National Capital Region Transportation Planning Board

Evaluating a Network of Variably Priced Lanes for the Washington Metropolitan Region

Presented to
The TPB Technical Committee
Item 4

March 7, 2008

Funded under a grant from the Federal Highway Administration's Value Pricing Pilot Program

Preface

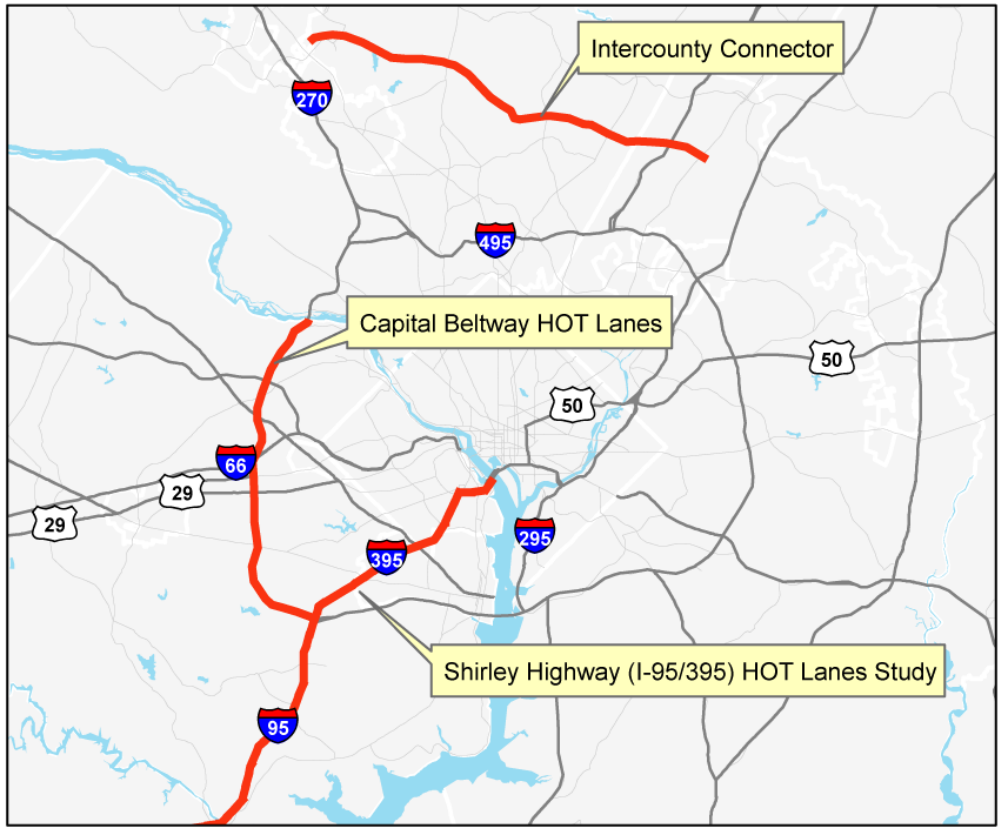
"Under urban conditions we cannot have both free flowing rush hour traffic and the absence of user charges or other constraints on highway use. One or the other of these desiderata must yield."

"Pricing of highway use will thus make it possible to provide at reasonable cost uncongested and speedy transportation anytime, anywhere, and for anyone for whom the occasion is sufficiently urgent to warrant the payment of the corresponding charge. Without pricing, it is very likely that during the rush hours this degree of freedom of movement would not be available to anyone at any price."

William Vickrey, Statement to the Joint Committee on Washington DC Metropolitan Problems, 1959.

2007 Value Pricing Projects

- Intercounty Connector (ICC)
  - 2004 CLRP Update*
- Beltway HOT
  - 2005 CLRP Update*
- I-95/I-395
  - 2007 CLRP Update



* Federal Record of Decision approved

Study Assumptions

- All scenarios are for the year 2030, and all toll values and revenue calculations are in 2010-dollars.
- Variable tolls will be used on the lanes to prevent congestion and maintain reasonably flowing traffic.
- Occupancy requirements for all HOV lanes will be increased to at least three people or more, based on planning assumptions in the region's long-range plan.
- The variably priced facilities will be physically separated from the other lanes, where possible.
- At least one variably priced lane will be provided in the peak direction.
- All tolled infrastructure will be priced 24/7/365, except where reversible lanes are proposed due to lack of reverse flow demand.
- Access and egress points will be primarily focused around the regional activity clusters.
  - COG and TPB adopted regional activity centers and clusters to help guide regional transportation planning decision-making, The 58 Centers are based on local government growth forecasts and categorized according to similar employment, residential, and growth pattern characteristics. The 24 Clusters tend to be groupings of Centers and are a more conceptual, stylized depiction of development than the Centers. The activity clusters are shown in many of the maps below, beginning with the map of Scenario A.

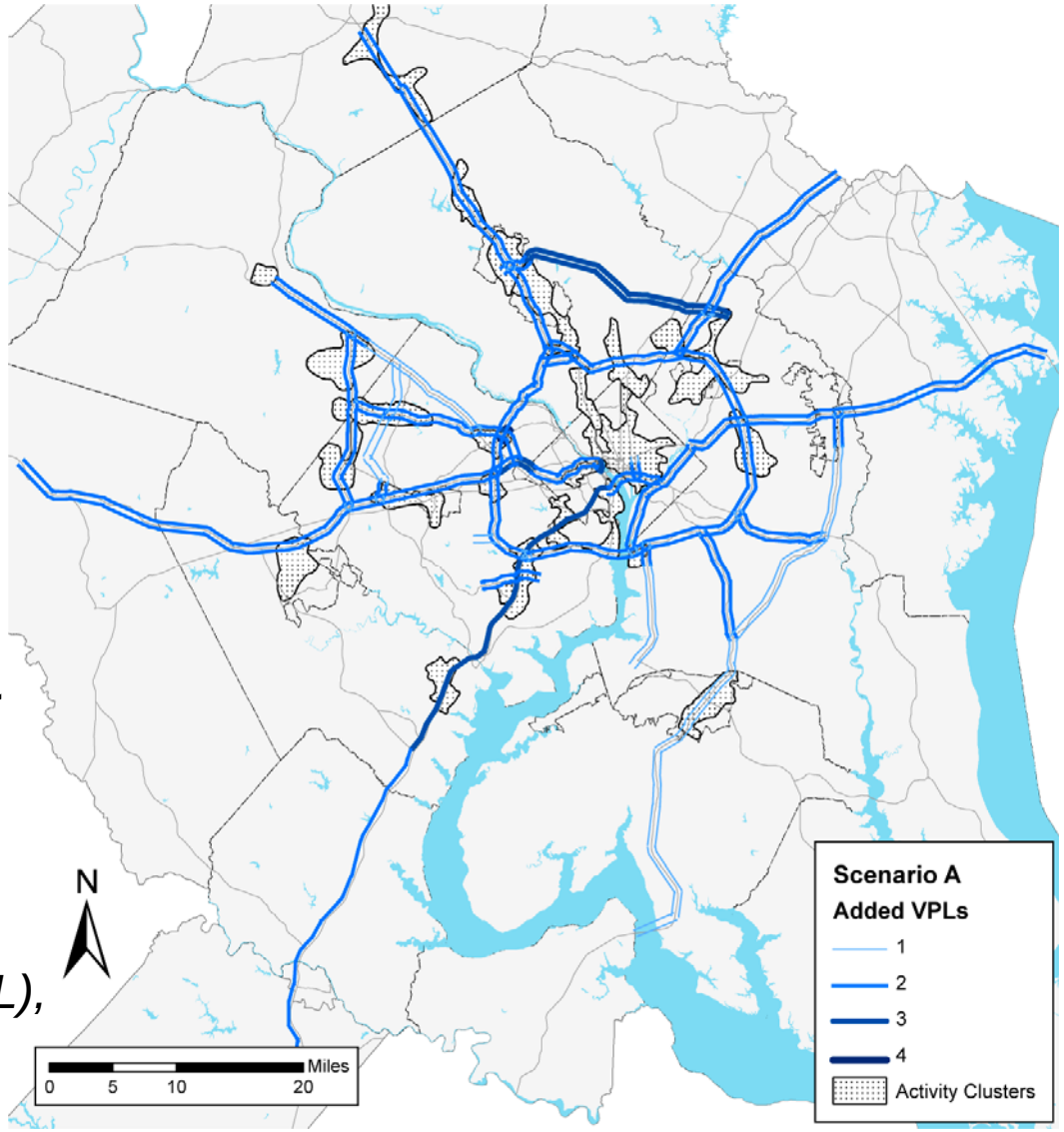
First Round Scenarios – Scenario A

In addition to the ICC, Beltway and I-95/395:

