSX tracks. Some work would have to be performed on the Talbot Street bridge to accommodate the additional train tracks.

North of Talbot Street to Tunnel Under CSX Tracks: Section 4-4: North of Talbot Street, the line continues in the standard double-track configuration on the east side of the CSX tracks. The total length of the at-grade and retained cut section from the 16th Street tunnel exit to north of Talbot Street is 1900 feet.

***Tunnel Under CSX Tracks: Section 4A-4A*:** The line then descends to a 1100-foot-long mined tunnel under the CSX tracks, emerging on the west side of the CSX tracks just south of Brookville Road. The line passes under the Brookville Road bridge over CSX on the west side of the existing tracks. Some work would have to be performed on the highway bridge to accommodate the additional train tracks.

***North of Brookville Road to Beltway Crossing: Section 5-5*:** After passing under the Brookville Road bridge, the line proceeds 1100 feet either at-grade or in a retained cut in a side-by-side double track configuration on the west side of the CSX tracks to the site of the proposed Walter Reed Annex station, southwest of Montgomery Street. Departing the station site, the line continues for 1500 feet either at-grade or in a retained cut on the west side of the CSX tracks before crossing the Capital Beltway (I-495) on a new bridge parallel to the existing bridges for the CSX tracks and Seminary Road. Immediately following the bridge, the line turns west and continues on an aerial structure, passing over Linden Lane before descending to roughly the same grade as the Beltway itself and continuing on the north side of the Beltway. The total length of the bridge over the Beltway and subsequent aerial structure is 2000 feet.

***North of Capital Beltway to Rock Creek Crossing: Section G-G* and Typical Cross Section** (on bottom left of map): While traveling for a distance of 1000 feet at roughly the same grade as the Beltway or slightly higher in this section, the line is shown on WMATA maps as at-grade.

Rock Creek Crossing to West of Connecticut Avenue (MD 185): Section F-F and Section E-E: The line would cross Rock Creek on a 600 foot-long single-column structure supporting double-track on top, northwest of and parallel to the Beltway crossing of Rock Creek. The line would then return to the at-grade alignment shown in section G-G for a distance of 2500 feet before ascending to an aerial structure and the proposed station in the northwest quadrant of the Beltway interchange with Connecticut Avenue (MD 185). This station would be an aerial station on a bridge long enough to pass over the interchange ramps as well as Connecticut Avenue itself. Section E-E shows the aerial structure on either side of the proposed Connecticut Avenue station. The total length of this aerial structure is 3300 feet.

***Descent to Western Tunnel: Section D-D**:* After leaving the aerial section west of Connecticut Avenue, the line descends into a 1050-foot-long retained cut and enters a 1500-foot-long cut-and-cover tunnel parallel to the Beltway, on the north side just east of Cedar Lane.

Mined Tunnel Under Beltway to Medical Center Station: Section C-C: From the cut and cover on the north side of the Beltway, the line enters a mined tunnel that passes underneath the Beltway and turns to the southwest. The mined tunnel continues underneath the public right-of-way for Elmhirst Parkway and beneath parkland owned by the Commission before moving underneath the right-of-way for Cedar Lane. The line would then pass through an underground junction to join with the main branch of the Red Line north of the Medical Center station and continue into the station itself, which is approximately 85 feet underground. The total length of new mined tunnel is 3800 feet.

Potential Stations

Walter Reed Annex, located on the west side of the CSX tracks southwest of Montgomery Street. This station would be at-grade and adjacent to property owned by the U.S. Army. Currently, both walk and auto access to this site is only from the west, with the auto access via either Linden Lane or Brookville Road and then through the Walter Reed Annex.

Connecticut Avenue (MD 185) and the Capital Beltway (I-495), located in the northeast quadrant of the interchange (the area bounded by the on-ramp from northbound Connecticut Avenue to the westbound Beltway/Outer Loop). This station would be on an aerial structure. Auto and bus access to the station and an adjacent parking structure would be via the interchange ramps.

Cost Estimates

WMATA has estimated the capital cost of the PLL as described above at $616 million. Eliminating either of the two new stations would reduce the overall capital cost.

Operating costs depend primarily on the frequency of service along the PLL. Initial operation of the PLL at 6-minute headways (10 six-car trains per hour) would increase Metrorail annual operating costs by approximately $10 million for the increase in vehicle-hours of operation but would not require capital expenditure for new railcars. Year 2025 operation of the PLL at 5-minute headways (12 eight-car trains per hour) would increase annual operating costs by $10 million over base Red Line operations for the year 2025, again for the increase in vehicle-hours.

Future System Expansion

There are three potential system expansion points for the PLL. The first is from Silver Spring east to Takoma Park, Langley Park, College Park, and New Carrollton, generally following the route of the IPL. This extension could be done with either light rail or heavy rail. The second and third potential expansion points would branch off the PLL on the north side of the Beltway. On the west side, the line would branch off prior to the Cedar Lane portal and continue on the north side of the Beltway to Rock Spring Park (via

Grosvenor or a new transfer station at Pooks Hill Road), Montgomery Mall, and ultimately Tysons Corner in Virginia. On the east side, the line would branch off prior to the Linden Lane bridge crossing the Beltway and continue on the north side to Four Corners (via Forest Glen), White Oak/FDA, and then turn down New Hampshire Avenue (MD 650) to Langley Park, where it would join the IPL alignment to College Park and New Carrollton. Both of these lines would almost certainly have to be operated as heavy rail. No detailed engineering has been performed on any of the three potential expansions.

Surrounding/Adjacent Land Uses at Proposed PLL Stations

An analysis of job and household data for a half-mile radius around each new station on the Purple Line Loop yielded the following results[4]:

In 2025, the Connecticut Avenue/I-495 station is projected to serve approximately 620 single-family households, no multi-family households, and about 795 jobs. The Walter Reed Annex station is projected to serve about 445 single-family households, 615 multi-family households, and 2,990 jobs. These are roughly the same as current conditions, as little new development is planned for these two areas under current plans.

Tunnel/Rock Conditions

Although detailed geotechnical and feasibility studies will be needed in siting and designing the tunnels of the PLL, an initial examination of the information available from published maps indicates no obvious problem with tunneling through the rocks along the proposed tunnel alignments. Indeed, these same formations have already been tunneled through for Metro in other locations in Montgomery County. However, specific locations of important features, such as depth to bedrock, formation contacts, and the Rock Creek Shear Zone, are subject to mapping resolution limitations and error, and if of geotechnical concern, would have to be assessed and/or verified in the field.

[4] Data rounded to the nearest 5 jobs and households.

IV. Inner Purple Line

The term Inner Purple Line (IPL) generally refers to a rail transit corridor connecting the Bethesda, Silver Spring, and New Carrollton Metrorail stations. The western portion of this corridor, primarily referred to as the Georgetown Branch, is a 4.4-mile master-planned transitway between Bethesda and Silver Spring along historic freight rail alignments. This section has a long and detailed planning history. It is summarized in Attachment 2 of this report. In the following text, the terminology will be:

- "IPL" refers to the Inner Purple Line between Bethesda and Silver Spring, the Georgetown Branch section.

- "IPL East" refers to the Inner Purple Line between Silver Spring and New Carrollton

Inner Purple Line Description

The current design being evaluated for the IPL between Silver Spring and Bethesda includes the following features:

- A double-track light-rail system, except for a portion of single-track adjacent to the Metro Plaza Building northwest of Colesville Road in Silver Spring

- A continuous trail adjacent to the light-rail line, except for a section approximately 1500 feet in length near the CSX Metropolitan Branch junction where the trail follows residential streets in the Rosemary Hills community

- Stations at Bethesda (Metrorail Station), Chevy Chase Lake (Connecticut Avenue), West Silver Spring (Lyttonsville Place), Woodside (16th Street), and Silver Spring (Transit Center).

