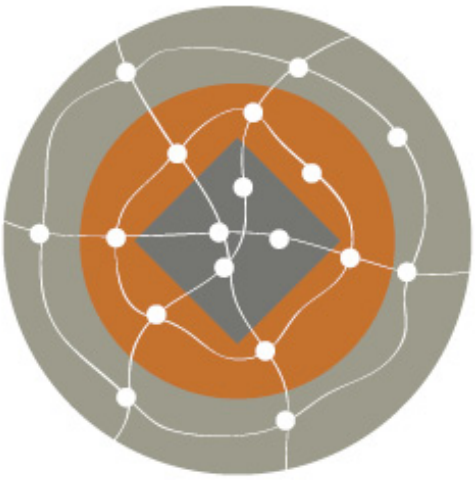
TPB CLRP Aspirations Scenario

2012 CLRP and Version 2.3 Travel Forecasting Model Update



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INTRODUCTION

The National Capital Region Transportation Planning Board's (TPB) Constrained Long Range Plan (CLRP) Aspirations Scenario was developed in an effort to pull together alternatives from previous TPB scenario studies into a comprehensive scenario that could offer a promising path forward for the region. The CLRP Aspirations Scenario is an alternative land use and transportation scenario for the future whose purpose is not just to explore a single regional challenge or experiment with a single strategy, but instead to take a comprehensive approach to long-range regional planning. The Aspirations Scenario combines an alternate land use scenario with more dense, transit-oriented development; a regional network of variably price lanes (VPLs); and high quality bus rapid transit (BRT) and circulator bus service focused on supporting the land use plan.

The first report for the CLRP Aspirations Scenario Study was completed and presented to the TPB in September 2010. (*1*) In October 2011, the "Streamlined" VPL Network Sensitivity Test, which was designed reduce construction costs without significantly compromising the performance of the VPL network, was presented to the TPB. *(2)* The findings of the "Streamlined" VPL Network Sensitivity Test and a discussion of how well the TPB's scenario planning process for designing and analyzing scenarios compares to the guidance in the new federal surface transportation legislation, MAP-21, was presented at the 92nd Annual Meeting of the Transportation Research Board in January 2013 and will be published in an upcoming issue of the Transportation Research Record. *(3)*

This memorandum presents the initial results of updates to the CLRP Aspirations Scenario Study for the modeled region. The updates were made based on the lessons learned from the "Streamlined" VPL Network Sensitivity Test using new baseline regional planning assumptions and newly available modeling tools. In addition to the changes in planning assumptions and modeling tools, the variably priced lane (VPL) network was refined to align with requirements in MAP-21. Table 1 illustrates the changes in planning assumptions and modeling tools.

Table 1: Differences in Planning Assumptions and Modeling Tools

	October 2011	**April 2013**
Constrained Long-Range Plan	2008	2012
Cooperative Forecast	7.2	8.1
Horizon Year	2030	2040
Travel Forecasting Model	Version 2.2	Version 2.3
TAZ System	2191	3722
Emissions Model	Mobile 6.2	MOVES2010a

THE CLRP ASPIRATIONS SCENARIO

The CLRP Aspirations Scenario has two components, land use and transportation, which are built upon the adopted COG Cooperative Forecast and TPB CLRP respectively. For this update, the baseline is the Round 8.1 Cooperative Forecast (adopted by the COG Board of Directors in July 2012) and the 2012 CLRP (adopted by the TPB in July 2012). The analysis year for the scenario is the current planning horizon year 2040. A detailed description of the previous TPB scenario studies and outreach that were used to develop the initial land use and transportation assumptions for the CLRP Aspirations Scenario can be found in the September 2010 report. *(1)*

Land Use Component

The land use component focuses on shifting projected household and employment growth into "targeted growth areas" based in part on the findings from the TPB's Regional Mobility and Accessibility Study (RMAS), *(1)* The areas designated as targeted growth areas are a combination of: (1) Regional Activity Centers and Clusters previously identified by COG through extensive collaboration with local jurisdictions in the region as places where it would be desirable for future growth to occur; and (2) other areas near existing or planned transit infrastructure. In the scenario, a portion of the residential and employment growth anticipated in the region between 2015 and 2040 was shifted into the targeted growth areas to make those areas supportive of transit and mixed use development, and to make them walkable, while still reflecting local-level planning realities. *(1)*