- All Freeways:
  - Add 2 VPLs
- Arterials outside of beltway:
  - Add 1 VPL
- Existing HOV lanes:
  - Convert to VPLs
- Direct access ramps at key interchanges
- Incorporate existing transit service

Variably Priced Lanes (VPLs):

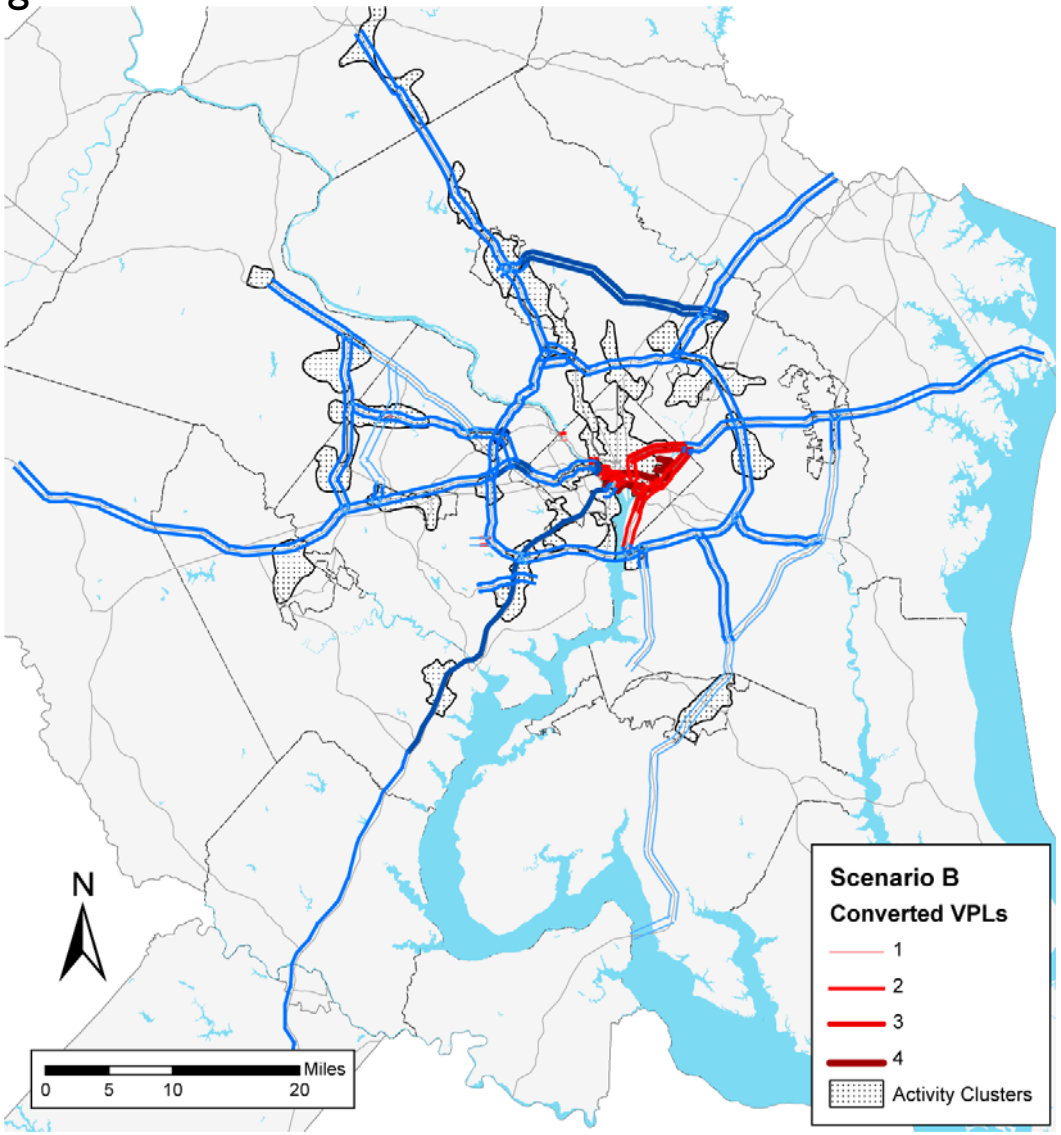
- *VA: HOT lanes, HOV 3+ free*
- *DC, MD: Express Toll Lanes (ETL), all pay*



First Round Scenarios – Scenario B

Add Variable Pricing to Existing DC Bridges and Other Facilities

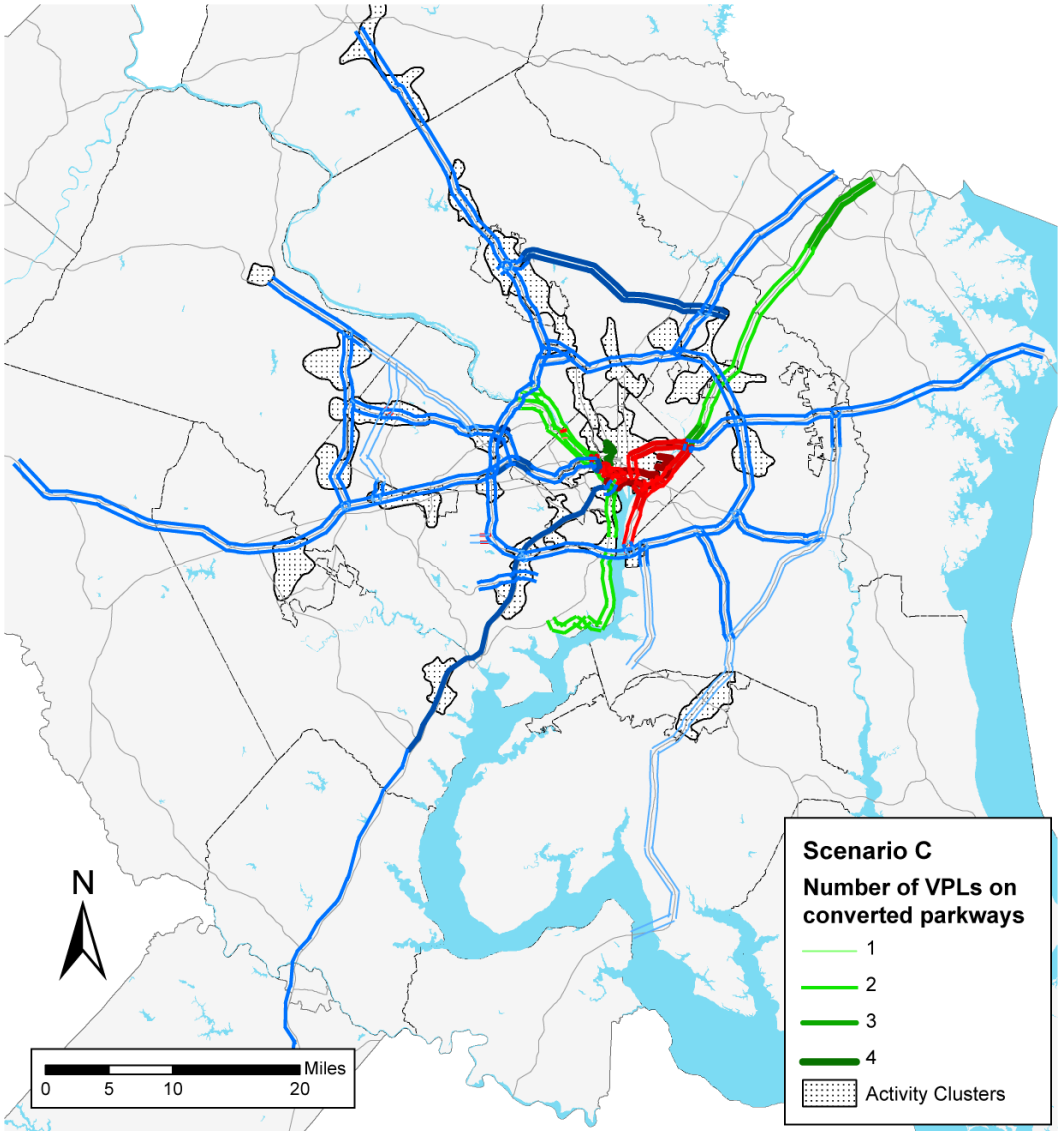
- **DC Bridges (Existing Capacity)**
  - Chain Bridge
  - Key Bridge
  - Memorial Bridge
  - South Capitol Street (Frederick Douglas) Bridge
  - Pennsylvania Avenue (John Phillip Sousa) Bridge
  - East Capitol Street (Whitney Young Memorial) Bridge
  - Benning Road Bridge
- **Other DC Facilities (Existing Capacity)**
  - New York Avenue from the District line to I-395 at 4th St NW
  - Independence Ave SW and Maine Ave SW between the Memorial Bridge and the Southeast/Southwest Freeway
  - Remove added capacity on Southeast/Southwest Freeway and I-295 and toll all existing lanes.
- **Additional VPLs to Address Scenario A Chokepoints**
  - Fairfax County Parkway northbound and southbound at the Dulles Toll Road (VA-267)
  - Braddock Road westbound at the Capital Beltway (I-495)
  - Indian Head Highway (MD-210) southbound at the Capital Beltway (I-495)