Inner Purple Line Performance and Impacts from DEIS

The 1996 Draft Environmental Impact Statement for the IPL (Georgetown Branch Transit/Trail) concluded that the primarily single-track light-rail/trail alternative would:

- Carry approximately 19,500 daily riders

- Save travelers 427,400 hours annually

- Have a capital cost of approximately $205M and a cost-effectiveness per new rider of $23.29.

Park and Planning staff have conducted a separate analysis using their forecasting methodology to provide a comparison with the Purple Line Loop. The figures used are somewhat different than those from the DEIS due to different methodologies and future

land use assumptions (this analysis uses a year 2025 jobs-and-household forecast, for example, while the DEIS used 2020).

The current capital cost estimate for the IPL is $371M, substantially higher than the 1996 DEIS estimate of $205M. The reasons for the increase are:

- $45M for escalation from 1995 dollars to 2003 dollars

- $100M associated with both the need to double-track the system to incorporate future operating plans for the IPL East extension and to increase the separation from CSX rails from the 18 feet acceptable to CSX in 1996 to the 25 feet now required by CSX

- $21M for locally preferred options described in the DEIS, including an overpass at Connecticut Avenue and underpass at the CSX Metropolitan Branch junction, and trail extensions through the Bethesda and Silver Spring stations

V. PURPLE LINE LOOP PERFORMANCE

Transportation and Mobility Impacts

This section presents the transportation and mobility impacts of the Purple Line Loop. Specifically, this analysis looked at network connectivity, travel demand for the new line including ridership by station, travel time savings, and access to stations. Section 6 compares the results of the PLL with the Inner Purple Line.

1. Demand Forecasting Methodology

The analysis of transportation and mobility impacts performed for this study is based on travel forecasts performed using the M-NCPPC TRAVEL/2 demand model. This analysis used MWCOG Round 6.2 cooperative land-use forecasts for the year 2025 as the primary input to project travel demand. TRAVEL/2 is a regional travel model encompassing the greater Washington-Baltimore region, but with greater network detail within Montgomery County. Travel forecasts from the model are for the three-hour evening peak period.

It should be noted that the level of analysis performed for this study can best be described as sketch-level planning, given the limited time available for study. Travel forecasts developed to support Major Investment Studies in the corridor, such as the Georgetown Branch DEIS and the Capital Beltway Corridor Study, should be more reliable. However, TRAVEL/2 allows for a relative comparison of the Purple Line alternatives using the same methodology.

A summary of key project assumptions is shown in Table 1.

Table 1: Travel Model Assumptions

Input	Assumption
Land Use	MWCOG Round 6.2 Cooperative Forecasts (2025)
Base Highway and Transit Network	2025 Regional Constrained Long-Range Plan network (without Georgetown Branch)
Headways*	Metrorail (PLL): 5 minutes Light Rail (IPL): 6 minutes
Average Transit Speeds, including station stops	Metrorail: 37 mph Light Rail: 29 mph
Station Parking	Unconstrained (no parking charge)
Fare Structure	No Change from Base – assumes average Metro fare based on distance
Drive Access	Uses TRAVEL/2 coding convention, drive access allowed at all new stops
Bus Service in the Corridor	CLRP network assumes 10 minutes headways for bus routes serving the Silver Spring transit center. J2 Bus headway increased to 20 minutes for the PLL and IPL forecasts.
* The one-minute difference in headways between IPL and PLL has a negligible effect on travel demand forecasts.	

2. Travel Patterns in the Corridor

Travel forecasts for the proposed Purple Line Loop provide an indication of the success of the line in terms of increasing transit ridership in the corridor, providing mobility benefits for new and existing transit riders, and supporting the economic viability of the communities connected by the transit line.

Future travel conditions are a function of both the underlying land use patterns and assumptions about the transportation network. According to the Round 6.2 forecasts, both population and employment are expected to increase for the area of Montgomery County inside of the Beltway. Between 2000 and 2025, employment is forecasted to increase by 17.5% and households are expected to increase by 15.3%. Information from the 1997 Census Update Survey reveals that 18.4% of Montgomery County residents work inside the Beltway, a total of about 85,000 workers.

The PLL would provide a critical link between the two legs of the Metrorail Red Line. As a result, it would serve both local and regional transit trips. Many of the riders would be expected to have at least one trip end within the portion of Montgomery County within the Beltway, but there would also be a number of potential through trips on the line – riders that begin and end their trips outside of the corridor.

3. Travel Time Savings

The PLL would average a speed of 37 miles per hour over 5.3 miles between Medical Center and Silver Spring for a total time of 8.6 minutes. Removing the Connecticut Avenue station would increase the average speed slightly to 39.3 miles per hour, decreasing the line time to 8.1 minutes. The current Metrorail time between Bethesda and Silver Spring is 35 minutes; the J2 bus travels between the two centers in 18 minutes.

Table 2 presents travel times for some typical origin-destination pairs for the Baseline and PLL scenarios. Travel times assume a walk connection to transit and include in-vehicle, walk, wait, and boarding times.

Table 2: Transit Times (in minutes) Between Selected Origin-Destination Pairs

Origin-Destination Pair	Base	With PLL
Bethesda to Silver Spring	34	17
Friendship Heights to Wheaton	41	33
Rockville to Takoma Park	50	40
Dupont Circle to Connecticut Ave (new station)	53	30

Council staff comments: Council staff asked M-NCPPC to calculate peak-period origin-destination transit travel times under the PLL option and the IPL

option. These origin-destination represent most types of trips from one side of the Red Line to the other.

Note that neither the IPL nor the PLL has a clear advantage over the other in terms of origin-destination travel time.

Table 2A: Transit Times (in minutes) Between Selected Origin-Destination Pairs

	PLL	IPL
Silver Spring to Rockville	*30.1*	*28.5*
Silver Spring to Friendship Heights	*22.1*	*24.9*
Silver Spring to Bethesda	*17.4*	*16.8*
	PLL	**IPL**
Takoma Park to Rockville	*36.8*	*35.2*
Takoma Park to Friendship Heights	*29.9*	*32.0*
Takoma Park to Bethesda	*24.0*	*24.3*
	PLL	**IPL**
Wheaton to Rockville	*34.1*	*34.2*
Wheaton to Friendship Heights	*33.3*	*37.8*
Wheaton to Bethesda	*28.6*	*28.8*
	PLL	**IPL**
*Langley Park to Rockville**	*39.6*	*40.3*
*Langley Park to Friendship Heights**	*31.6*	*31.0*
*Langley Park to Bethesda**	*27.0*	*22.9*

One measure of the benefits of the new line is the travel-time savings for transit riders. For transit trips that have a time savings with the PLL, the average time saved (as compared with the 2025 Baseline scenario) is 5.7 minutes. This amounts to a total time savings of 3,200 hours daily or 952,200 hours annually. For the PLL without the Connecticut Avenue station, time savings would be 3,030 hours daily or 900,200 hours annually.

4. Impact on Mode Shares

By improving transit service in the corridor, the PLL would attract some new work trips to transit causing a slight increase in the mode share for these trips. A number of factors affect mode share, including in-vehicle travel time, waiting time, walking time, auto availability, and characteristics of the station area such as density and walkability.

Table 3 shows transit mode shares for the Baseline and PLL scenarios. The PLL increases transit shares more in the Silver Spring policy area than for the county as a whole. This policy area includes the Lyttonsville/Walter Reed annex areas. Transit shares are projected to be greater for the home end of the trip, with the PLL increasing the share from 19.3% to 20.6% of work trips. Larger shifts in mode shares in this part of the county are difficult because there is already significant transit usage.

