ITEM 12 - Information
December 17, 2008

Briefing on the Development of
the "What Would It Take" and "CLRP Aspirations" Scenarios

Staff Recommendation: Receive briefing on the status of the development and analysis of the "What Would It Take" and "CLRP Aspirations" transportation and land use scenarios to be analyzed in FY 2009.

Issues: None

Background: On May 21, the TPB was briefed on the status of the development of the two scenarios. The TPB Scenario Task Force, which is chaired by Mr. Knapp, met on November 19 to review the development of the two scenarios.

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MEMORANDUM

TO: Transportation Planning Board

FROM: Ronald F. Kirby
Director, Department of
Transportation Planning

SUBJECT: Development of What Would it Take and CLRP Aspirations Scenarios

DATE: December 17, 2008

At its September 19, 2007 meeting, the TPB established the Scenario Study Task Force, chaired by TPB Member Michael Knapp. The mission of the Task Force is to provide policy-level stewardship for the continuation of the Scenario Study and related TPB activities, including consideration of opportunities for the integration of study findings into TPB planning processes and initiatives. The Scenario Study Task Force has been moving forward with the development of two new scenarios, "CLRP Aspirations" and "What Would it Take", which build upon the lessons from previous scenarios analyzed under the Regional Mobility and Accessibility Study (RMAS) to address current policy priorities and initiatives. The CLRP Aspirations scenario will provide a realistic, but ambitious alternative growth and transportation strategy for the region that is intended to feed into the 2010 CLRP update. The What Would It Take (WWIT) scenario differs from this model in that it begins with regional climate change mitigation goals, as identified in the COG Climate Change Report, and examines how these goals might be met in the transportation sector through different combinations of transportation interventions, including some that are not normally reflected in the TPB travel demand modeling process, such as significant changes in individual travel behavior.

This memo provides a detailed overview of the process of developing the two new scenarios, and is presented in the following sections:

- **Baseline**: Describes the starting point for the scenarios: the Round 7.1 Cooperative Land-Use Forecasts and the 2008 CLRP.

- **Schedule**: Describes the proposed schedule for the scenario development and analysis process, including potential interaction between the two scenarios.

- **Developing and Analyzing the What Would It Take Scenario:** Explains in detail the background of this scenario and describes how it is being developed and analyzed.

- **Developing the CLRP Aspirations Scenario**: Explains in detail the background of this scenario and describes the process by which the transportation and land use components are being developed.

Baseline

Both scenarios are being developed using the Round 7.1 Cooperative Land-Use Forecasts and the 2008 CLRP as the baseline. Therefore, the various transportation projects planned in the 2008 CLRP are assumed in the WWIT scenario and are included in the transportation component of the CLRP Aspirations scenario. Moreover, the Round 7.1 land use projections out to 2015 are also taken as given since many, if not all, development projects up to that date are either already on the ground or in the pipeline. For the purposes of the WWIT scenario, currently employed transportation emissions reduction measures (TERMs), such as the Commuter Connections program, are included in the baseline.

Schedule

While the initial schedule for the scenario study has been revised, the same completion timeframe remains. The scenarios are expected to be completed by the end of July 2009, which aligns with the beginning of the 2010 four-year CLRP update cycle. This 2010 update will provide many opportunities for consideration of components from the scenarios, such as a longer CLRP horizon out to 2040, finer grained transportation analysis zones, and the incorporation of new surveys into forecasting models, including new regional household travel and on-board bus surveys.

The CLRP Aspirations and WWIT scenarios will be done concurrently; however, they will follow slightly different schedules. Initial specification of the CLRP Aspirations scenario, including finalization of the land use inputs and completion of transportation network coding, is expected to be completed by January 2009. Completion of scenario analysis and finalization of results is expected to be completed in June 2009, followed by public outreach in June and July 2009. Analysis of the WWIT scenario is expected to be completed prior to the CLRP Aspirations scenario in January 2009 since it will not be relying on the travel demand model for results. At this point, the results of the WWIT scenario can begin informing the analysis of the CLRP Aspirations scenario.