First Round Scenarios – Scenario C

Add Parkways to Scenario B, Tolls applied to existing capacity

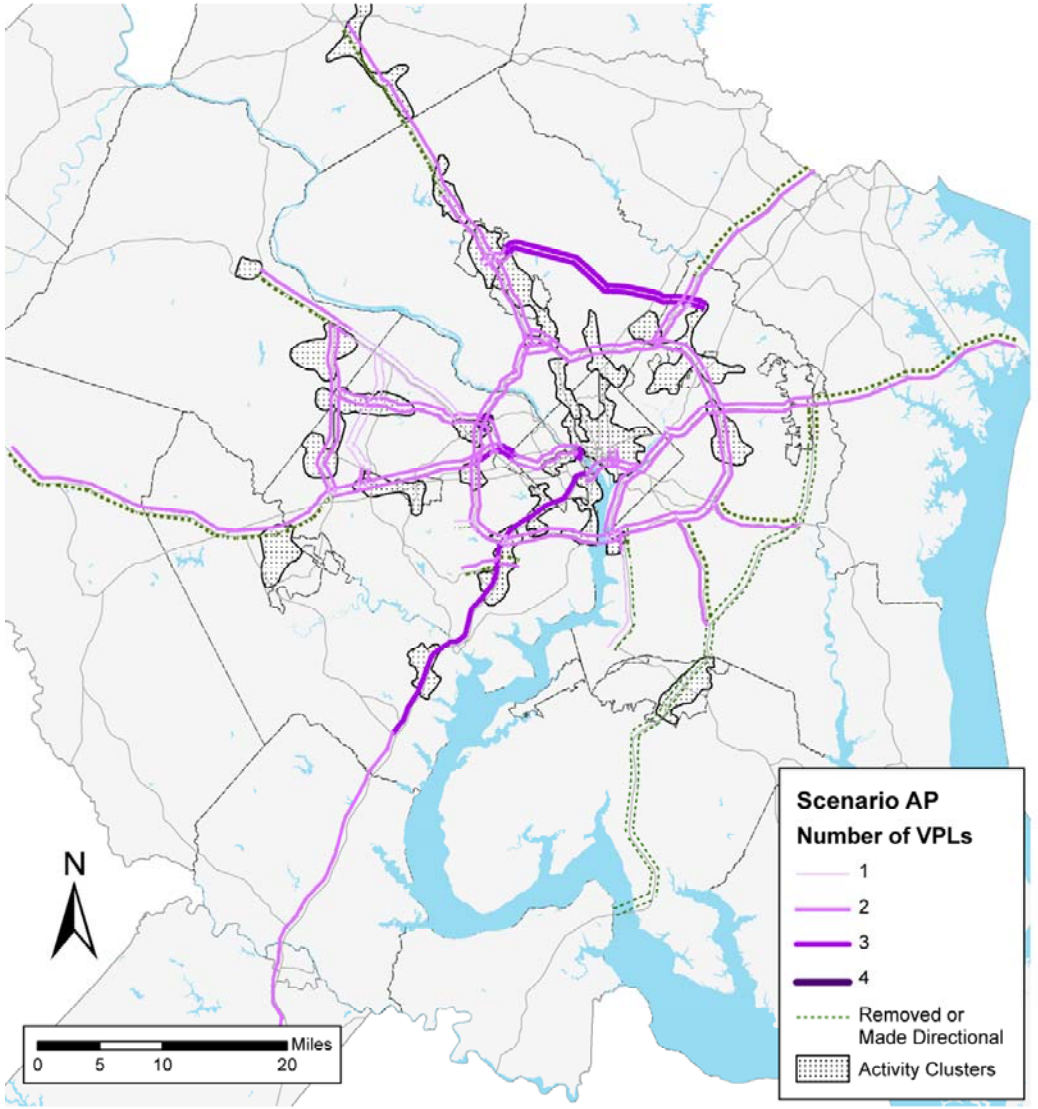
- Baltimore Washington Parkway (MD-295)
- George Washington Parkway
- Rock Creek and Potomac Parkway
- Clara Barton Parkway
- Suitland Parkway



Prioritized Scenarios – Scenario AP

Prioritizing from A, Drop facilities/directions with low toll rates

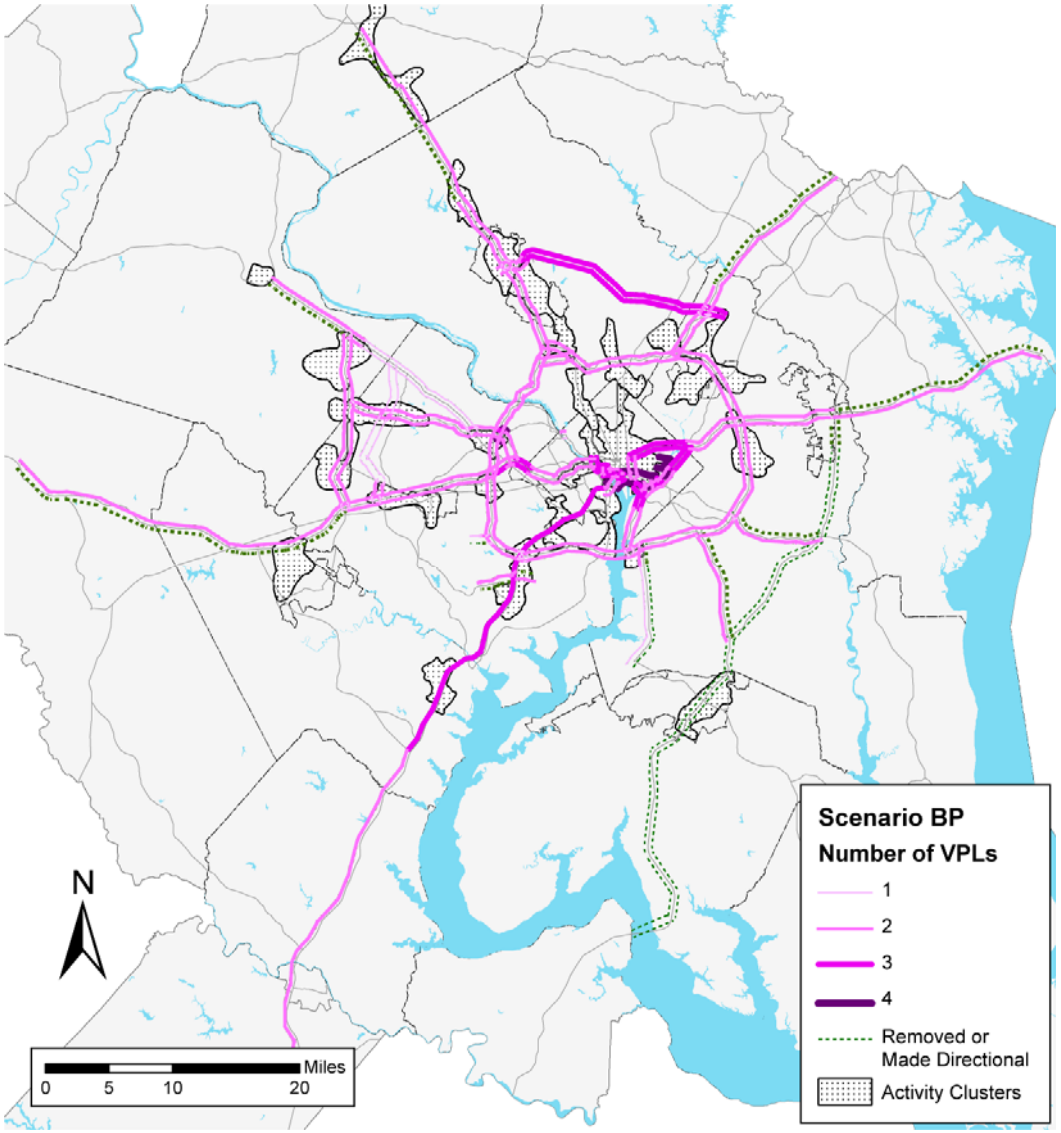
- 2030 Scenario A network pared back where demand is low, as indicated by low toll rates:
  - Segments that have high toll rates in the peak direction only are changed to directional toll lanes
  - Segments with low toll rates in both directions are removed from the network