Table 3: Transit Mode Share for Work Trips

	Baseline		With PLL	
Area	**Work End**	**Home End**	**Work End**	**Home End**
Montgomery County	9.2%	14.1%	9.4%	14.4%
Policy Areas:				
Bethesda	18.0%	18.5%	18.8%	19.0%
Silver Spring	15.3%	19.3%	16.0%	20.6%

The mode shares shown above suggest that the PLL will primarily serve existing transit riders who are already using bus or rail service. The line may show a larger increase in boardings than in person-trips using transit. The person-trips are called “linked” trips because all of the segments of a transit trips are linked together. Boardings are referred to as “unlinked” trips. For example, a transit passenger who takes a bus to the PLL in Silver Spring, transfers to the Red Line in the direction of Shady Grove, and then walks to a job in Rockville would have three transit boardings (1 on bus, 2 on rail), but only one linked trip. On a regional basis, when compared with the Baseline scenario, the PLL alternative would increase linked transit trips by 1100 in the evening peak period, or 3850 daily trips. If the Connecticut Avenue station were not included in the PLL, there would be fewer new transit trips, about 1060 in the evening peak period, or 3725 daily trips.

5. Projected Ridership on the Purple Line Loop

Table 4 shows the projected evening peak-period ridership for the PLL, with and without the Connecticut Avenue station. The PLL would carry 9,700 evening peak-period passengers with the Connecticut Avenue station and 8,470 passengers without the Connecticut Avenue station.

Because the PLL would be operated as a loop, the segment between the Medical Center and Silver Spring does not reflect the entire ridership of the loop. However, riders who exit and board on this segment are counted as ridership for the new segment of the loop. There may be some through trips that are also using the line but are not shown in this table. For example, a trip from Bethesda to Takoma would use the loop, but would not board or exit along the new segment.

Ridership on the entire Red Line including the PLL includes about 1,500 new boardings not accounted for by the 9,700 riders on the new PLL segment. However, there are roughly the same number, about 1,500 boardings, that are transfers from the PLL to the Red Line. These riders are counted as being on both the Red Line (outside of the PLL) and on the PLL.

Table 4: Evening Peak-Period Ridership for PLL Stations

	With Conn. Ave Station		Without Conn. Ave Station	
	Exits	**Boards**	**Exits**	**Boards**
Medical Center	1,240	2,700	1,630	2,610
Connecticut Ave	1,830	450	n/a	n/a
Walter Reed	1,480	470	1,720	520
Silver Spring	5,150	3,220	5,120	3,060
Evening Peak	**9,700**	**6,850**	**8,470**	**6,190**
Daily Riders	**34,000**		**29,700**	
Annual Riders	**10.10 million**		**8.82 million**	

The evening peak period ridership figures indicate the directionality of trips, with exits representing the home end of trips, and boardings representing the work end of trips in the evening peak period. The transit volumes by segment show a directional imbalance, with heavier flows from west to east. The maximum load point would be just east of Medical Center, with transit volumes of about 6900 eastbound and 2600 westbound.

Projections of daily and annual ridership have been developed by factoring evening peak-period totals. The peak-to-daily factor is a key assumption that affects the daily and annual evaluation measures. There is a range of values for existing Metro stations to convert evening peak period to daily trips, depending on the level of mid-day and non-work trips. The system average is about 3.0, but values can range from 2.6 for New Carrollton to 3.8 for Dupont Circle. To be consistent with the Georgetown Branch DEIS, a peak-to-daily factor of 3.5 was used in this study. A daily-to-annual factor of 297 was also used to generate annual trip estimates.

If the PLL were extended from Silver Spring to New Carrollton, ridership would significantly increase. Evening peak period riders on the entire line from Medical Center to New Carrollton are projected to be 20,500, or about 72,000 daily trips. The Medical Center to Silver Spring segment would increase from 9,700 to 11,300 evening peak period riders with the line extended to New Carrollton.

6. Access and Egress Modes

The access and egress modes of passengers boarding and alighting at the new stations on the PLL were analyzed as a transportation impact. The travel forecasts conducted for this study assumed that there would be unconstrained parking for “park & ride” trips. Other riders would arrive at the stations as auto passengers, or “kiss & ride”. The forecasts indicate that if drive-access facilities were available, the Connecticut Avenue station would be primarily accessed by automobile, at 67% of the trips. Walk and bus access are expected to have about equal shares of the riders. Walk access to a Connecticut Avenue station would depend on proper facilities for pedestrians. Some

existing Metrorail stations that are suburban and isolated in nature do attract walk-access trips. For example, Greenbelt (9.5%), Dunn Loring (12%), and Twinbrook (17%) do not have high residential densities near the station. Bus transfers at the Connecticut Avenue station would depend on routing existing L7 and L8 Connecticut Avenue buses with a direct connection to the new station.

The proposed Walter Reed station would have lower percentages of drive-access trips. The station would have a majority of trips accessing the station by walking. Bus access to the area would be minimal, currently served only by the Ride-On Route 4.

Table 5: 2025 Evening Peak Period Access/Egress Modes for New Stations

	Access/Egress Modes		
STATION	**Drive**	**Walk**	**Bus Transfer**
Connecticut Ave	67%	19%	14%
Walter Reed	43%	54%	4%

7. Highway Traffic Impact

The PLL would have a minimal impact on vehicle miles traveled (VMT). Countywide, the PLL does not change VMT compared with the Baseline scenario. For the section of the county inside the beltway, the PLL reduces VMT by less than 0.1%. There is a very slight 0.2% increase in VMT in the Kensington/Wheaton area, probably as a result of the new park-and-ride trips. Traffic volumes on the Capital Beltway do not show any reduction due to the new transit line. There would likely be local traffic impacts around new stations due to transit riders arriving by automobile.

Purple Line Loop Natural Environmental Impacts

Any transportation facility requiring Federal funds must go through an environmental impact statement. M-NCPPC has a Geographic Information System (GIS) that has information for a number of elements considered as sensitive areas. This is not intended to replace the millions of dollars that will ultimately have to go into detailed studies, but it does provide a preview of areas that may require avoidance, minimization, or mitigation. For the purposes of consistency, the data to create the chart below come from GIS. The chart did not use data from the draft EIS for the Georgetown Branch Trolley. **A map showing critical environmental features is attached to this memorandum.**

The best thinking on the proposed Purple Line Loop is that after following the CSX right-of-way to I-495, it will generally be on the north side of the existing edge of paving but still within SHA's easement for I-495. Staff looked at an area 50 feet from the edge of paving. **Actual impacts would be substantially reduced if the line were supported on piers above the grade of I-495.**

Overall, the PLL will have much greater impacts on the natural environment than the IPL. Its alignment adjacent to Rock Creek Park means it will, by its nature, produce negative effects that will be difficult to avoid.

There are several cautions about the following information. This is a planning level analysis and is based on many simplifying assumptions and should be used as a preliminary screening method. The results are less precise than would be determined from individual project engineering studies and extensive environmental fieldwork. Limitations include the following:

- The locations and extent impact were determined by a 50-foot right-of-way. Areas of disturbance could change significantly as the design process reduces impacts through relocation and design and construction methods.

- Steep slopes are generally not accounted for.

- The right-of-way does not capture project components such as storm water management facilities and staging areas, which create additional areas of disturbance.

- The extent of the environmental features is often more extensive than the indicators available in the GIS. Therefore this tool should be used to compare alignments rather to evaluate a single alignment.

These limitations are acceptable for a planning level review, because the measurements are primarily to be used in relative terms rather than as absolutes. They are a useful composite indicator of relative resource disturbance among these alternatives.

A definition of the terms used in the Environmental Features is in Attachment 3. Note that the PLL assumes 50 feet of disturbance outside the current Beltway pavement. This could be reduced with structures.

Table 6: Environmental Features

Environmental Features (Shown in acres, except as noted)	IPL	PLL
Total Acres of Surface Right-of-Way (not tunnel areas)	27.4	21.5
Wetlands	0.1	2.8
Floodplain	0.9	6.1
Number of Stream Crossings	2	5
Stream Buffers	4.4	7.6
Park Property	0	7.0
Forest	0.9	9.5
Significant Forest (100 acres or more)	0.1	6.3
Interior Forest Habitat (300 feet from edge of forest)	0	5.5
Number of Buildings	2	0
Number of Private Home Lots	0	1
Number of Archeology Sites	6	2
Number of Historic Districts	0	0
Linear Feet of ROW Adjacent to Park Property	1199	6945

Community Impacts of the PLL

A number of area master plans contain references to the Georgetown Branch Trolley/ Trail (now Inner Purple Line western portion), providing guidance to the access, land use, and other features, all supporting this project. Some considered other options. The North and West Silver Spring Master Plan (August 2000) recommends the implementation of the Georgetown Branch Transitway between Silver Spring and Bethesda to reduce demand along East-West Highway. However the Plan also says that "This Master Plan's proposed land uses and transportation network do not preclude any of the transit modes or alignments which are currently proposed in the CBMIS (The Capital Beltway Major Investment Study)." Transit access to the two major Central Business Districts is not negatively affected by the PLL, so it generally carries out the master plan goals of improving transit use.