Developing and Analyzing the What Would It Take (WWIT) Scenario

The WWIT scenario arose out of the growing urgency felt throughout the region to begin addressing climate change in our transportation planning. This scenario has become an important part of a greater COG climate change effort, including the approval of the COG Climate Change Report in November 2008. The Climate Change Report contains regional greenhouse gas (GHG) reduction targets and a comprehensive list of potential strategies for each sector, including transportation. These targets serve as the primary goal of this scenario and the recommended strategies provide a portion of the analytical framework. The WWIT scenario differs significantly from the CLRP Aspirations scenario in that it begins with COG climate change mitigation goals and determines the different scales and combinations of interventions that would be necessary to achieve those objectives. The scenario will be designed to facilitate regional dialogue with the public and among decision-makers about the steps necessary to

implement a proactive approach to greenhouse gas reduction, in a way that moves beyond the typical constraints of the TPB analysis process.

Goals

The scenario begins with the COG regional goals of reducing annual regional CO_2 emissions to 2005 levels by 2012, 20% below 2005 levels by 2020, and 80% below 2005 levels by 2050. For the purposes of this scenario, these same reduction targets are being assumed for the transportation sector. Mobile-source emissions are roughly 30% of overall regional CO_2 emissions, making the transportation sector an integral factor in the region's ability to meet CO_2 reduction goals.

Framework for Analysis

The WWIT scenario is analyzing a full range of transportation emissions reductions strategies, which fall within three possible categories:

(1) *fuel efficiency*, through the imposition of stricter CAFE standards and/or incentives to purchase highly fuel-efficient vehicles;
(2) *reducing the carbon intensity of fuels*, through increased use of alternative-fuel vehicles, such as biofuel, electric, hybrid, plug-in hybrid, and hydrogen-powered vehicles; and
(3) *improvements in travel efficiency*, through reductions in vehicle travel (which are being addressed through land use patterns, fuel prices, other driving costs, and the availability of non-SOV alternatives, such as transit, walking and bicycling) and operational improvements.

All strategies that fall within these three categories are being analyzed along three lines: (1) effectiveness at reducing GHG emissions, (2) cost-effectiveness per ton of CO_2 abated, and (3) the timeframe, either short, medium, or long, on which the measure can be implemented. The primary measures being analyzed are the current and potential transportation emissions reduction measures (TERMs), the transportation strategies listed in the COG Climate Change Report, and broader strategies, such as fuel efficiency and alternative fuel use.

This analysis of transportation emissions reduction strategies will inform the development of a series of alternatives for meeting the goals of the scenario. Each alternative will examine different scales and combinations of the strategies necessary to meet the goals. The strategies will then be prioritized according to their cost-effectiveness and placed on a planning horizon based on their implementation timeframe.

Effectiveness

Each strategy is being analyzed for general effectiveness to determine the total emissions reduction that can be achieved by implementing the strategy. An example can be given for each of the three categories of mobile emissions reductions. First, when examining fuel efficiency, it is important to understand the magnitude of the emissions reduction that the new CAFE standards (35 mpg by 2020) will achieve so that it can be factored into the study assumptions. Analysis of regional VMT and emissions by vehicle type (passenger cars, light duty trucks, and heavy duty vehicles), as shown in Table 1 below, illustrates the limits on the impacts that national light duty CAFE standards are likely to have in this region. Passenger cars and light duty trucks (highlighted in orange) are the only vehicle types to be affected by the new CAFE

standards. They represent 93% of regional VMT, but only 80% of CO_2 emissions, indicating that 20% of current emissions will not be covered under the new legislation.

Table 1: 2010 Travel and CO_2 Emissions, 8-Hour Ozone Non-Attainment Area

	Annual VMT (billions	%	Annual CO_2 Emissions (million tons)	%
Passenger Cars	19.06	47%	6.76	24%
Light Duty Trucks (SUVs, etc)	18.94	46%	15.38	56%
Heavy Duty (Trucks, Buses, etc)	2.94	7%	5.46	20%
Total	40.95	100%	27.60	100%

Figure 1 below shows the age distribution for the regional vehicle fleet in 2005. It is evident that in 20 years the region can expect to see almost a full turnover of the fleet, indicating that by 2030, vehicles meeting the new CAFE standard will be almost all of the region's vehicle fleet.