Because local jurisdictions in the Washington region have primary responsibility for comprehensive land-use planning and zoning, determining how much development could realistically be shifted into targeted growth areas required a collaborative process much like that used by COG to compile its Cooperative Forecasts of residential and employment growth. After TPB staff developed the basic framework for the land use component of the Aspirations Scenario, local jurisdictions were asked to provide realistic estimates of how much growth could take place in areas identified as targeted growth areas. *(3)*

In the development of the land use component, there was a certain recognition that redistribution of jobs and households will benefit individual jurisdictions as well as the region. Many jurisdictions sought to improve the balance between jobs and households within their jurisdictions. Another common interest was to improve utilization of the existing transportation network by shifting growth away from areas where the network is forecasted to be overburdened, and adding growth to less developed areas such as areas around those Metrorail stations that are not currently meeting their development potential. *(3)*

The CLRP Aspirations land use component was originally built upon the Round 7.2 Cooperative Forecast on the 2191 zone system for the forecast year 2030. For this updated analysis, the same principles for shifting growth were used to build the land use component on the Round 8.1 Cooperative Forecast on the 3722 zone system for the forecast year 2040.

Based on the Round 8.1 Cooperative Forecast, the region is forecasted to add 26% more households and 32% more jobs between 2015 and 2040. The Aspirations land use assumptions begins by shifting forecasted job and households in 2040 from outside the region into targeted growth areas. The result is the number of households in the modeled region increase by 2.6% and the number of jobs by 0.3% between the 2040 Cooperative Forecast and the CLRP Aspirations Scenario. Jobs and households growth in the region between 2015 and 2040 is then shifted within the region into targeted growth areas. In the Round 8.1 Cooperative Forecast, 25% of household growth and 35% of employment growth between 2015 and 2040 takes place in zones with targeted growth areas. In the CLRP Aspirations land use component, 57% of household growth and 58% of employment growth between 2015 and 2040 takes place in zones with targeted growth areas.

Transportation Component

The transportation component contains three elements: a regional network of priced lanes, an extensive bus rapid transit network, and selected projects identified by the RMAS. The scenario's transportation component was designed to support the land use component by providing "increased accessibility to targeted growth areas, specifically for transit riders, carpools, and those willing to pay tolls to drive low-occupant vehicles on variably priced lanes." (1)

The regional network of priced lanes is built upon the 2012 CLRP which contains three priced lane facilities in 2040: the Intercounty Connector in Maryland, the Express Toll Lanes on I-495 in Virginia, and the Express Toll Lanes on I-95 in Virginia. The regional network of priced lanes is based on the network developed in the "Streamlined" VPL Network Sensitivity Test. This network was designed in response to concerns that the original CLRP Aspirations VPL network was too expensive. The "streamlined" VPL network reduced the number of lane miles constructed by 30% and the new interchanges constructed by 33% over the original VPL network. The travel forecasting analysis showed that the "streamlined" network performed comparably to the original VPL network with a sketch-level financial analysis showing that for the "streamlined" scenario toll revenues covered most of the highway and transit costs, both capital and operating.

The VPL network for this analysis was edited based on provisions in MAP-21, which became effective October 1, 2012. Section 1512 "Tolling" in MAP-21 allows for "initial construction of 1 or more lanes…that increase the capacity of a highway…if the number of toll-free non-HOV lanes, excluding auxiliary lanes, is not less than the number of toll-free non-HOV lanes, excluding auxiliary lanes, before such construction." *(4)* To account for this, all non-HOV lanes conversions to VPL were removed from the VPL network. This includes all National Park Service parkways in the region and existing lanes in the District of Columbia that were tolled in the original Aspirations network, and the "add-a-lane, take-a-lane" on the Beltway in Maryland that was included in the "streamlined" network.