Probably the largest change from current plans is in the station locations. The Georgetown Branch Master Plan Amendment specifically recommends a transitway and trail along the Georgetown Branch alignment between Bethesda and Silver Spring. The

plan recommends a light-rail line with up to eight stations total, six of them being neighborhood stations in between the terminal stations in the Bethesda and Silver Spring CBDs. It recommends that there be a minimum of five stations built initially: Bethesda CBD, Connecticut Avenue/Chevy Chase Lake, Lyttonsville, Spring Street and Silver Spring CBD. The Plan also recommends three additional stations for future consideration: East-West Highway, Jones Mill Road and Woodside/16th Street. The current Inner Purple Line proposal is consistent with these recommendations and includes five stations. Additional stations could be added in the future.

By comparison, the PLL includes only two new middle stations to serve neighborhoods. However, they are in new locations: the Connecticut Avenue/Chevy Chase Lake station is moved north to Beach Drive where it is no longer near the Chevy Chase Lake commercial neighborhood and is no longer a "walk-to" station. It would become a park and ride station with a parking garage.

The Lyttonsville Road station is moved northeast to the campus of the Walter Reed Army Institute for Research where there are security issues for the campus. There are also access issues for the surrounding neighborhoods due to distance and the fact that access may be limited by Army security. This station would be better located on Linden Lane where the community has access and where it could benefit the reuse of the historic National Park Seminary property. However, the latter site also poses acquisition issues since it is the site of an Army warehouse and salt dome. To date, the Army has not been willing to include the property in the National Park Seminary sale even though it would add significantly to the economic feasibility of restoring and reusing the National Park Seminary site. Without a new site and new warehouse, the Army will likely not be interested in selling or leasing the site.

On the positive side, a station at Linden Lane could increase the land use options and economic feasibility of reuse of the National Park Seminary historic resource.

With the PLL, the 16th Street Station is eliminated. In recent Inner Purple Line studies, the 16th Street station took the place of the one at Spring Street. The PLL would include neither station.

Several master plans may need to be amended to reflect a substitution of the PLL for the IPL alignment.

The alignment that better provides transit to the local neighborhoods also has the greater potential impact on those neighborhoods in terms of views and noise. The necessary community impact mitigation would therefore be greater for the Inner Purple Line which best serves the local neighborhoods than it would be for the PLL alignment.

The PLL would remove the need for a maintenance yard in the Lyttonsville area. The privately-owned land could be used for other industrial uses consistent with the master plan recommendations for that area. The property owned by M-NCPPC at Lyttonsville Road/Lyttonsville Place could be retained for public use such as trailhead parking for the Capital Crescent Trail.

Noise, Vibration and Visual Impacts

It is likely that the PLL will have some negative effects on homes near the alignment. The use of the CSX and Capital Beltway right-of-way means that no homes are directly adjacent to the alignment. However, depending on the height of the structures and location within the right-of-way, homes in some communities may have negative noise, vibration or visual impacts. Only further detailed study could quantify this topic, and the necessary information is not available at this time.

Many of the communities that could be directly affected already have noise walls designed to mitigate traffic noise generated from vehicles on the road surface and not from a higher level. Therefore, the visibility and proximity of an elevated heavy-rail line would be an issue. The neighborhoods that should be evaluated are:

- Forest Glen Park on the south side of the Beltway, particularly Newcastle Avenue
- Jones Mill Road on the south side of the Beltway, particularly Parkview Road
- Kensington Parkway, particularly Glenmoor Drive on both the north and south sides of the Beltway
- Stoneybrook Road near the Mormon Temple on the north side, particularly Hill Street and Campbell Drive

VI. EVALUATION AND COMPARISON OF PURPLE LINE LOOP AND INNER PURPLE LINE

This section compares the PLL and IPL and describes the pertinent findings summarized in Section I of this memorandum.

Benefits of PLL

Staff finds three distinct advantages to the PLL proposal that would make it appealing for further study if they were not outweighed by other factors.

1. PLL Addresses Known Concerns with IPL

Current project planning efforts for the IPL have identified a number of concerns that will be addressed and resolved in the SDEIS and FEIS documentation for the IPL, but would be eliminated if the IPL were functionally replaced by the PLL:

- Issues associated with introduction of the light-rail mode:
  - The yard and shop required along the alignment
  - The short segment of single-track operation at the Metro Plaza Building
  - Need for additional cross-sectional width through the Silver Spring Transit Center
  - Location of tail-tracks at Silver Spring
- Issues associated with the introduction of transit vehicles in the Georgetown Branch right-of-way
  - Mitigation of indirect adverse impacts to adjacent property owners, primarily related to noise/vibration and visual effects
  - Concerns regarding a degraded experience for trail users, particularly in the tunnel under the Apex and Air Rights Buildings in Bethesda
  - Opposition by adjacent property owners, notably the Columbia Country Club

2. PLL Attracts More New Transit Riders

The PLL is projected to attract more new transit riders than the IPL. There are two primary factors that make the PLL more attractive to transit users:

- Slightly higher speeds than the IPL and average of 37 miles per hour compared with 29 miles per hour.
- A reduced need for transfers compared with the IPL. There are more “one-seat rides” with the PLL because it connects directly with the Red Line. The IPL would have a greater number of trips that would transfer at least once between the Purple Line and the Red Line.

The cost-effectiveness calculations included in this section use both new riders (linked) and total riders (unlinked) trips. Total riders gives an indication of the number of users of the new line but this number includes some riders who could take bus or rail under the Baseline scenario. New riders only included those person trips that shifted from an auto mode to a transit mode.

3. PLL Enhances Metrorail Operations Efficiency and Flexibility

There are operating efficiencies in having a Purple Line Loop.

- It would use WMATA's current rolling stock.
- It could start with no additional cars.
- It would not require a new maintenance yard.
- It would provide more options for Metrorail operators to switch trains to different locations in the event of an emergency.
- It would even be possible to bypass downtown and still serve many stations should an emergency require it.
- It would be a "one seat" ride from Silver Spring to Bethesda and all Redline stations to the south.
- In contrast, the **Inner Purple Line** would: add a new technology to the region with all new cars, would require a new maintenance yard, a unique labor force and the development of operating rules for the trolley.

Disadvantages Of PLL

Despite three substantial benefits of PLL described above, staff finds many more concerns with the PLL that form the basis for the recommendation not to introduce the PLL into the current state study process.

1. Federal Study Process Delays

Staff understands from our experience and discussions with MTA that if the PLL is incorporated into the current Purple Line EIS process, it will take approximately two years of data collection, alternatives development, and engineering to bring the PLL to a common level of detail with the IPL. If these efforts result in identifying major environmental issues, the outcome will take much more time and it may be that the Inner Purple Line is the preferred alternative from the perspective of the Federal approval agencies.

FTA Criteria

The Federal Transit Administration (FTA) evaluates new transit projects making its decisions on those projects, with the selected ones obtaining Full Funding Grant Agreements and thereafter appropriations. Specifically they look at mobility improvements, environmental benefits, operating efficiencies, cost effectiveness and supporting land use. The level of local support, as reflected in funds available, and readiness to implement are also considered.