Prioritized Scenarios – Scenario BP

Prioritizing from B, Drop facilities/directions with low toll rates

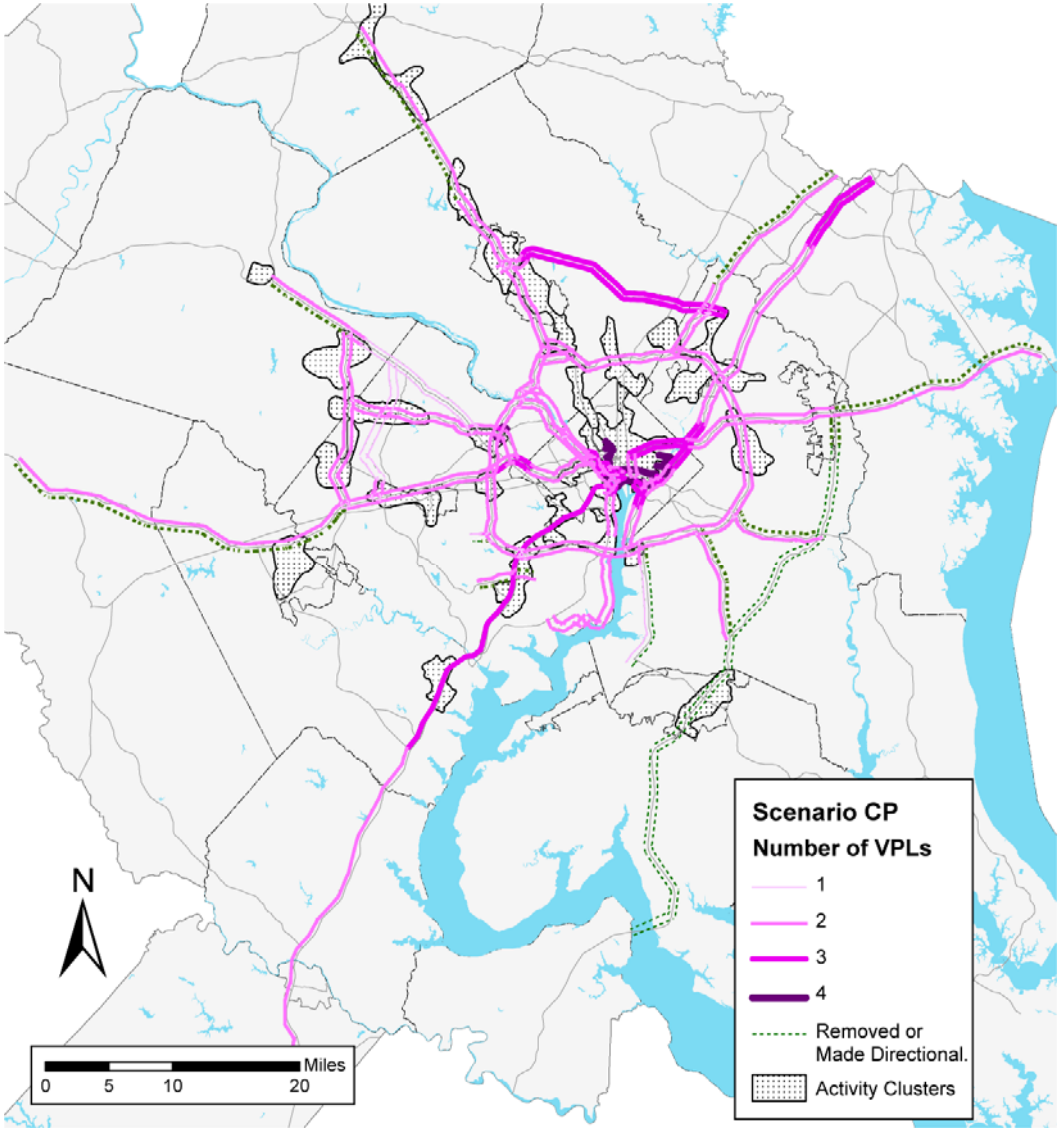
- 2030 Scenario B network pared back where demand is low, as indicated by low toll rates:
  - Segments that have high toll rates in the peak direction only are changed to directional toll lanes
  - Segments with low toll rates in both directions are removed from the network



Prioritized Scenarios – Scenario CP

Prioritizing from C, Drop facilities/directions with low toll rates

- 2030 Scenario C network pared back where demand is low, as indicated by low toll rates:
  - Segments that have high toll rates in the peak direction only are changed to directional toll lanes
  - Segments with low toll rates in both directions are removed from the network



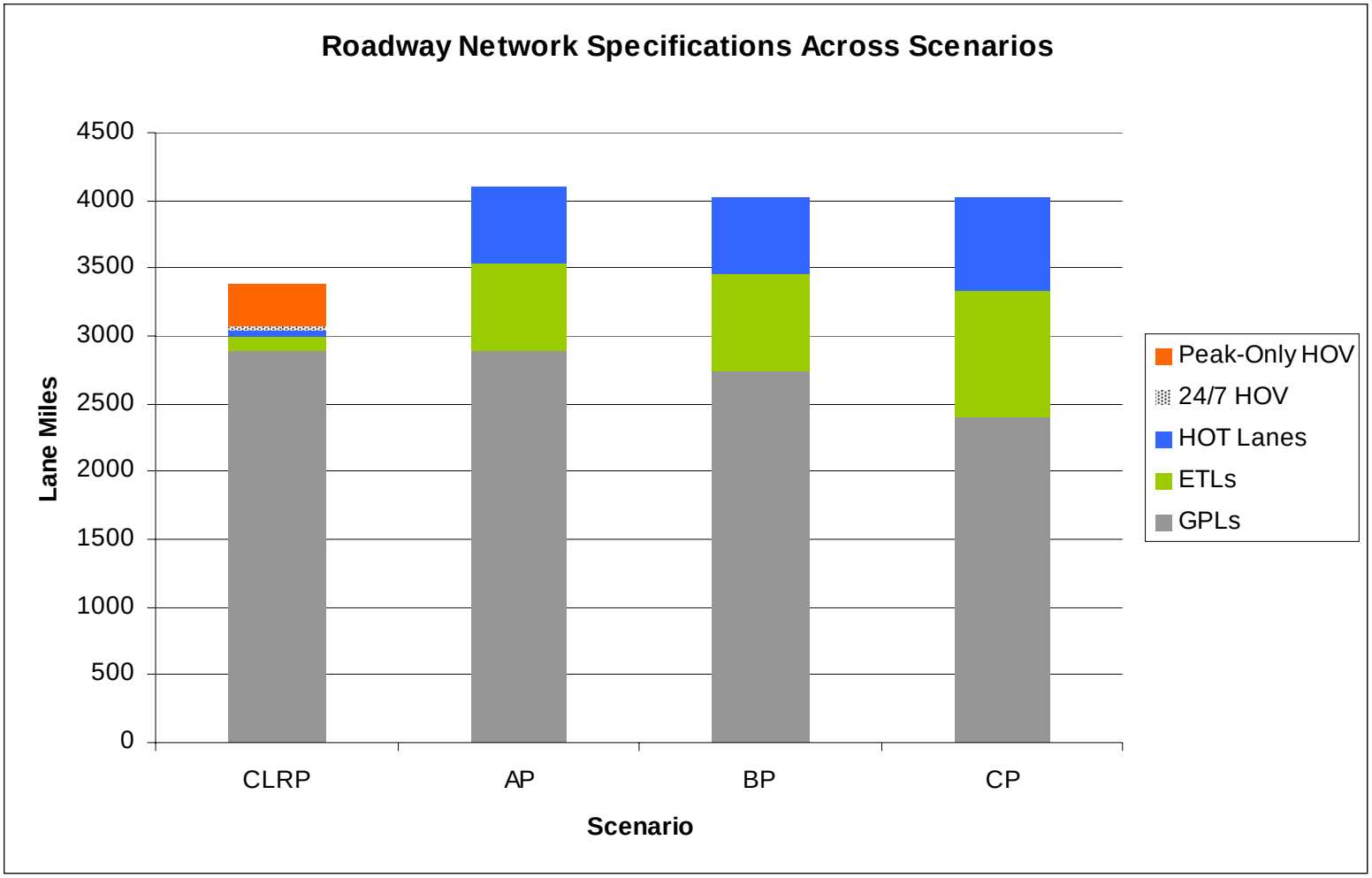
Composition of Studied Scenarios

- General purpose network reduces in size across scenarios.
- Percentage of highway network that is priced reaches 36% in Scenario CP.
- Regional network grows by 18% in Scenarios BP and CP.