The CLRP Aspirations VPL network adds 740 lane-miles of new construction, 186 lane-miles of HOV conversion, and 100 interchanges to the 2040 network. All BRT and circulator bus service for the original scenario remained in place. Buses that had been routed on VPLs that no longer exist in the network are now traveling on the same facility in general purpose lanes. The projects from RMAS that are in the network are unchanged. Table 2 describes the variably priced lanes in 2040 in the CLRP and in the CLRP Aspirations Scenario. Attachments A and B are maps of the VPL and BRT networks, respectively.

Table 2: Variably Priced Lane Facilities in the CLRP and CLRP Aspirations Scenario, 2040

Currently Built or Included in the CLRP:			
Facility	**Start**	**End**	**Assumptions**
I-495	I-395	American Legion Bridge	2-4* HOT lanes both directions; 24/7
I-395	I-495	VA 648 - Esdall Rd.	2-3 HOT lanes peak direction
I-95 (VA)	Spotsylvania Pkwy.	I-495	2-3 HOT lanes peak direction
MD 200	I-370	US 1 - Baltimore Ave.	Entire Facility**
Aspirations Scenario Additions:			
Facility	**Start**	**End**	**Assumptions**
I-95 (MD)	I-495	Anne Arundel Co. line	2 HOT lanes both directions; 24/7
I-495 (MD & VA)	American Legion Bridge	I-395	2-4* HOT lanes both directions; 24/7
I-270	I-495	Old Hunters Rd (Co. line)	2 HOT lanes both directions; 24/7
I-270	Old Hunters Rd (Co. line)	I-70	2 HOT lanes peak direction
US 50	MD 295	US 301	2 HOT lanes both directions; 24/7
US 50	US 301	Chesapeke Bay Bridge	2 HOT lanes peak direction
MD 4	I-495	US 301 - Crain Hwy	1 HOT lane both directions; 24/7
MD 5	I-495	US 301 - Crain Hwy	1 HOT lane both directions; 24/7
MD 210	I-495	MD 228	1 HOT lane both directions; 24/7
I-66 inside I-495	GW Memerial Pkwy	I-495	2-4* HOT lanes both directions; 24/7
I-66 outside I-495	I-495	US 17 - Winchester Rd	2 HOT lanes peak direction
I-395/I-95	VA 648 - Esdall Rd.	US 1 - Jefferson David Hwy	2-3 HOT lanes peak direction
VA 267	I-66	VA 28 - Sully Rd.	2 HOT lanes both directions; 24/7
VA 7	VA 267	Leesburg	1 HOT lane both directions; 24/7
VA 28	VA7	I-66	2 HOT lanes both directions; 24/7
Fairfax Co. Parkway	VA 267	I-66	1 HOT lane both directions; 24/7
Braddock Road	I-495	VA 645 - Burke Lake Rd.	2 HOT lane peak direction
Franconia-SP Parkway	VA 286 Faifax Co. Pkwy.	Frontier Rd.	1 HOT lane both directions; 24/7

* Lane merging segments have more than 2 lanes

** Intercounty Connector is not variably tolled as a fixed toll by MDTA by time period is being administered.

METHOD FOR ANALYSIS

This analysis looks at a baseline (2012 CLRP with Round 8.1 Cooperative Forecast) and three scenarios: a transportation component-only scenario (Scenario 1), a land use component-only scenario (Scenario 2), and the updated CLRP Aspirations Scenario (Scenario 3). Table 3 summarizes the land use and transportation assumptions for the baseline and the three scenarios.

Table 3: Baseline and Scenario Land Use and Transportation Assumptions

	Land Use	Transportation
Baseline	Round 8.1 Cooperative Forecast	2012 CLRP
Scenario 1: Transportation Component-only	Round 8.1 Cooperative Forecast	CLRP Aspirations
Scenario 2: Land Use Component-only	CLRP Aspirations	2012 CLRP
Scenario 3: CLRP Aspirations Scenario	CLRP Aspirations	CLRP Aspirations

In reality, planners would be unlikely to suggest concentrating land use around transit-friendly areas without planning transit improvements to serve that growth or assume that an extensive VPL and BRT network would not have an impact on land use. The sensitivity tests provide a better understand of the performance of the CLRP Aspirations Scenario by isolating the impacts of the land use and transportation components.