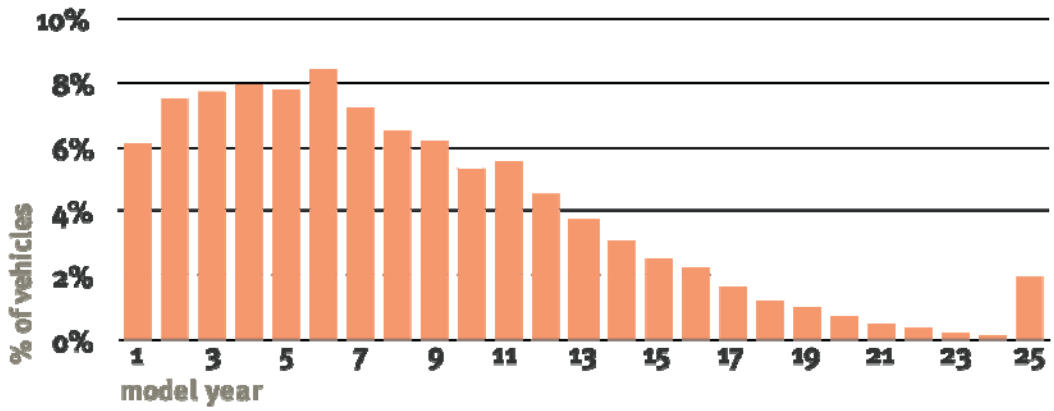

Figure 1: 2005 Regional Light Duty Age Distribution for the Washington Metropolitan 8-hour Non-Attainment Area

It is projected that, by 2030, CAFE standards will result in a 21% reduction in CO_2 emissions below what was expected prior to the passing of the new standards. However, in order to meet the 2030 COG CO_2 reduction target of 40% below 2005 levels, an additional 45% reduction in 2030 CO_2 emissions would still be necessary.

Similarly, the use and effectiveness of alternative fuels must be factored in and assumed for the region. The Energy Information Administration (EIA) at the US Department of Energy publishes a yearly annual energy outlook with 2030 projections of energy use across a variety of sectors, including transportation. These projections are relatively conservative estimates based on current national policy and assumptions regarding fuel production potential and market penetration. For transportation, staff analyzed EIA data to produce specific projections by regional VMT for a variety of alternative fuel uses, as shown in Figure 2: alternative fuels, including biodiesel, ethanol, and electric-gasoline hybrids, are projected to be used for 29% of the 2030 VMT. This translates into an additional 13% reduction in 2030 emissions beyond the

new CAFE standards. After accounting for this additional 13%, meeting the 2030 COG CO_2 reduction goal requires an additional 32% reduction in 2030 emissions. It should be noted that other alternative fuel projections will be researched to analyze a full range of possibilities in this category.

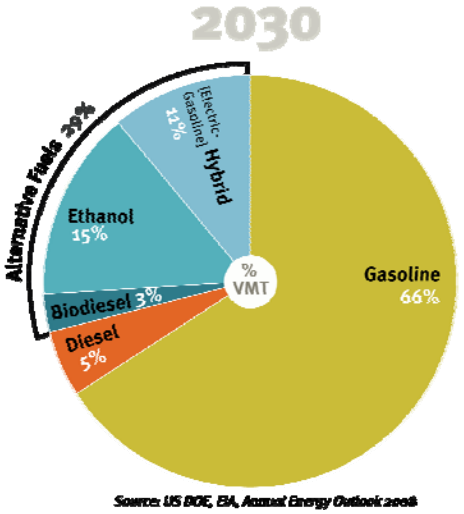

Figure 2: Projection of Alternative Fuels Use in 2030.