	CLRP	AP	BP	CP
GPLs[1]	2891	2891	2738	2400
VPLs	155	1208	1291	1629
ETLs (DC/MD)	*102*	*640*	*714*	*934*
HOT Lanes (VA)	*53*	*569*	*577*	*694*
24/7 HOV (US-50, MD)	25	0	0	0
Peak-Only HOV[2]	312	0	0	0
Regional Network	**3,383**	**4,099**	**4,029**	**4,029**
Percent Priced Lanes	**5%**	**29%**	**32%**	**40%**
Percent Increase from CLRP	**n/a**	**20%**	**18%**	**18%**

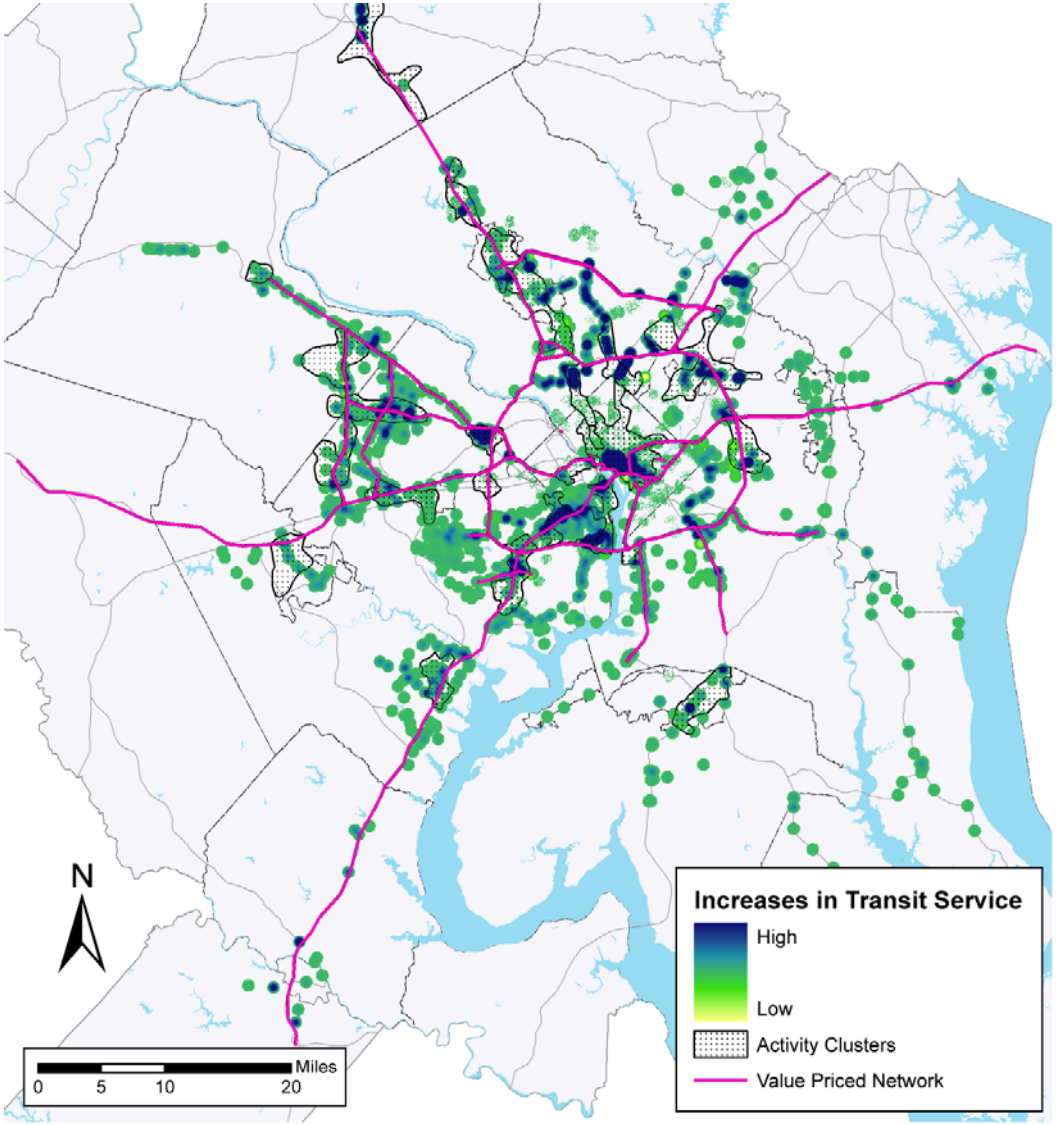
[1] 2007 CLRP GPLs include all freeways, major arterials outside the beltway, parkways and selected arterials in the District as specified in Scenario B.
[2] Peak-only HOV includes lane miles that are available to SOVs in the off-peak direction during peak periods.

Composition of Studied Scenarios



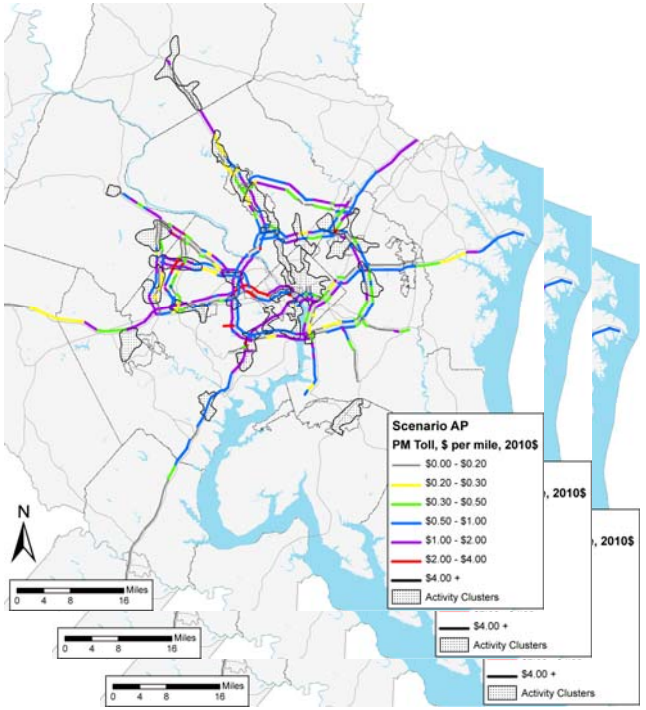
Scenarios with Enhanced Transit

- Create a bus transit network that operates on the network of variably priced lanes:
  - All planned transit along BP, CP Networks
  - Add Beltway bus routes from the TPB-assisted studies
  - Create routes on VA 28 and Fairfax County Parkway
    - Running between I-66 and VA-7
    - Include stops at major activity centers
- Enhance bus speeds/frequencies:
  - Increase speeds, reducing run-times by 10%
  - Increase frequency, reducing headways by 50%
- Scenario CPT: Add new and enhance existing bus routes on Parkways



Scenario AP, Scenario BP, Scenario CP

- Scenario AP- Compared to 2006 CLRP:
  - To ensure free flow, toll rates vary significantly by segment, direction and time of day
  - 2.7 % increase in regional VMT
  - 20% increase in HOV use
  - 3.4% increase in transit use
- Scenario BP - Compared to AP:
  - 37% increase in revenue
  - 0.6% increase in VMT
  - 7.5% decrease in HOV use
  - 1.8% increase in transit use
- Scenario CP - Compared to BP:
  - 32 % increase in revenue
  - 0.6% increase in VMT
  - 13% decrease in HOV use
  - 1% increase in Transit Use



Updated 3/05/08

Comparison of Scenarios to 2006 CLRP

- VMT: All scenarios raise VMT
- HOV use decreases as existing lanes are tolled
- Transit use increases across scenarios
- System revenue of CP nearly double that of AP

	Scenario AP	Scenario BP	Scenario CP
New PM Priced Lane Miles[1]	1,054	1,136	1,474
% Converted Lane Miles	32%	43%	56%
Regional VMT	2.7%	2.0%	1.2%
HOV Use	20.4%	11.4%	3.6%
Transit Use	3.4%	5.3%	5.9%
Annual System Toll Revenue (millions)	$1,520	$2,080	$2,750
Average Bridge Toll	n/a	$2.41	$2.80

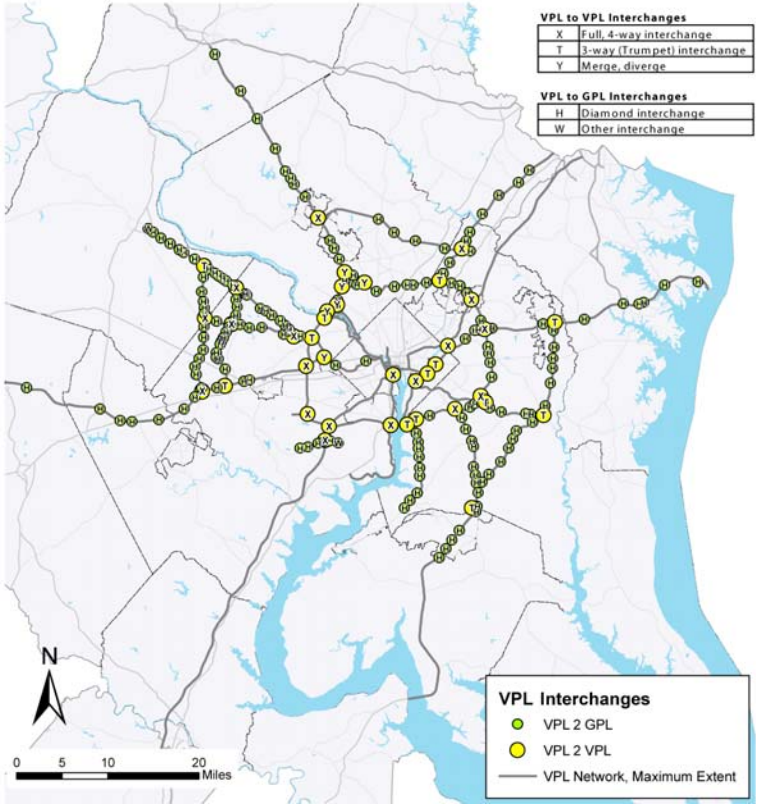
Updated 3/05/08

Compared to base case, 2006 CLRP

[1] The 2006 CLRP for 2030 contains the Beltway HOT Lanes project and the ICC, resulting in 155 existing priced lane miles in the base case not included here.