The travel forecasting analysis for this update uses the TPB's Version 2.3 Travel Forecasting Model which was adopted in November 2011. This model provides a significant update for conducting scenario studies. Inputs to the model are based on newer travel data including the 2007/2008 Household Travel Survey and transit surveys including a bus on-board survey and a Metrorail passenger survey. The model uses a more refined zone system (3722 vs. 2191) which allows for more sensitivity to changes in the networks. Additionally, the model has improved forecasting capabilities for non-motorized trips, high-occupancy vehicle trips, and transit trips.

The emissions analysis was conducted using the new EPA MOVES2010a model which on average estimates higher emissions than the Mobile6.2 model previously used in the CLRP Aspirations Scenario analysis.

MAJOR FINDINGS

Unless noted, all of the analysis presented in this memorandum was conducted for the TPB modeled area. As there is a great deal of variability in land use and travel throughout the region, an analysis conducted at a smaller geography would yield different findings.

Regional Travel

Table 4 shows the regional travel for the baseline and the three scenarios with respect to 2015 for the TPB modeled area. The Round 8.1 Cooperative Forecasts contains a 26% growth in households and a 32% increase in employment between 2015 and 2040. For the 2012 CLRP baseline, the travel forecasting model shows notable growth in vehicle-miles traveled (VMT) (24%) and transit trips (26%) between 2015 and the baseline in 2040. None of the three scenarios have a significant impact on reducing VMT growth, but all of them slow the growth in vehicle-hours of delay (VHD).

Table 4: Change in Regional Travel for the Scenarios Compared to the 2015 for the TPB Modeled Area, Average Weekday

	2015	2040							
	2012 CLRP	Baseline	% Diff	Scenario 1	% Diff	Scenario 2	% Diff	Scenario 3	% Diff
Households	2,653,905	3,349,025	26%	3,349,025	26%	3,434,878	29%	3,434,878	29%
Population	7,028,991	8,660,697	23%	8,660,697	23%	8,859,200	26%	8,859,200	26%
Employment	4,175,373	5,507,271	32%	5,507,271	32%	5,522,704	32%	5,522,704	32%
Vehicle Miles Traveled (VMT)	171,523,126	212,923,598	24%	215,450,668	26%	209,936,143	22%	212,699,019	24%
VMT per Capita (miles)	24.40	24.59	0.8%	24.88	2.0%	23.70	-3%	24.01	-1.6%
Average Trip Length (miles)	9.96	10.08	1.2%	10.27	3.1%	9.92	0%	10.12	1.6%
Total Auto Person Trips	19,937,253	24,524,649	23%	24,497,539	23%	24,880,707	25%	24,852,509	25%
Total Transit Trips	1,295,088	1,628,359	26%	1,656,658	28%	1,705,251	32%	1,745,488	35%
Total Non-Motorized Trips	1,999,553	2,691,874	35%	2,688,987	34%	2,912,279	46%	2,909,028	45%
Vehicle Hours of Delay			98%		53%		88%		45%
**VHD is only reported as a relative difference*									

Table 5: Percentage Change in Regional Travel for the Scenarios Relative to the 2012 CLRP Baseline for the TPB Modeled Area, 2040 Average Weekday

	Scenario 1	Scenario 2	Scenario 3
Households	0.0%	2.6%	2.6%
Population	0.0%	2.3%	2.3%
Employment	0.0%	0.3%	0.3%
Vehicle Miles Traveled (VMT)	1.2%	-1.4%	-0.1%
VMT per Capita (miles)	1.2%	-3.6%	-2.4%
Average Trip Length (miles)	1.9%	-1.6%	0.4%
Total Auto Person Trips	-0.1%	1.5%	1.3%
Total Transit Trips	1.7%	4.7%	7.2%
Total Non-Motorized Trips	-0.1%	8.2%	8.1%
Vehicle-Hours of Delay (VHD)*	-23.1%	-5.2%	-26.6%