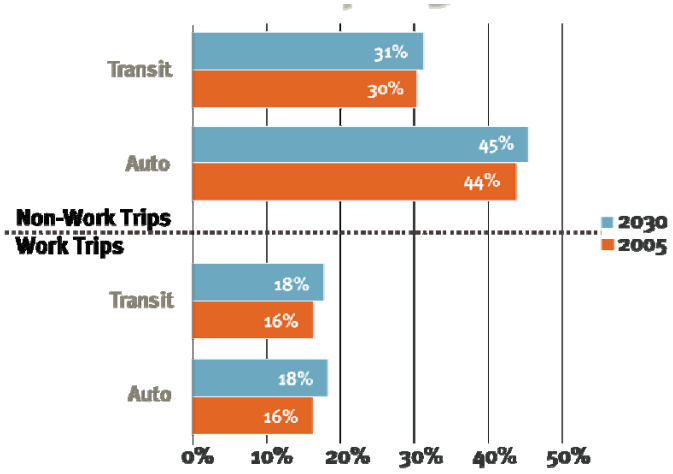

Figure 3: Percentage of trips under 3 miles for both work and non-work trips, by auto and transit for the Washington region.

Effectiveness analysis is also being conducted with the final category of strategies, travel efficiency, in order to determine different possibilities for achieving the final 32% emissions reduction that is still necessary, using the aforementioned conservative assumptions regarding fuel efficiency and alternative fuel use. The first step in analyzing the effectiveness of enhancing travel efficiency is to understand how the region uses its vehicle fleet. This information can help identify the most effective ways to change current fleet use. An example is analyzing the distribution of trip lengths in the region. Figure 3 shows high percentages of trips below three miles in length for both auto and transit trips and both work and non-work trips. These trips thus represent a large portion of travel that could potentially be converted to non-emitting modes, such as walk or bike, with increased infrastructure, safety improvements, and public awareness.

Another example points to congestion management and mitigation as a potentially highly effective means of reducing current CO_2 emissions. New research from the University of California at Riverside shows that CO_2 emissions vary greatly across vehicle speeds. Figure 4 shows a U-curve indicating that for a typical vehicle fleet very slow vehicle speeds (less than 15 mph) can have up to twice the CO_2 emissions per mile of higher speeds (20-70 mph).

Other travel efficiency measures are being analyzed, such as telecommuting, land use measures to achieve VMT reductions, increased transit capacity, and pricing policies, such as parking and gas taxes. Past and concurrent TPB studies will be used as inputs, such as the results of the Value Pricing Study and the land use and transportation components of the CLRP Aspirations scenario.

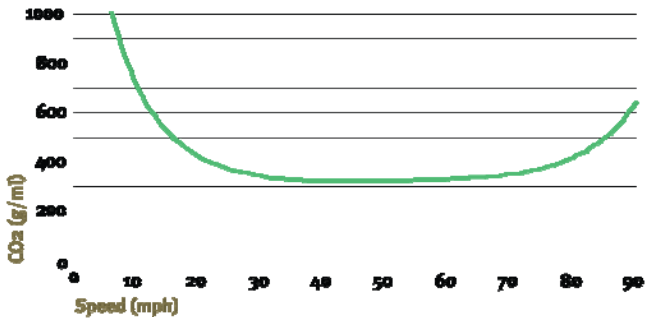

Figure 4: CO2 Emissions Rates by Speed.

Cost-Effectiveness

In addition to assessing the effectiveness of transportation measures at achieving the COG climate change goals, measures will be also assessed for their cost-effectiveness as a method of prioritizing the variety of possible interventions. Some strategies can serve as "low-hanging fruit" and provide relatively cheap benefits, such as telecommuting programs, as opposed to more complex and expensive measures, such as major changes to current land use patterns. Recent studies have pointed to a cost-effectiveness threshold that serves as the point at which the nation's emissions reduction goals can be met. Measures whose cost falls far above the threshold could be considered unnecessarily expensive. For instance, a 2007 McKinsey & Company study identified a price threshold of $50 per ton of carbon dioxide abated. A similar threshold can be used to measure and prioritize regional strategies. This analysis will be used in conjunction with other considerations, such as multiple benefits that may be offered and a high level of general effectiveness at reducing CO_2 emissions. An example of this type of cost-effectiveness work is below.

Table 2: Cost-Effectiveness of CO2 Reduction Measures.