Scenario Cost Estimates

- Determine Extent of Scenario Networks
  - Interchanges,
    - VPL to VPL
    - VPL to GPL
  - Lane Miles,
    - New
    - Upgraded Existing – HOV lane converted
    - Converted Facility – Entire facility converted from general purpose to priced.



	AP	BP	CP
New VPL to VPL Interchange	32	29	29
New VPL to GPL Interchange	152	152	152
New VPL Lane Mile	717	646	646
Upgraded Existing Lane Mile	194	194	194
Converted Facility Lane Mile	143	295	634

Updated 3/05/08

Scenario Cost Estimates

- Unit Costs
  - VDOT costs based on Beltway HOT Lanes project
  - MDOT costs based on West Side and South Side Mobility Studies
  - VDOT and MDOT costs reconciled, adjusted to 2010$

	MDOT	VDOT	Reconciled Costs 2007$	**Reconciled Costs 2010$**
Cost Per New/Major Interchange	$230	$175	$200	**$220**
Cost Per Modified/Intermediate Interchange	$130	$100	$120	**$132**
Cost Per New Separated VPL Lane Mile	$45	$11	$30	**$33**
Cost Per Converted Lane Mile	$4	$3	$4	**$4**

Costs in millions

Scenario Cost Estimates

- Interchanges are a large part of the scenario costs.
  - Large number of access and egress points (VPL to GPL interchanges) significantly impacts costs
- New VPL Lane Miles largest cost component

	AP	BP	CP
New VPL to VPL Interchange	$7,000	$6,400	$6,400
New VPL to GPL Interchange	$20,100	$20,100	$20,100
New VPL Lane Mile	$23,600	$21,300	$21,300
Upgraded Existing Lane Mile	$900	$900	$900
Converted Facility Lane Mile	$600	$1,300	$2,800
Total	**$52,200**	**$49,900**	**$51,400**

Costs in millions

Updated 3/05/08

Scenario Financial Feasibility - % Revenue/Cost

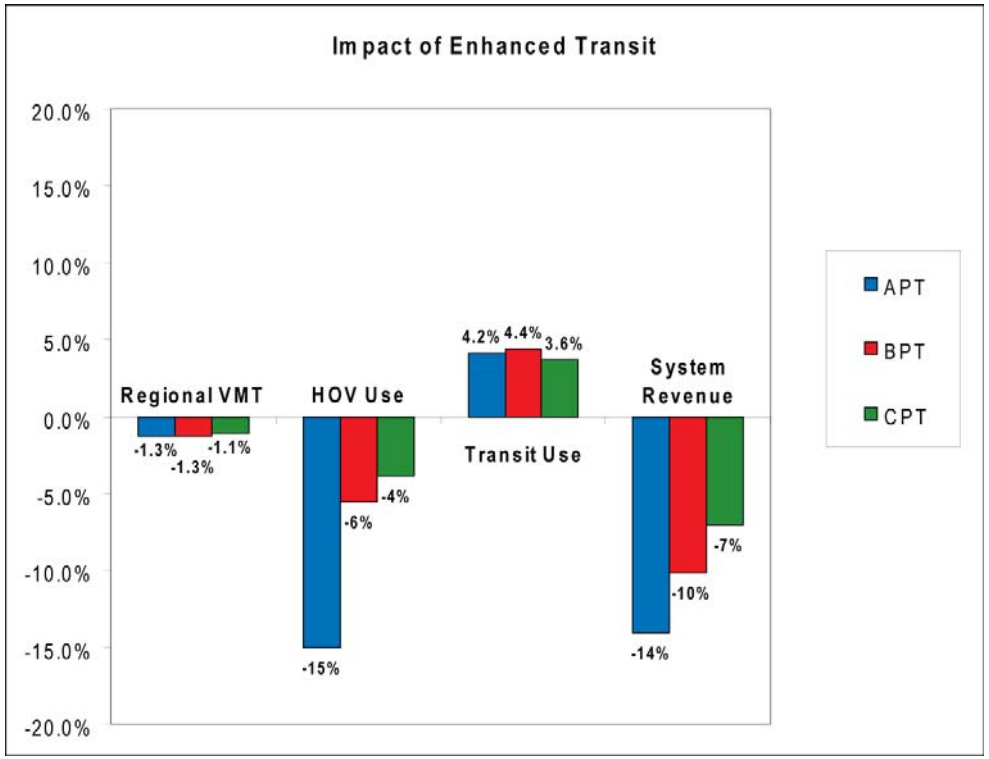
- Only CP has revenues in excess of costs
  - Parkways are low-cost revenue generators
- Virginia HOV-3 free policy impacts revenues and feasibility
- Converted Facilities – All lanes converted, no new ramps or interchanges are needed
  - Scenario AP: I-66 inside the Beltway, I-95/395 from 14th Street Bridge to Dumfries
  - Scenario BP: add DC facilities and bridges
  - Scenario CP: add Parkways

	AP	BP	CP
Regional	58%	83%	110%
Upgraded/New Facilities	43%	48%	47%
Converted Facilities	1300%	1430%	1200%

Updated 3/05/08

Impact of Transit on Performance of the Scenarios

- Increasing Transit Service on the Value Priced Network Results In:
  - Increased transit use
  - Decreases in HOV use, VMT and toll revenue.
- Would expect toll rate decreases and little change in volumes and speeds.



Results to date indicate that transit will impact tolls in a few "high transit" corridors, but will have little impact in many corridors with modest transit demand and service.

Updated 3/05/08

Evaluation of Potential Land Use Impacts

Rationale

- Land Use changes are influenced by transportation improvements.

- These changes can be attributed to increases in accessibility.