Scenario 1 has the same land use assumptions as the baseline, a larger transportation network, but fewer overall auto person trips. The travel forecasting model has a demographic submodel which considers the number of jobs accessible by Metrorail or by Bus/Metrorail within 45 minutes for each zone as an input to forecasting the breakdown of vehicle availability by household. *(5)* The increase in transit in Scenario 1 contributes to the model estimating more zero (2.1%) and one (0.3%) car households than in the Baseline and those households generate a lower number of trips. Additionally, the VMT, VMT per capita and average trip length all increase, indicating that drivers may be making fewer, longer trips.

In Scenario 2, jobs and households in the region are shifted into targeted growth areas and additional jobs and households are brought in from outside the region. There is a resulting increase in auto person trips; however, VMT, VMT per capita, and average trip length decrease with the more concentrated land use. Despite not adding transit, there is an increase in overall transit trips as jobs and households were shifted to areas in close proximity to existing baseline transit.

The combination of concentrated land use and the VPL and BRT networks in Scenario 3 result in only a slight decline in VMT over the baseline, but a significant reduction in delay in the modeled area (26.6%). The addition of the BRT network and the relocation of jobs and households to the targeted growth areas resulted in the highest increase in total transit trips over the baseline of the three scenarios.

Non-motorized trips are based mostly on land use. The scenarios with more concentrated land use showed significant increases non-motorized trips.

All scenarios reduce congestion in the modeled region as calculated by vehicle hours of delay. The reduction is most significant in the scenarios that add highway capacity, pricing it to maintain free flow conditions.

Commuter Mode Split

Table 6 shows the mode split for commuter (home-based work) trips for the baseline and the three scenarios compared 2015. Table 7 shows the relative change in commuter mode split between the scenarios and the baseline.

Table 6: Change Commuter Mode Split for the Scenarios Compared to 2015 for TPB Modeled Area, Average Weekday

	2015	Baseline	% Diff	Scenario 1	% Diff	Scenario 2	% Diff	Scenario 3	% Diff
Total HBW Auto Person Trips	3,189,858	3,995,829	25.3%	3,987,162	25.0%	4,046,714	26.9%	4,030,478	26.4%
Single Occupant Vehicle	2,710,305	3,265,604	20.5%	3,188,179	17.6%	3,320,685	22.5%	3,246,404	19.8%
HOV2	354,008	377,662	6.7%	356,395	0.7%	388,101	9.6%	368,179	4.0%
HOV3+	125,546	352,563	180.8%	442,588	252.5%	337,928	169.2%	415,895	231.3%
Total HBW Transit Trips	861,667	1,082,797	25.7%	1,084,419	25.9%	1,132,431	31.4%	1,141,529	32.5%
Metrorail Only	416,406	520,342	25.0%	497,377	19.4%	553,304	32.9%	528,524	26.9%
Bus/Metrorail	191,864	211,496	10.2%	201,232	4.9%	218,327	13.8%	208,338	8.6%
Commuter Rail	26,470	46,521	75.7%	30,567	15.5%	45,125	70.5%	29,464	11.3%
Bus Only	226,927	304,439	34.2%	355,244	56.5%	315,675	39.1%	375,204	65.3%
Total HBW Non-Motorized Trips	155,171	231,783	49.4%	231,557	49.2%	275,170	77.3%	274,889	77.2%
Total HBW Person Trips	4,206,696	5,310,409	26.2%	5,303,138	26.1%	5,454,315	29.7%	5,446,896	29.5%

Table 7: Change in Commuter Mode Split for the Scenarios Relative to the 2012 CLRP Baseline for the TPB Modeled Area, 2040 Average Weekday

	Scenario 1	Scenario 2	Scenario 3
Total HBW Auto Person Trips	-0.2%	1.3%	0.9%
Single Occupant Vehicle	-2.4%	1.7%	-0.6%
HOV2	-5.6%	2.8%	-2.5%
HOV3+	25.5%	-4.2%	18.0%
Total HBW Transit Trips	0.1%	4.6%	5.4%
Metrorail Only	-4.4%	6.3%	1.6%
Bus/Metrorail	-4.9%	3.2%	-1.5%
Commuter Rail	-34.3%	-3.0%	-36.7%
Bus Only	16.7%	3.7%	23.2%
Total HBW Non-Motorized Trips	-0.1%	18.7%	18.6%
Total HBW Person Trips	-0.1%	2.7%	2.6%

Both scenarios with the VPL network showed a decrease in HOV2 trips and a significant increase in HOV3+ trips likely because HOV3+ trips in Virginia are toll-free.