Number	Category Description	CO2 Cost Effectiveness Range *
1	Telecommute Programs	$10 to $40
2	Signal Optimization	$30 to $50
3	Rideshare Assistance Programs	$30 to $300
4	Bicycle / Pedestrian projects	$50 to $100
5	Access Improvements to Transit/ HOV	$100 to $400
6	Park & Ride Lots (Transit and HOV)	$100 to $500
7	Transit Service improvements	$100 to $800
8	Bus Replacement Programs	$525 to $775
	* Several locations / applications studied	

Timeframe for Implementation

The third layer of analysis is examining the timeframe for implementation for strategies. Experts have stated that GHG emissions remain in the atmosphere for many decades, making them unlike criteria pollutants, such as PM and NO_x, where only annual emissions are examined.

Therefore, GHG emissions cannot be looked at on an annual basis, but rather should be considered cumulatively across several decades. If emissions are examined in a cumulative manner, early emissions reductions will have a compounding effect upon future emissions levels, demonstrating that early GHG emissions reductions will be increasingly necessary to effectively stabilize GHG emissions and avoid the most severe impacts of climate change. Therefore, this scenario will examine strategies for the timeframe on which they can deliver emissions reductions and what the total impact of their implementation will be for the region. For instance, actions that can have an effective and immediate response, such as increased fuel prices, can be looked at as an early strategy, while those that require a long planning horizon, such as a new facility, should be planned early in order to realize cumulative benefits by target years.

Developing the CLRP Aspirations Scenario

The purpose of the CLRP Aspirations scenario is to create an ambitious, yet realistic vision for land use growth and transportation service in the Washington region. More specifically, the scenario seeks to better align land use and transportation planning with the goals of the TPB Vision and of the previous RMAS initiative. These goals include creating "economically strong regional activity centers with a mix of jobs, housing, services, and recreation in a walkable environment", "a web of multi-modal transportation connections which provide convenient access", "a user-friendly, seamless system", and a combination of land use and transportation options that result in the "reduction of per capita VMT." In addition, the scenario seeks to maintain the principles of RMAS, such as capitalizing on existing transit infrastructure through transit-oriented development, addressing geographic imbalances in development, and reducing congestion and commute times by getting jobs and housing closer together. The scenario in its completed form is intended to achieve these goals to the extent possible by creating highly accessible and developed activity centers served by an extensive transit network. It could serve as a regional unconstrained long-range transportation plan in anticipation of the full 2010 CLRP update.

The scenario begins with past TPB studies, including the five transportation and land use scenarios of RMAS and the three scenarios of the Value Pricing Study. These two studies examined various "what ifs," where a growth or policy possibility was studied for its effects on various transportation conditions. This new scenario takes these "what ifs" a step further by using the results of these studies to create a vision for the region that strives to meet the TPB's goals.

The RMAS scenarios examined five different methods of bringing jobs closer to housing and thus reducing VMT: adding more households to the region, moving households from outer jurisdictions to inner jurisdictions, moving jobs from inner jurisdictions to outer jurisdictions, concentrating development around transit, and moving development from the western half of the region to the eastern half. The results illuminated particularly successful strategies, such as adding even more households to the region than was projected and directing them into regional activity centers, but did not achieve as great of a change in travel demand (particularly the reduction of VMT) as may have been expected. The Value Pricing Study resulted in three scenarios that showed that pricing existing and new capacity could provide a viable revenue source for new highway and transit capacity. The study also left room for further study of high quality transit operating on toll lanes in the region.

Based on the principles and lessons from these two studies the CLRP Aspirations scenario has been built with three elements: a land use component, a pricing component, and a transit component, which have been developed concurrently. In order to maintain a realistic foundation, the CLRP Aspirations scenario is limited by two primary criteria: (1) proposed densities and growth shifts must be "within reach" in order to be considered for possible inclusion in the Cooperative Forecasts; (2) proposed transportation projects should be financially within reach by utilizing realistic funding sources, such as local and/or regional tax revenues, financial contributions from developers, revenue streams from pricing selected facilities, and possible new federal funding.

Land Use Component

In order to achieve the goals of the TPB vision and RMAS, the land use component of the CLRP Aspirations scenario centers on strategic shifts in projected land use growth to concentrate both jobs and housing in activity centers and around existing or planned transit infrastructure. The current demographic forecast for the region (Round 7.1 Cooperative Forecast), shows that only about 45% of new jobs between 2015 and 2030 and about 30% of new households will be added to activity centers. Therefore, there is growth that can be better managed and concentrated to achieve the region's development goals.