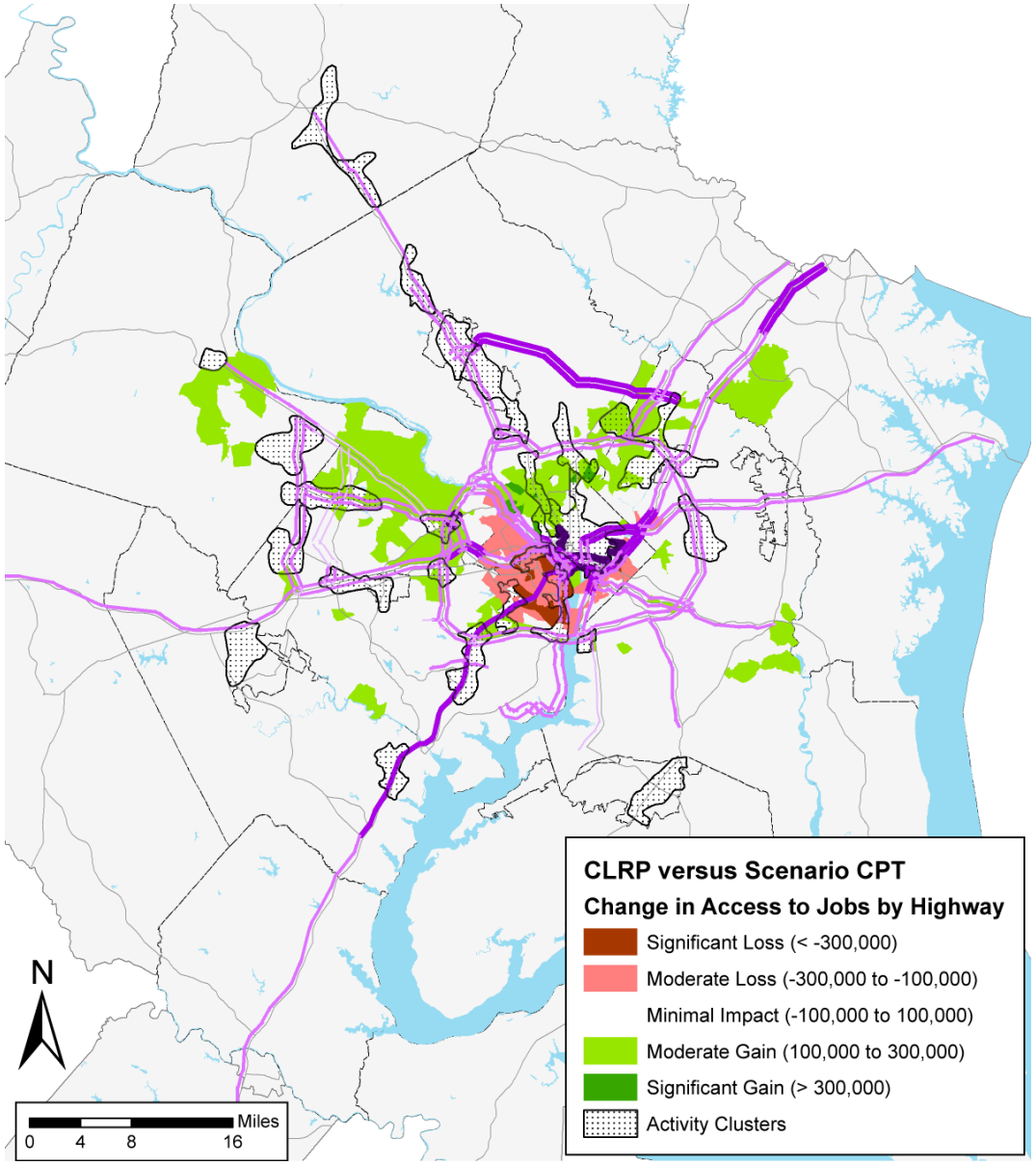
- TPB Accessibility Analysis tool is used to compare change in accessibility between the CLRP for 2030 and the Regional Value Priced Network Scenario

Evaluation of Potential Land Use Impacts

Location of Households

- Few zones experience significant changes in accessibility to jobs by highways
  - Beneficial impacts concentrated at major access points to the VPL network
  - Minimal impact in the exurbs
  - Losses concentrated in core clusters, likely due to DC bridge tolls
- Increases in accessibility to jobs by transit and walk-access transit

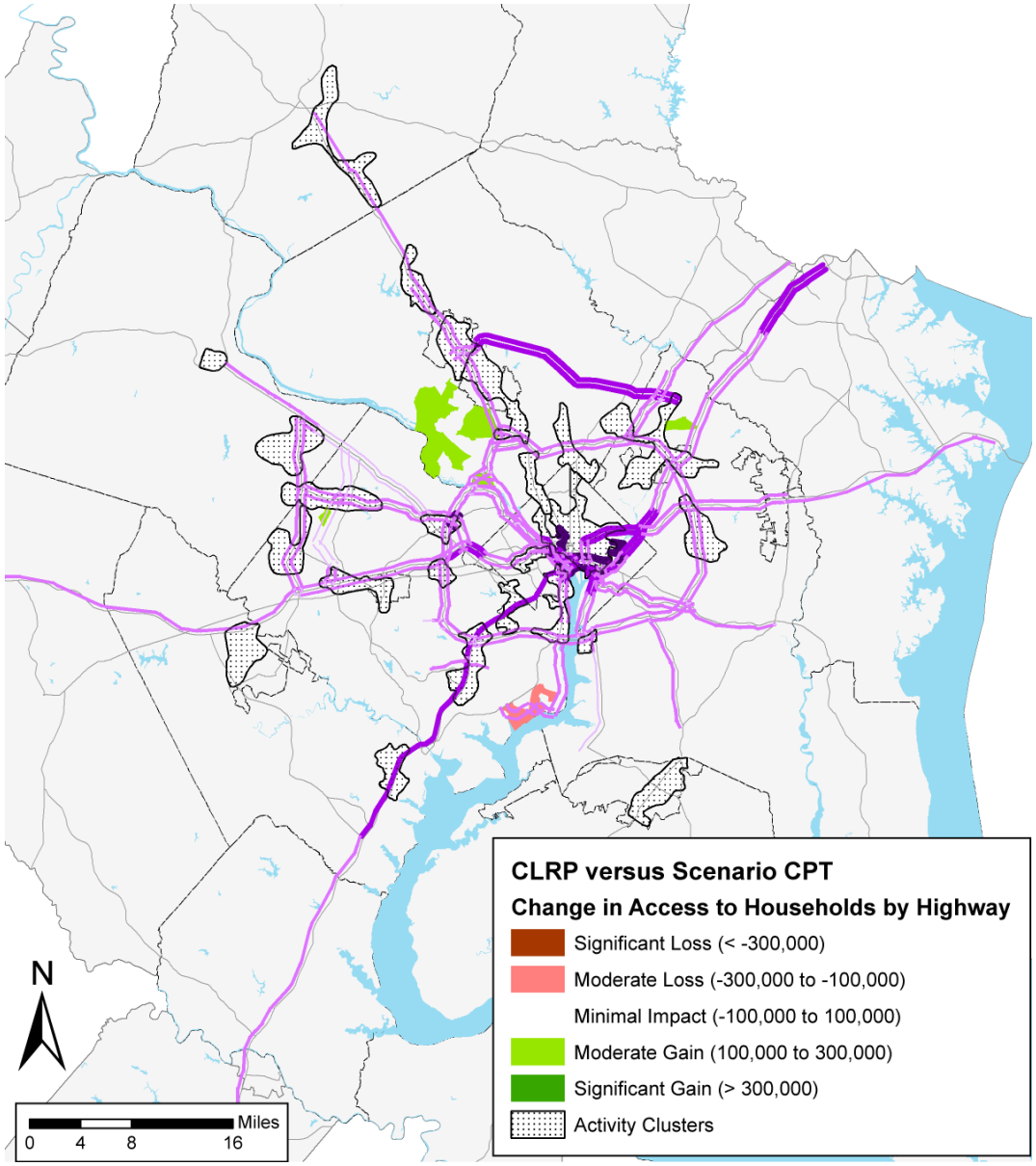
Update 3/05/08



Evaluation of Potential Land Use Impacts

Location of Jobs

- Moderate gains in accessibility to households near intersections of major roadways in the VPL network
- Few zones with moderate gains scattered throughout the regional core and inner suburbs
- Minimal impact in the exurbs
- Increases in accessibility to jobs by transit and walk-access transit



Update 3/05/08

Connectivity to the Regional Core and Activity Centers

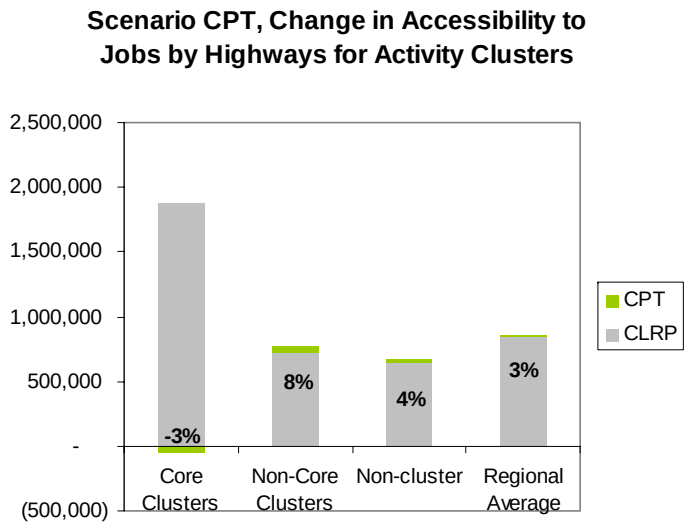
Methodology

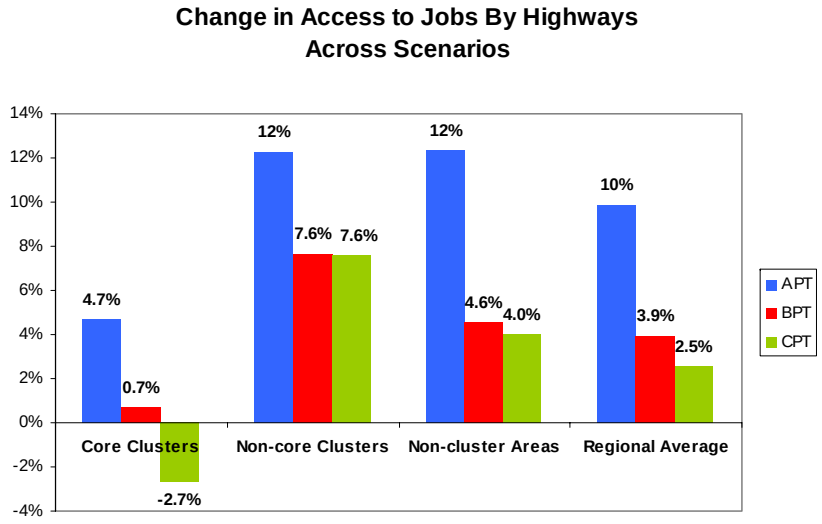
- Based on accessibility analysis
- Categorizes transportation analysis zones:
  - Core cluster
  - Suburban cluster
  - Non-cluster areas
- Increased accessibility to zones in clusters represents increased connectivity to the clusters.