Home-based work transit trips increase in all three scenarios, more so in the scenarios with the CLRP Aspirations land use. The BRT network relieves some of the ridership burden on Metrorail and commuter rail in Scenarios 1 and 3. Compared to Metrorail, the BRT provides suburb-to-suburb service without transfers, and in many cases the BRT fare is lower. Commuter rail shows over a 30% decline between the baseline and the two scenarios with the VPL and BRT networks; however, as shown in Table 6, commuter rail ridership still increases by more than 11% between 2015 and each of those scenarios. BRT travels in many of the same corridors as commuter rail, with transfer-free service to more downtown locations and more frequent headways. Further analysis could be done to determine where BRT demand is greatest.

Table 8 shows the transit mode share for 2015, the baseline, and the scenarios for commuter (home-based work) trips and all trips. The overall transit mode share changes little between the baseline and the scenarios.

Table 8: Transit Mode Share for Commuter Trips and All Trip Purposes, Average Weekday

	2015	Baseline	Scenario 1	Scenario 2	Scenario 3
Home-based Work	20.5%	20.4%	20.4%	20.8%	21.0%
All Trip Purposes	6.0%	6.0%	6.1%	6.1%	6.3%

Mobile Emissions

The MOVES2010a model was used to forecast emissions for 2015, the baseline, and the three scenarios. At this time, mobile emissions budgets for the region have not yet been established and adopted with the MOVES2010a model. Table 9 shows the percentage difference in emissions for the baseline and the three scenarios as compared to 2015. Despite the growth in

travel from 2015 to 2040, all criteria pollutant emissions decrease due to improvements in vehicle technologies in the future. Greenhouse gas emissions were not calculated as the current release of the MOVES model does not reflect new light-duty fuel economy standards beginning in model year 2017 and medium- and heavy-duty fuel efficiency standards for model years 2014-218 which are expected to lower greenhouse gas emissions in the future.

Table 9: Percentage Change in Mobile Emissions Relative to 2015

Category	Pollutant	2015	Baseline	Scenario 1	Scenario 2	Scenario 3
ANNUAL* (tons/year)	Precursor NOx	49,330.17	-46%	-46%	-46%	-45%
	PM2.5	2,002.49	-33%	-34%	-33%	-34%
OZONE DAY** (tons / day)	VOC	60.07	-22%	-22%	-22%	-22%
	NOx	138.21	-48%	-47%	-48%	-47%

* Forecasted for the 8-Hour Ozone Non-Attainment Area

** Forecasted for the PM2.5 Non-Attainment Area

FINANCIAL ANALYSIS

A financial analysis was performed to gauge whether the toll revenue generated by the VPL network could offset the cost of constructing the VPL network and the enhanced transit system in either the Full or Streamlined scenarios. The financial analysis for 2040 conditions in 2010 dollars considered the following:

- The cost of constructing the highway facilities
- The capital and operating cost of enhanced transit
- The toll revenue from the VPL network
- The fare revenue from the increased transit ridership

While the cost of constructing the VPLs and the toll revenue from such a system can be estimated at the state level, the cost and fare box recovery from the transit system can be estimated only at the regional level since the regional travel forecasting model is not capable of providing the increase in transit ridership at the state level, or by the different transit types such as commuter rail, light rail, bus rapid transit, or Metrorail.