Perhaps the most heavily-weighted factor is **cost effectiveness**. In general terms, cost effectiveness is the cost of the proposed new start (annualized incremental capital plus annualized operating cost) per unit of benefit. The FTA is changing its definition of "benefit". In the last authorization process, FTA used new transit trips as its measure of benefit. They are changing that to total "user benefits" which is calculating the time saving by all users of the new project as well as time saved by roadway users from reduced congestion. As this new measure is still somewhat under development, no one can yet perform these calculations. M-NCPPC staff has provided the old measure of cost per new rider, while recognizing that it does not capture the complexity of the pending FTA criteria.

Staff is using our in-house transportation forecasting computer model to make estimates of ridership and user benefit. It has not been specifically calibrated for this area as would be done for an analysis with more time. Staff is confident, however, in the model's ability to calculate the relative differences of alternate routes. Readers must recognize that the calculation of user benefits will change when the new FTA methodology is available for use. In the absence of the actual user benefit calculation that FTA will use (and not knowing what percentage of the costs will be paid by non-Federal sources for either alignment), staff cannot be certain of each alternative's relative competitiveness for FTA approval. Staff can only make a quick-response assessment on the basis of the information available.

Certainly, the project with the most benefits per dollar of cost has the higher probability of being recommended by FTA. On the comparison made by M-NCPPC, the IPL is more cost effective. The Purple Line Loop's increased ridership, due to increased speed, and time saved by travelers over light rail is not enough to overcome the increase in cost as compared to the IPL.

One proxy for **environmental benefits** is new transit riders; the other is changes to total vehicle miles of travel. Both these measure are related to reduced air pollution. The PLL has more new transit riders and reduces vehicle miles of travel more than the IPL.

On the basis of **land use**, the IPL would rate better. There are certainly no differences in land use in either the Silver Spring CBD or Bethesda CBD, which have stations in the same locations under all routes. The difference is between those major centers. The master plans for the areas covering Connecticut Avenue and Lyttonsville anticipate light rail. There would be one less station on the PLL and the relocation of two intermediate stops would be required. The Connecticut Avenue stop would move to an elevated spot above I-495. Transit-oriented development at this location would be highly unlikely. The Purple Line Loop would replace the Lyttonsville stop to a location along the CSX tracks south of Linden Lane. There would have to be significant zoning changes in the area to take advantage to the accessibility that Metrorail would bring. How much acceptance or resistance there would be for such changes is unknown. The light rail alignment also had a stop at 16th Street to support the existing residential

high rises nearby, with the possibility of a future stop at Spring Street. These stops are absent in the PLL proposal.

Mobility improvements look at user benefits, service to low-income households and service to employment. The only measure available is the proxy for user benefits, which is discussed below as part of cost effectiveness.

Readiness to go to construction is not a stated FTA criterion, but it may have an influence on their decision-making process. As an outside date, the authorization is only good for six years, the maximum expected life of the new Surface Transportation Act. If the project was not approved by FTA and a Full Funding Grant Agreement not signed in that period, it would have to go for reauthorization. The IPL can have a final Environmental Impact Statement in 2003. Adding the Purple Line Loop as an alternative would add 18 to 24 months to the EIS process.

If the PLL is most locally desirable, the most effective means of ensuring the success of the PLL would be to begin with a new DEIS, including Federal agency concurrence on a newly defined Purpose and Need that would focus on the operational benefits of connecting the sides of the Red Line with Metrorail service. Returning to the Purpose and Need statement would mean that circumferential rail in this corridor would be set back by about four years.

2. Staff Critique of WMATA Capital Cost Estimate

M-NCPPC staff finds that the $616M capital cost estimate provided on January 22, 2003, by WMATA for the PLL is not appropriate for comparison to the $371M capital cost estimate provided by MTA for the IPL. Staff suggests that $746M is a more appropriate capital cost estimate for the PLL. The difference of $130M in PLL estimates is attributable to the following items:

- $35M for aerial structure in locations where WMATA presumed an at-grade alignment
- $14M for a parking garage associated with the Connecticut Avenue station
- $81M for levels of project contingency more appropriate for project planning analyses than assumed by WMATA design engineers.

Each of these items is discussed in greater detail below.

Aerial versus At-grade Alignment

The PLL follows the Capital Beltway alignment for approximately two miles. WMATA has not yet developed an explicit profile (i.e., an assessment of the grades and vertical curves) to accompany the concept plan, but has assumed that three segments, totaling approximately 4,550 linear feet, can be built at

grade adjacent to the Capital Beltway. Staff disagrees and concludes that all 4,550 feet will require aerial structure, for the following reasons.

- The easternmost of the three segments is between Linden Lane and Rock Creek/Beach Drive. WMATA assumes the PLL will be above Linden Lane and will transition from aerial to at-grade structure approximately 300 feet west of Linden Lane. Linden Lane has an elevation of 282 feet at the north end of the Capital Beltway, so a Metrorail crossing above Linden Lane would need to have an elevation of at least 295 feet. At the Rock Creek bridge, 2,000 feet to the west, the Capital Beltway has an elevation of 225 feet. The 70-foot difference in elevation along 2,000 linear feet is an average grade of 3.5%. WMATA's maximum grade for Metrorail is 4.0%. Therefore, even discounting the complicating effects of developing the maximum grade through vertical curvature, staff finds that the entire segment between Linden Lane and Rock Creek would need to be on aerial structure as the PLL "chases the grade" of the Capital Beltway into the Rock Creek stream valley.

- The central of the three at-grade segments is a 2500-foot segment between the Rock Creek/Beach Drive crossing and the Connecticut Avenue crossing. Within this segment, Rock Creek is immediately adjacent to the Capital Beltway, with typically 60 feet between the edge of current pavement and the stream bank, a result of stream channel relocation when the Capital Beltway was constructed in the 1960s. In this section, staff proposes that the stream channel location and other associated environmental constraints would dictate PLL construction on aerial structure.

- The westernmost of the three at-grade segments is a 1,050-foot segment that is part of the transition between the aerial structure above Connecticut Avenue crossing and the tunnel beneath the Capital Beltway and Locust Hills community. At the eastern end of this segment, the Capital Beltway is located on a berm approximately 40 feet above the Rock Creek stream valley. Again, staff proposes that in consideration of the environmental resources in the stream valley, aerial construction would be warranted rather than lateral extension of the berm up to 40 feet above the stream valley.

The WMATA cost estimate of $616M includes $347M of line profile costs disaggregated by four profile types; at-grade/retained cut, aerial, cut and cover, and mined tunnel. Attachment 5 demonstrates that shifting the 4,550 feet described above from at-grade/retained cut to aerial structure would increase the capital cost by approximately $35M. The unit costs in Attachment 5 reflect WMATA's total cost estimate for each profile type divided by mileage estimated by WMATA for each type. WMATA developed their cost estimates based on the recently completed Blue Line extension to Largo. The resulting unit cost estimates are generally consistent with WMATA planning guidelines. The $103M per mile for mined tunnel costs is a bit lower than might otherwise be expected,

but conversely, the average costs per mile for the other three profile types are a bit higher than might otherwise be expected.

Parking Garage at Connecticut Avenue Station

The $616M PLL estimate provided by WMATA includes an aerial station at Connecticut Avenue, but with inconsistent presentation regarding long-term parking capacity. During development of the "P3" alignment for the State's Capital Beltway Corridor Study, WMATA developed conceptual plans for a 2,000-space garage at Connecticut Avenue. While PLL discussions have suggested that WMATA staff still proposes park-and-ride capacity at the Connecticut Avenue station, none is explicitly included in written materials provided by WMATA.

The travel demand forecasts prepared for this memorandum assumed unconstrained parking at Connecticut Avenue and indicated that approximately two-thirds of the Connecticut Avenue station patrons would arrive via auto (either park-and-ride or kiss-and-ride). Historically, M-NCPPC staff has supported adjacent community efforts to reduce Metrorail park-and-ride garage sizes. In considering all the above factors, staff recommends that some park-and-ride capacity should have been included in the WMATA concept. Using WMATA cost estimate guidelines, staff estimates that a 1,000-space parking structure (a compromise between the 2,000-space concept and no parking at all) would cost approximately $14M.