Connectivity to the Regional Core and Activity Centers

VPL Impacts on Land Use: Change in Accessibility to Jobs

- Core clusters lose access to jobs, non-core clusters gain.
- Bridge tolls likely impact accessibility to jobs in the regional core.



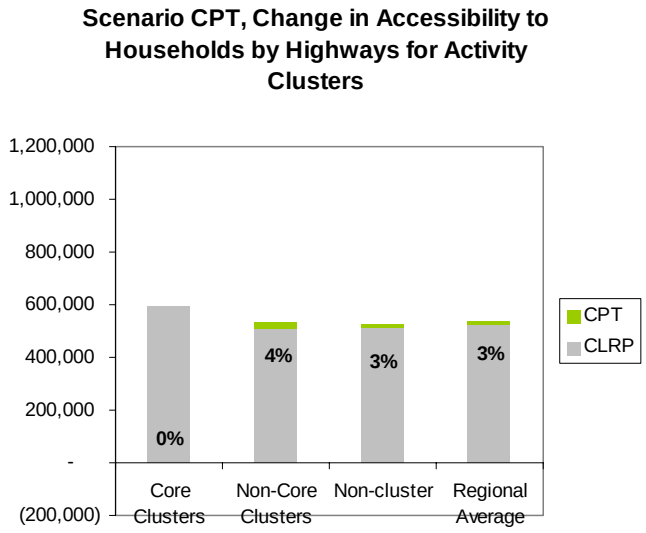


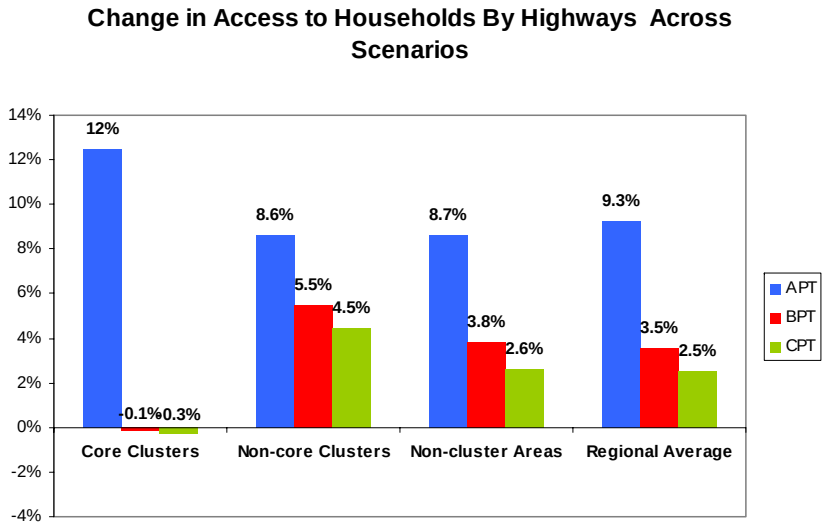
Update 3/05/08

Connectivity to the Regional Core and Activity Centers

VPL Impacts on Land Use: Change in Accessibility to Households by Highways

- Non-core clusters and non-cluster areas experience greatest increase in accessibility.
- Pricing gives advantage to non-core clusters over non-cluster areas.





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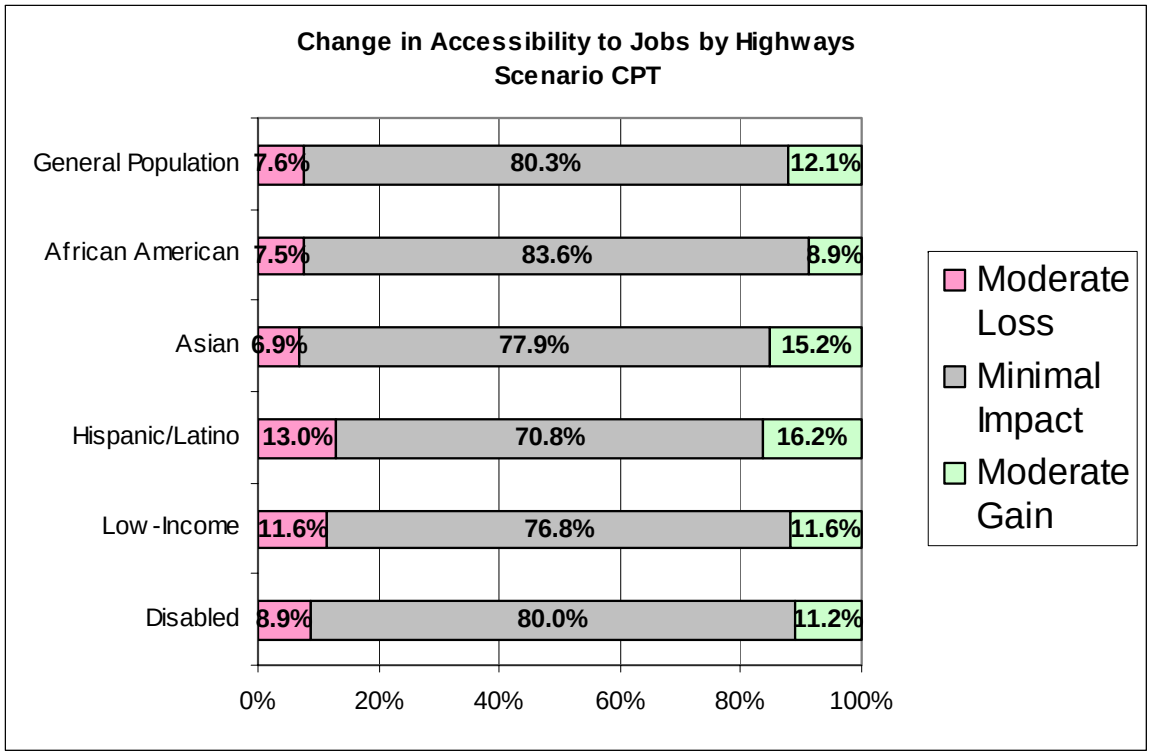
Impacts of Pricing Scenarios on Different Populations

- Benefits and burdens are distributed across the different population groups.



Update 3/05/08

Assessing the Impact of Tolling Existing Lanes (1)

- Zettel & Carll (1964) note that tolling of existing lanes impacts three groups of people differently:
  - The Tolled: drivers using the newly tolled road who are willing to pay the toll
  - The Tolled-off: Former users of the newly tolled road, who have switched routes, modes or times for their trip, or are no longer making their trip altogether
  - The Un-tolled: Drivers who do not use the road in question but are impacted by the drivers diverted by the tolls

Assessing the Impact of Tolling Existing Lanes (2)

- Zettel and Carll (1964) frame the assessment of pricing strategies as follows:
  - The benefits: "*by reducing traffic flow, 'savings' in travel time, accidents, operating costs, etc., are provided for those who continue to use the highway.*"
  - The costs: "*the loss to users who must be prevented or induced not to use a congested road. The amount of the loss depends on what alternatives are available to those who are diverted.*"
  - *The rationale should be drawn up in broad planning terms, involving community amenities and esthetics. This requires a balancing of the total consequences, the adverse as well as the beneficial, not only as they affect users but also as they affect the community-at-large.*

Topics for Further Consideration

- What Could Future Scenarios Include?
  - Tolling more existing lanes
  - BRT systems on toll lanes
  - Accommodation of commercial vehicles

- What Considerations Affect the Inclusion of VPLs in a Regional Network?
  - Phasing of VPL facilities
  - Effects of Chokepoints on Network Performance
  - Visual Esthetics & Geometries of Parkways

- Coordination with Current Corridor Studies in the Region
  - Southern Mobility Study, Western Mobility Study, 14th Street Bridge EIS, and I-66 Corridor Study

- Public Education about the Impacts and Rationale for Pricing
  - Importance demonstrated in international examples.

Next Steps

1. Draft Final Report was reviewed by TPB Value Pricing Task Force at its February 27, 2008 meeting
2. Extension granted by VDOT to allow time to address comments provided at final task force meeting
3. Presentation to the TPB on March 19

The final report is available online at http://www.mwcog.org/TPB/VPTF/docs/