However, as evidenced by RMAS, the amount of growth available to shift into existing activity centers is limited. In this study, the growth available for redistribution is limited by assuming that anything planned before 2015 is in the pipeline. This constraint requires a highly strategic framework for shifting growth that directly seeks to achieve the goals within the TPB Vision. This framework is comprised of a series of goal-oriented "rules" for shifting growth. All activity centers and transportation analysis zones (TAZs) with current/planned transit infrastructure will receive the necessary amount of residential and employment growth to be (1) transit supportive, (2) walkable, and (3) mixed use. These areas will be the scenario's "receiving zones."

(1) Transit Supportive:

All receiving zones will have varying residential and employment density goals that reflect what is realistic given their current urban form, but that are high enough to support varying levels of transit service, from local bus service with 30 minute or more headways to rapid transit with 5 minute or less headways. These assessments will be based on the best available research linking density and urban form to transit service, such as the example below in Table 3 from the Institute of Transportation Engineers, 1989:

Table 3: ITE Relationships Between Transit Frequency and Land-Use Density

Transit Mode	Frequency of Service	Density Threshold
Bus	60 Minute Headway	4-5 du/acre
	30 Minute Headway	7 du/acre
	10 Minute Headway	15 du/acre
Light Rail	5 Minute Peak Headway	9 du/acre
Rapid Transit	5 Minute (or Less) Peak Headway	12 du/acre
Commuter Rail	20 trains/day	1-2 du/acre

(2) Walkable:
Similarly, all receiving zones will have varying residential and employment density goals that reflect what is realistic given their current urban form, but that are high enough to meet regional criteria for walkability. This region has several models of walkable urban centers, each with varying levels of density and scale of development. Two models that can be used to frame different density goals for higher density activity centers and lower density activity centers are available: the Rosslyn-Ballston Corridor, which has high densities of 20 du/acre or more and Old Town Alexandria, which has lower, but walkable densities of 7-10 du/acre.

(3) Mixed Use:
Lastly, all receiving zones will have varying goals for jobs/housing balance that reflect what is realistic given their current urban form. Of the five different types of activity centers (DC Core, Mixed Use, Employment Center, Suburban Employment Center, and Emerging Employment Center) only Mixed Use centers have a residential density requirement. The three types of employment centers have varying levels of density, but in some instances the residential density can be very low, such as only one unit per acre. Therefore, the goal for these types of activity centers is to begin approaching a balance of housing, employment and services. For other centers where the current densities are higher, the goal will be to create a truly balanced mix of uses, enabling a resident to walk to a myriad of destinations. A jobs/housing balance for the region will also be improved by using the strategy of the More Households RMAS scenario, in which additional households were added to the region's 2030 forecast. Jobs/housing balances will also be maintained at the jurisdictional level to guide the inter-jurisdictional shifts of housing and jobs.

As stated in each of the above categories of goals, the density and jobs/housing goals for each receiving zone will vary according to existing or planned conditions. It is clear that some activity centers that currently have lower densities cannot support the density of the DC Core or the Rosslyn-Ballston Corridor, nor is there enough projected growth between 2015 and 2030 to bring the densities of the 58 regional activity centers to those levels. Therefore, the concept of the receiving zone will be disaggregated further to represent the five types of activity centers and zones not in an activity center but with transit infrastructure (either metrorail/transitway or commuter rail), each with different, realistic density and jobs/housing balance goals.

By concentrating growth strategically in these different types of zones, the goals of the TPB Vision as well as the principles of RMAS can be better achieved. Not only is much future growth directed into activity centers, but with the increased growth, the activity centers themselves can be more walkable and amenable to greater, high quality transit infrastructure. Additionally, because growth is directed to areas with current transit infrastructure, great progress is made toward capitalizing on transit assets and concentrating increased development in the eastern portion of the region in order to address current development imbalances.

Transportation Component

The transportation component of the CLRP Aspirations scenario focuses on providing increased accessibility to the areas receiving the growth shifts described in the previous section: the regional core and activity centers. This accessibility will be provided for transit riders, car-pools

and those willing to pay tolls to drive low-occupant vehicles on variably priced lanes and facilities.