Contingency

The $616M PL cost estimate provided by WMATA indicates that a 7% contingency is included. This level of contingency may be appropriate at the design stage, but is lower than typically assumed in project planning. For comparison purposes, the $371M cost estimate prepared by MTA for the IPL includes contingency factors for independent cost elements that range from 5% to 40%, with a "weighted average" of 22%. Staff recommends that a 20% contingency factor for all costs is appropriate at this level of project planning, where many design and mitigation elements remain uncertain or unknown.

<u>Council staff comments</u>: Either the 20% contingency factor is too low for the PLL cost, or the 22% "weighted average" contingency factor for the IPL is too high. First of all, MTA has nearly completed preliminary engineering, and so there are fewer unknowns that comprise the need for contingency funds. The IPL contingency percentage should be lower than the PLL contingency for this reason alone.

Secondly, the PLL includes a larger portion of elements that warrant a high contingency percentages. Note the contingency percentages currently in MTA's $371 million estimate for the IPL:

Civil/Structural	***40%***
Utilities	***40%***
Stations	***40%***
Yard & Shop	***40%***
Trackwork	***35%***
Signals	***20%***
Traction Power	***20%***
Communications	***5%***
Fare Collection	***5%***
Mechanical/Electrical	***40%***
Vehicles	***5%***
Environmental Mitigation	***40%***

While most of the IPL is at grade, two-thirds of the PLL's constructed length is either in aerial structure or a mined tunnel, which carry among the heaviest contingencies (40%). One of the lightest contingencies is for rail vehicles (5%), but the PLL estimate does not assume any vehicle purchases.

Thirdly, WMATA based its unit cost estimates on the Largo extension of the Blue Line. However, the Largo extension will sit in a shallow tunnel built by cut-and-cover construction, not the mined tunnel construction that will be required for 1.16 miles of its length. Deep tunnel construction involves more uncertainty, and so usually is accompanied by a higher contingency factor.

Finally, among the reasons for MTA's high contingency percentage is the uncertainty vis-à-vis what will be required for construction along the CSX Metropolitan Branch right-of-way. But the PLL alignment runs along the CSX right-of-way more than the IPL does.

In summary, therefore, either the PLL contingency is underestimated, or the IPL contingency is overestimated, or both. The cost differential between these two options is probably $50-100 million greater than has been estimated by the Planning staff.

Table 7 provides a summary of the WMATA and M-NCPPC capital cost estimates for the PLL. Since the Connecticut Avenue station is controversial, the M-NCPPC analysis reflects ridership and capital costs for options both "with Connecticut Avenue station" and "without Connecticut Avenue station". As indicated by numbers outlined by bold borders, M-NCPPC estimates that the PLL cost estimate is $746M with the Connecticut Avenue station and $674M without the Connecticut Avenue station.

Certainly the differences in costs between the Purple Line Loop and the Inner Purple Line are not inconsequential. WMATA's preliminary estimate of cost (which does not include adequate amounts for contingences, parking at

Connecticut Avenue or the cost of a trail between Silver Spring and Bethesda) is $246 million above the IPL. Most projects that get funding from FTA are matched dollar for dollar with local funds. This project will need an additional $123 million of scarce local funds.

At the risk of going beyond the mandate given to staff, we would offer the following. If the purpose of the Purple Line Loop is to avoid nearby houses, give more breathing space to the Capital Crescent Trail and avoid all noise and visual impacts to some adjacent properties, it may be effective to cut and cover portions of the light rail on the Georgetown Branch right-of-way between Bethesda and Connecticut Avenue. This might increased the estimated $370 million cost by 10%-20%.

Council staff comments: ***MTA and its consultants have explored the additional cost of placing portions of the IPL in a shallow concrete box tunnel using cut-and-cover construction, with the trail situated on top. The additional costs of cut-and-cover construction have been estimated for the following sections:***

Through the Columbia Country Club	***$10,000,000***
From the Columbia Country Club to East-West Highway	***$ 9,600,000***
From East-West Highway to the Air Rights Building Garage	***$15,400,000***

3. Cost Effectiveness

As described above, cost-effectiveness has been one of the key measures used by FTA to evaluate New Starts projects. Cost-effectiveness of a proposed major investment is measured in terms of its added benefits and added costs when compared to lower cost options. The FTA guidelines for cost-effectiveness have changed significantly since the Georgetown Branch DEIS was completed in 1996. At the time that the DEIS was completed, the cost-effectiveness formula included was calculated as follows:

$$\text{C.E. Index} = \frac{\text{Capital Costs + O\&M Costs – Travel Time Savings}}{\text{New Transit Riders}}$$

Where:

Capital Costs = change in annualized capital costs compared with Base
O & M Costs = change in operating and maintenance costs compared with Base
Travel Time Savings = value of travel time savings for existing (Baseline) riders annually
New Transit Riders = attraction of new transit riders annually
The DEIS compares the “Build” scenario with TSM and No-Build scenarios. The TSM scenario is the Transportation System Management alternative, designed to achieve the goals of the project without a major investment in new facilities. The Baseline scenario used in the PLL analysis assumes a level of service between the No-Build and TSM alternatives in the DEIS, because it includes significant bus service improvements in the corridor already included in the CLRP.
Current FTA guidelines are being updated to include Hours of Transportation System User Benefits. This measure was not used in this study because the methodology has

not been fully adopted in the region at this time. Travel time savings for existing riders does provide an indication of the relative levels of benefits for transit riders who would already be using transit, but would have reduced travel times with the PLL.

The following table shows the cost-effectiveness for the PLL alternative, with and without the Connecticut Avenue station, as compared with the IPL. The figures shown for the IPL are based on the latest available costs and ridership forecasts developed by M-NCPPC for this study. The table presents the annual costs (capital and O&M), annual ridership (total and new riders), and time savings (in hours and dollars). A value of about $11.70/hour was used to convert time savings into dollars, the same value used in the DEIS.

Three cost-effectiveness indices are presented:

- **Cost per New Rider**: the cost-effectiveness as calculated in the Georgetown Branch DEIS.
- **Cost per Total Rider**: Annual costs (with value of time savings subtracted out) are divided by Annual Total Riders (boardings).
- **Cost per Hour Saved**: Annual costs (with value of time savings subtracted out) are divided by Annual Travel Time Savings (in hours).

Table 8: Cost-Effectiveness Indices Using Revised Purple Line Loop Costs from M-NCPPC

	PLL	PLL (No Conn)	IPL
Costs (000's):			
Total Capital	746,285	673,706	371,000
Annualized Capital Costs	55,693	50,277	30,053
Annual O & M	10,000	10,000	5,800
Total Annual Costs	65,693	60,277	35,853
Ridership:			
Total Daily Riders	34,000	29,700	29,000
Annual Daily Riders (thousands)	10,098	8,821	8,613
Daily New Riders	3,850	3,725	2,900
Annual New Riders (thousands)	1,143	1,106	861
Percent of Riders that are New	11.3%	12.5%	10.0%
Time Savings:			
Annual Time Savings (hours) for Base Riders	952,200	900,207	702,700
Value of Time Saved ($ thousands)	11,131	10,523	8,215
Cost-Effectiveness:			
Cost Per New Rider vs Baseline	$47.72	$44.97	$32.09
Cost Per Total Riders vs Baseline	$5.40	$5.64	$3.21
Cost per Hour Saved	$68.99	$66.96	$51.02

The cost-effectiveness measures show that the PLL is not as cost-effective as the IPL. The higher number of new riders on the PLL does not offset the much higher costs

compared with the IPL. The resulting cost per new rider is $48 for the PLL versus $32 for the IPL. Cost per hour saved shows the same relative performance with greater time savings for the PLL not offset by much higher costs. The PLL has $69 per hour saved as compared with $51 per hour saved for the IPL.