Cost of Highway Facilities: The number of new VPL miles to be constructed, and the number of HOV lane miles converted to VPLs, were identified for each of the three states. In addition, the number of new interchanges to be constructed to support the VPL network was identified by state. Cost information was obtained from the state DOTs for new construction and conversion of existing lanes, and a regional unit cost number per lane mile and per interchange in 2010 dollars was developed. It is assumed 4% of the capital cost would be needed on an annual basis for debt financing, and 1% for maintenance of the facility, administration, and other expense. This is based on the revenue expenditure analysis of Virginia's Capital Beltway HOT Lane Project. *(6)* The total capital cost was calculated and amortized over a 20 year period.

Annualized cost expenses which account for debt financing, maintenance and other expenses were estimated using the amortized cost.

Capital and Operating Cost of Enhanced Transit: The transit network plan is the same for both Scenario 1 and Scenario 3. Infrastructure capital costs for the network are estimated at $1.13 billion. This does not include vehicle costs, which are annualized over 20 years. The BRT Network and its feeder buses would require some 274 vehicles for peak operations. Additional commuter rail and light rail service and infrastructure are also included. The BRT and circulator network would have annual operating costs of approximately $214 million. Some of the capital costs such as station costs and rail cost were amortized over a 50 year period whereas rolling stock such as buses were amortized over a 20 year period.

The three scenarios have different operating expenses. Scenario 1 would have slightly higher operating expenses while revenues decreased, as more travel would take place by bus and travel on Metrorail and commuter rail would decrease. Net operating subsidies would increase by just under thirty million dollars to about $166 million a year, as more bus service is provided on the BRT Network and its feeder buses. Scenario 2 would have higher operating transit expenses, as additional Metrorail and additional bus capacity is needed. Vehicle fleets would require 50 more railcars and 100 more buses. Net operating subsidy would be higher than the Base, but comparable to Scenario 1 due to the increased cost efficiency of Metrorail. Scenario 3 has higher costs than either the other two. Metrorail ridership would increase slightly, requiring more service (10 more railcars). Though commuter rail service and costs would decrease, there would be much higher bus costs, with an additional 100 buses needed beyond the 274 buses of the BRT Network and its feeder buses. Net operating subsidy would be highest under this scenario, increasing by over sixty million dollars to just over $200 million.

Toll Revenue: The regional travel forecasting model output was used to develop revenue estimates for the weekday peak period. It was assumed that 50% of the peak period traffic would use the VPL lanes during the off-peak period, and during weekend and holidays. Since HOV3+ do not pay tolls on Virginia VPLs, they were excluded in the revenue estimation.

Transit Fare-Box Revenue: Based on the increase in transit ridership of the scenarios allocated across modes in proportion to the increased capacity and based on a typical average recovery ratio for each mode, the estimate of annual farebox revenue was completed.

Final Cost Analysis: Table 10 shows the total annualized capital and operating cost of the highway and transit system together with annualized revenue from the tolls and the fare-box revenue together. Revenue to cost ratio of one would indicate the total revenue would be sufficient to meet the capital and operating expenses of the variably priced lanes and transit.

The analysis completed as part of this scenario study is a sketch level analysis and is not a substitute for a detailed financial analysis.

Table 10: Year 2040 Revenue to Cost Analysis of VPL Scenarios (2010$)

Scenario	Annualized Cost (millions)	Annual Revenue (millions)	Revenue/Cost
Scenario 1	$ 1,662	$ 1,110	0.40
Scenario 3	$ 2,017	$ 1,048	0.38

DISCUSSION AND NEXT STEPS

This update of the CLRP Aspirations Scenario Study was used the latest planning assumptions and modeling tools. With the exception of the changes to the VPL network in response to the MAP-21 legislation, the underlying principles guiding the original scenario development were unchanged. The inputs to the travel forecasting model developed for the CLRP Aspirations Scenario can be used as a basis to study variations on the scenario such as alternative land use forecasts and variations on the VPL and BRT networks. Additionally, analysis can be conducted for smaller areas such as jurisdictions or corridors to see the impacts on travel and congestion. The financial analysis in this memorandum is a conservative, sketch-level analysis. Other financing possibilities can be studied.