Activity centers and transit station areas will have increased local transportation infrastructure to facilitate the shifted growth. It is assumed that local streets and circulator transit services would be funded by various sources, such as special tax districts, tax-increment financing or developer proffers.

The transportation component consists of two interconnected components: a network of variably priced highway lanes, and high-quality transit service. The transit services to be studied include commuter rail and transit-way projects as well as a regional network of bus rapid transit (BRT) operating on the network of variably priced highway lanes.

Pairing the priced lanes with BRT service provides the potential for great synergy: toll lanes function as dedicated right-of-way for the bus rapid transit vehicles, and toll revenue offsets the cost of BRT facilities and service. BRT services reduce the demand for the priced lanes, allowing them to operate more smoothly and preventing congestion. Both the BRT and priced lanes should provide mode-shift incentives, providing congestion relief to the existing general purpose lanes.

Regional Network of Variably Priced Highway Lanes

In February, 2008, the TPB completed an 18-month study of networks of variably priced lanes for the Washington region. The study evaluated the demand and revenue forecasts for different combinations of pricing of newly constructed and existing lanes. One such network included new lanes on all freeways outside the District and selected urban arterials outside the Capital Beltway in addition to the tolling of selected existing facilities: US National Park Service Parkways and all freeways and river crossings in the District. This network resulted in large revenue forecasts that approached the estimated cost of constructing and operating the toll facilities.

This regional network of variably priced lanes will be the basis for the CLRP Aspirations scenario. The network will be modified to remove the dedicated interchanges between the priced and general purpose road networks that do not provide access to regional activity centers. This should result in a large reduction of the total construction costs of the toll network while focusing accessibility improvements on the regional activity centers.

Regional Bus Rapid Transit Network Operating on Toll Lanes

A high-quality network of bus rapid transit (BRT) service will layered onto to the regional network of priced lanes. This high-quality transit will use the priced lanes as its dedicated right-of-way, allowing for rail-like travel speeds and levels of service. The BRT network will provide service to BRT stations in the regional activity centers as well as connections to Metrorail stations and existing park-and-ride lots via dedicated access ramps. The station areas can be considered the focus areas for the increased density described above.

Bus transit service levels will depend on the assigned target densities specified in the Land Use Component. Lines connecting to the core will have headways between 10 and 12 minutes (5 or 6 trips per hour). Lines connecting less-dense activity centers will operate less frequently.

Bus transit operating on freeway lanes will provide service to bus stations via dedicated access ramps. All stations will include BRT design standards and technologies (off-board fare payment, level-boarding, multi-door access) to reduce the dwell time. This reduced dwell time, dedicated access ramps and pseudo-dedicated right-of-way should result in an average BRT operating speed of approximately 45 mph where the transit service operates on freeway lanes.

Within the urban core, where few priced lanes will be evaluated, the bus transit service will operate in mixed traffic lanes along selected priority corridors as identified by WMATA in its Priority Corridor Network plan. Technologies and techniques such as transit signal priority, queue jump lanes and selective dedicated bus lanes are being considered for these Metrobus corridors. Along these corridors, an approximate average speed of 15 mph will be assumed.

Bus stations will also be provided to areas recommended by advisory groups (Regional Bus Subcommittee and Scenario Study Task Force) consulted in the development of this scenario. These locations include Fort Detrick (Frederick Co.), Westphalia (Prince George's Co), Fort Belvoir (Fairfax Co.) and Landmark (City of Alexandria).

Selected RMAS Projects

Finally, selected projects previously evaluated under RMAS will be included in this scenario. These selected projects provide high quality transit service to activity centers not connected to the network of variably priced lanes and therefore not served by the BRT network to be evaluated. The included RMAS projects are:

- Purple Line Extension from Silver Spring to New Carrollton
- Georgia Avenue Transitway, from Glenmont to the Intercounty Connector (ICC)
- US 1 Transitway, from King Street Metrorail station to Potomac Mills via Fort Belvoir and Woodbridge.
- VRE Extension from Manassas to Haymarket, via "Innovation" and Gainesville.