4. Concerns Regarding Design Criteria

Because the PLL proposal has been developed by WMATA engineers rather than through the National Environmental Policy Act (NEPA) process, minor changes to several critical design criteria that the MTA staff have spent years addressing could have substantial impacts on costs or delays. In addition to NEPA concerns, other WMATA assumptions may need to be changed. For example, WMATA has assumed they can maintain their minimum 18-foot separation from CSX. CSX has informed MTA that this number has been increased to 25 feet. MTA has reflected the additional 7-foot requirement in the IPL conceptual designs.

5. Capital Crescent Trail Completion

The completion of the Capital Crescent Trail will be necessary as a separate project with the PLL and will have some cost associated with it that has not been determined. Completing the trail is included in the costs for the IPL.

Council staff comments: ***MTA estimates the cost of constructing the Capital Crescent Trail without the parallel light rail to be $25,000,000. This assumes a trail bridge over Connecticut Avenue, a trail underpass under Jones Mill Road, and other elements that the trail would have as part of the IPL.***

It is correct not to include this $25,000,000 cost in the FTA cost-effectiveness criteria for the PLL, since in this case the trail would be a separate project. However, it should be of special concern of State and local elected officials, since it will be State and local funds that will pick up the full tab.

Another element included in the IPL that is not included in the PLL is the master-planned southern entrance to the Bethesda Metrorail Station. This entrance, comprises four high-speed elevators connecting three levels: Wisconsin Avenue at Elm Street (the Bethesda United Artists theater complex), the Capital Crescent Trail in the tunnel under the Apex Building and at the same grade as Bethesda Row, and a new mezzanine at the south end of the Metro platform. The entrance was included in the Bethesda Sector Plan in the 1970s, more than a decade before the Georgetown Branch Master Plan Amendment was adopted. MTA estimates its cost at $26,000,000. This, too, is a cost that will eventually be borne, with or without the IPL.

6. Other Environmental Impacts

Staff findings on the PLL identify specific concerns regarding environmental impacts. In summary, the natural environmental impacts of the PLL are estimated to be greater than those of the IPL. These are described in greater detail in the context of Federal

study delays above. In summary, the natural environmental impacts of the PLL are estimated to be greater than those of the IPL.

7. Reduced Metrorail Service to Northern Montgomery County

The most significant attribute of the Purple Line Loop is the one-seat ride to the Bethesda and Silver Spring CBDs and on to stations south of the CBDs. That attribute will, however, limit the theoretical capacity of stations north of Silver Spring and north of the Medical Center Station. The maximum line capacity of the Metrorail system is 26 trains an hour with eight-car trains. Today, north of Silver Spring and Grosvenor, six-car trains are in use at a pace of ten cars per hour. By 2025, it is anticipated that WMATA could use its full capacity of 26 trains per hour. With the Purple Line Loop, however, half of the trains arriving at Medical Center will come from Silver Spring, the other half from Grosvenor and north. If demands were even, that would mean that a maximum of 13 trains per hour could come from north with the other 13 trains coming from Silver Spring.

Certainly, with the PLL capacity north of Grosvenor could still be increased slightly from today's service of ten trains per hour. With the Purple Line Loop, ridership capacity could be increased by about 75%, with additional cars per trains and more trains per hour. In any case, selection of PLL means that service north of Medical Center and Silver Spring would be at substantially lower levels than it would be with IPL; in essence, perpetuating the "turn back" service.

Findings That Favor Neither IPL nor PLL

1. Feasibility

PLL is feasible to construct from an engineering perspective using the WMATA staff assumptions. The design uses some unusual structures, but there is public land or land from CSX that would allow for construction, and there are no physical constrains that could not be overcome. The DEIS has already resulted in the same finding for the IPL.

2. Effect on Purple Line Extension to New Carrollton

If there is Metrorail between Bethesda and Silver Spring, what happens to the connection from Silver Spring to all points east: Langley Park, College Park and New Carrollton? No matter what technology is used going east from Silver Spring, it may not be prejudiced by the PLL.

A continuation of Metrorail would be challenging. Physically, the rail line runs between the CSX tracks and space for a Y connection going east would be needed. Financially the costs would be very high. Metrorail needs to be always grade-separated and a lot of that separation would be from being underground. This would be a very expensive project, particularly on the basis of cost effectiveness. Getting light rail out of the Silver Spring CBD and through Takoma Park would have some similar challenges.

If the Metrorail Purple Line Loop leads to a light rail connection in Silver Spring, there will be a time added to trips for a transfer, but that would be offset somewhat by reduced travel time from Silver Spring to Bethesda. The increased total travel time and need to transfer will lower ridership projections and make the light-rail extension less cost effective.

<u>Council staff comments</u>: The effect of the two options on the Purple Line Extension to New Carrollton is not neutral: the PLL is decidedly worse. MTA estimates the cost of constructing a Metrorail line along the same alignment as the IPL light rail line to be about $2.4 billion, or more than twice as expensive the light rail option. As MTA told the Planning Board, the cost-effectiveness of Metrorail following this route would be too poor to merit consideration.

Constructing light rail between Silver Spring and New Carrollton is technically feasible, but carries with it several disadvantages:

- ***As noted by the Planning staff, any rider going from the IPL East to the PLL would endure a transfer, adding an average of 4.5 minutes to the trip: 2 minutes from platform-to-platform and an average of 2.5 minutes wait time on the platform. (In the opposite direction there would be a 5-minute penalty, since the average wait time on the light rail platform would be 3 minutes.)***

- ***A light rail yard and shop would have to be built in the Silver Spring to New Carrollton segment. MTA did not identify a suitable site of a yard and shop in this segment during its earlier study of this line. The cost of this yard and shop—which MTA estimates at $33 million (not including land cost)—would need to be added to the IPL East cost. If a yard/shop site can be found it is likely to be east of College Park, which would mean that the College Park-to-Silver Spring segment of the IPL would be the last to be built.***

Another advantage cited for the PLL is its ability to extend east to White Oak and west to Rock Spring Park and Tyson's Corner. For the reasons demonstrated in the review of the Outer Purple Line, a deep tunnel line to White Oak is not cost feasible. The ridership demand generated by a White Oak Metrorail station is inflated by the heroic assumption that a 3,500-space parking garage could be sited there without significant community and traffic impacts.

The extension to the west is more plausible, but as been noted in the past, this line could start at the Grosvenor Station with or without the PLL. Fairfax County and the Commonwealth of Virginia have expressed no active interest in linking to Maryland with a circumferential rail line. On the other hand, they are actively pursuing construction of HOV/bus lanes on the Beltway, a facility that could easily carry 5,400 bus patrons per hour in each direction (assuming 45-passenger buses running at 30-second headways). Given the spiderweb pattern of suburban commuting, with many origins and destinations, extensive bus service on HOV/bus lanes would provide better service without the intense capital

cost. The Council will soon be reviewing a master plan amendment that would extend the I-270 HOV/bus lanes onto the Capital Beltway to Virginia.

While the potential for future Metrorail extensions from the PLL are slim, the potential for light rail extensions from the IPL are better. Within the past few months the WMATA Board of Directors adopted a Systems Expansion Program for the region. The plan includes $6 billion of future projects, about $2 billion in each of the three states. The plan includes the Inner Purple Line in Maryland (©45) but also includes several new light rail lines in the District of Columbia, including one that would run along Georgia Avenue and connect to the Silver Spring station (©46-47). More than half the cost of this expansion plan is for light rail lines, signaling WMATA's willingness to expand beyond its current heavy rail and bus systems.

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ATTACHMENTS

1. Review of Federal Surface Transportation Bill Reauthorization Process
2. Inner Purple Line Planning History
3. Definition of Environmental Features
4 Staff Critique of WMATA Line Profiles and Impact on Cost

ATTACHMENT 1: REVIEW OF FEDERAL SURFACE TRANSPORTATION BILL REAUTHORIZATION PROCESS

The current Federal surface transportation legislation, titled Transportation Equity Act for the 21st Century (TEA-21), was adopted in 1998 and is due to expire this October, 2003. It succeeded the groundbreaking Intermodal Surface Transportation Efficiency Act (ISTEA), which covered the Federal Fiscal years of 1991-1997. Both of these were very forward-looking bills that brought significant changes to the way our transportation networks are planned and operated and how Federal dollars were allocated and used.