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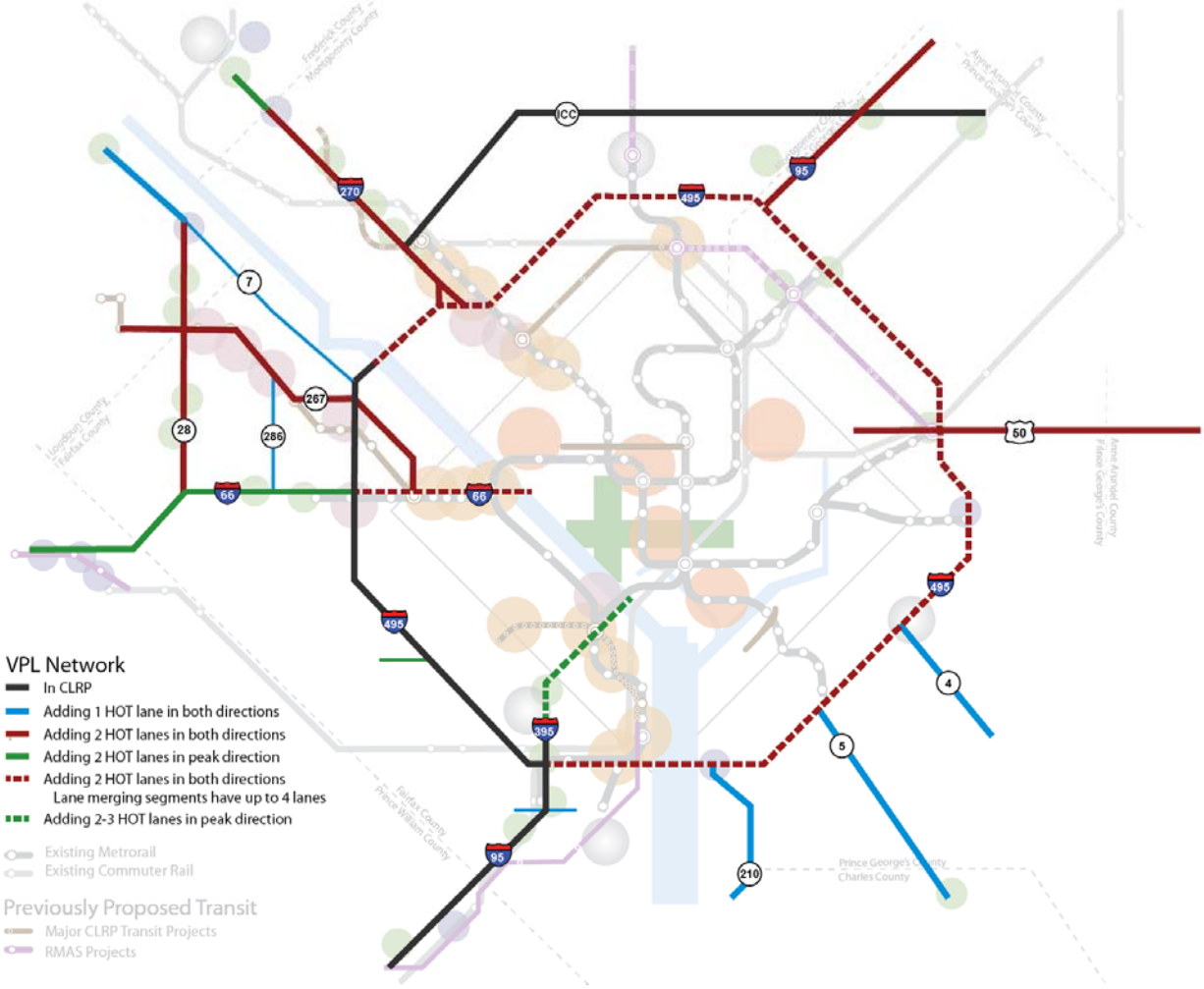
Attachment A: Regional Network of Variaby Priced Lanes for CLRP Aspirations Scenario



Attachment B: Regional Bus Rapid Transit Network for CLRP Aspirations Scenario