One major aspect of any Federal transportation bill is the allocation of Federal transportation funds. TEA-21 had a spending authority of $215 billion over the life of the legislation, with the actual amounts set each year by Congress, but with a floor of some $203 billion. Much of this was allocated with formulas. However, there were about 1,800 individual "high priority" projects identified in the legislation with specific funds allocated to each of them. These "earmarks" are important for roadway projects as they remove the need for the project to compete with other projects within a state for the funds. In Montgomery County, TEA-21 had the Randolph Road interchange with US 29 as a line-item project.

One important note is that the presence of one of these projects in the bill does not increase the total amount of funds that come to a state. These projects are counted against the formula amount the state receives. However, it does largely assure that the project will be funded during the life of the bill.

For transit projects, the process is somewhat different than for roadways. Transit funds for new construction are separate from highway capital funding. New transit project approval is a multi-step process, with the Federal Transit Administration (FTA) playing a significant role. The general process is:

- Get on the Authorized list as part of the reauthorization bill established by Congress. This makes a project eligible for further review. Then, if on the list, conduct additional planning, engineering, environmental and other work to finalize the definition and design of the project, complete environmental review requirements, obtain a firm cost estimate, and line up non-Federal funding.

- Sign a Full Funding Grant Agreement with FTA, if selected using the "new starts" criteria among other considerations. This identifies the amounts of funds that FTA will request for a project, and what funds the applicant and others will provide.

- Receive an annual appropriation from Congress funding the FTA part of the agreement.

FTA uses the following as their criteria when considering projects for "new starts" funding. This paper does not try to quantify or even identify how the PLL or the IPL would meet these, as producing these is a complex and lengthy process. In Chapters 5

and 6, a few of these characteristics, or close surrogates, are forecast using the information available to staff at this time.

- Mobility improvement, measured by travel time savings, number of low-income households served, and employment near stations
- Environmental benefits, measured by change in regional pollutant emissions, change in regional energy consumption and EPA air quality designation
- Operating efficiencies measured by operating cost per passenger mile
- Cost effectiveness expressed as transportation system user benefits divided by incremental cost
- Transit Supportive Existing Land Use, Policies, and Future Patterns, measured by combined ratings of several factors.

Other factors such as non-Federal funding support and readiness of the project for implementation are also considered.

ATTACHMENT 2: INNER PURPLE LINE PLANNING HISTORY

The IPL is a 4.4-mile master-planned transitway between Bethesda and Silver Spring along historic freight rail alignments. Plans for fixed-guideway (busway or rail) passenger transit service in this alignment have been developed over the past two decades.

- The November 1986 Georgetown Branch Master Plan Amendment designated the right-of-way for "public purposes such as conservation, recreation, transportation, and utilities."

- The County purchased the westernmost 3.3 miles of Metropolitan Branch right-of-way abandoned by CSX in 1988.

- The January 1990 Georgetown Branch Master Plan Amendment recommended both a trolley and trail within the right-of-way, including 26 explicit recommendations and detailed conceptual plans for both a trail and a single-track trolley configuration.

- The January 1996 Georgetown Branch Transitway/Trail Draft Environmental Impact Statement (DEIS) compared the impacts of busway/trail and light-rail/trail alternatives to a No-Build and a Transportation Systems Management (TSM) alternative consisting of enhanced bus services on existing roadways.

- The Maryland DOT Capital Beltway Corridor Transportation Study began evaluating regional, circumferential, rail transit alternatives in the late 1990s, colloquially described as the "Purple Line". The study analyzed six transitway alternatives (P1 through P6), three of which incorporated the 4.4-mile Georgetown Branch.

In 2001, the Maryland Transit Administration began project planning for the Capital Beltway Corridor Study "P6" alternative, a light-rail alternative between Bethesda and New Carrollton that incorporates the Georgetown Branch alignment. The State has initiated development of a Draft Environmental Impact Statement (DEIS) for the IPL East (Silver Spring to New Carrollton) and a Supplementary DEIS and Final EIS for the IPL (Bethesda to Silver Spring) that incorporates the need for increased double-track rail sections to accommodate current plans for the IPL East.

ATTACHMENT 3: DEFINITION OF ENVIRONMENTAL FEATURES

Wetlands: According to both Federal and state wetlands statues, a wetland is an area covered or saturated by surface or ground water for a long enough period of time to support a vegetation community that typically can live and adapt to water-saturated soil conditions. Only certain plants are able to grow and thrive in such wet conditions. Also many species of animals use wetlands for some portion of their life. Other species are completely dependent on damp soils and standing pools of water for their long-term survival.

Wetland impacts were defined as the amount of wetlands within the road right-of-way. This definition provides a measure of direct, physical disturbance, but does not necessarily reflect such impacts as: fragmentation of a wetland system; degradation of wetland plant community through reduction in size, introduction of non-native, invasive species along disturbed edges; degradation of a wetland system through change in hydrology in and around the wetland.

Floodplains: Floodplains are low-lying areas adjacent to streams, subject to intermittent flooding. Building permits are restricted within floodplains. This coverage was derived from the USDA Soil Survey of Montgomery County, Maryland, due to the fact that actual floodplain delineations have not been done uniformly over the entire county.

Stream Crossings: Stream crossings have a direct and significant negative impact on water quality. This is not only because sensitive buffer habitat is permanently removed and fragmented, but also crossings allow highly polluted road run-off to drain directly into the stream without the benefit of filtering through a naturalized buffer area.

GIS generally underestimates the location of streams, especially in headwater areas but is useful in comparing impacts among alternatives.

Stream Buffers: These were initially delineated by measuring a buffer of 150 feet from the outer edge of each side of the stream. This was expanded where the wetlands or floodplain extended beyond 150 feet, especially along the main stem of Rock Creek. Stream buffers are important because they generally contain environmentally sensitive areas such as the natural stream channel, riparian forests, floodplains, wetlands and adjacent steep slopes. Alteration of these areas exacerbates watershed erosion/ sedimentation and contributes significantly to water quality degradation.

Park Property: Park property is defined as State, Federal, M-NCPPC, WSSC, Municipal, and Revenue Authority.

Forests: A forest cover layer for the county was created by combining the existing woodland planimetric layer with 1999 state forest resource inventory attribute data. The layer was then updated using the forest inventories completed as part of recent master plans. The resulting updated layer was used as the basis for delineating significant forest.

Significant Forests are defined as upland forest stands that are at least 100 acres in size, but also include riparian forest corridors that are at least 300 feet wide. Impacts to these areas were considered of primary importance to track. Larger forest stands contain more species diversity, provide higher levels of forest functional benefits, and have the potential to provide increasingly rare habitat for forest interior dwelling plant and animal species. Riparian forest corridors provide habitat and are avenues for wildlife movement, and they are critical for the protection of stream resources. Significant forests are extensive along Rock Creek, especially in the low-lying floodplains.

Forest Interior Habitat: is defined as any portion of a forest stand that is at least 300 feet inside the outer edge of the stand. Interior forest habitat losses are a combination of direct disturbance associated with a road, plus loss of interior resulting from the penetration of the forest interior and the creation of new outer forest edges, often resulting in a total loss of interior habitat exceeding direct impacts. There are three sections of affected interior forest north of the beltway in Rock Creek Park.

Historic Properties: The proposed Purple Line Loop Alignment would not take any historic properties. As the CSX right-of-way approaches I-495, the new tracks would turn directly in front of the National Park Seminary Historic District. There is also the Forest Glen Historic District just north of I-495 and east of the CSX right-of-way. This proximity would initiate a review process to determine the extent (if any) of detrimental impact to the historic resources. This process (mandated by Section 106 of the National Historic Preservation Act) would be carried out by the State Office of Historic Preservation. It is M-NCPPC staff's assessment that the result of that process is likely to be a finding of no detrimental impact.