

National Capital Region Transportation Planning Board

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

**Presented to the TPB Technical Committee, January 4, 2008**

**Item 10**

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

# Preface

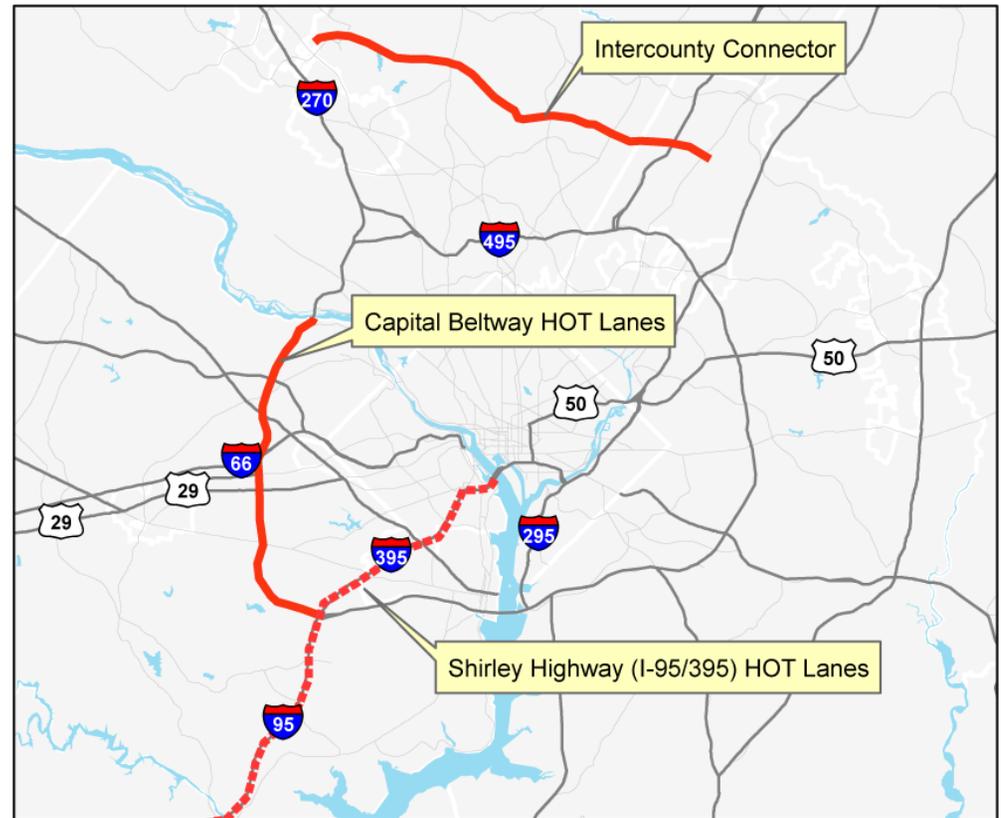
*“Under urban conditions we cannot have both free flowing rush hour traffic and the absence of user charges or other constraints on highway use. One or the other of these desiderata must yield.”*

*“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 (Underway)



\* 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.

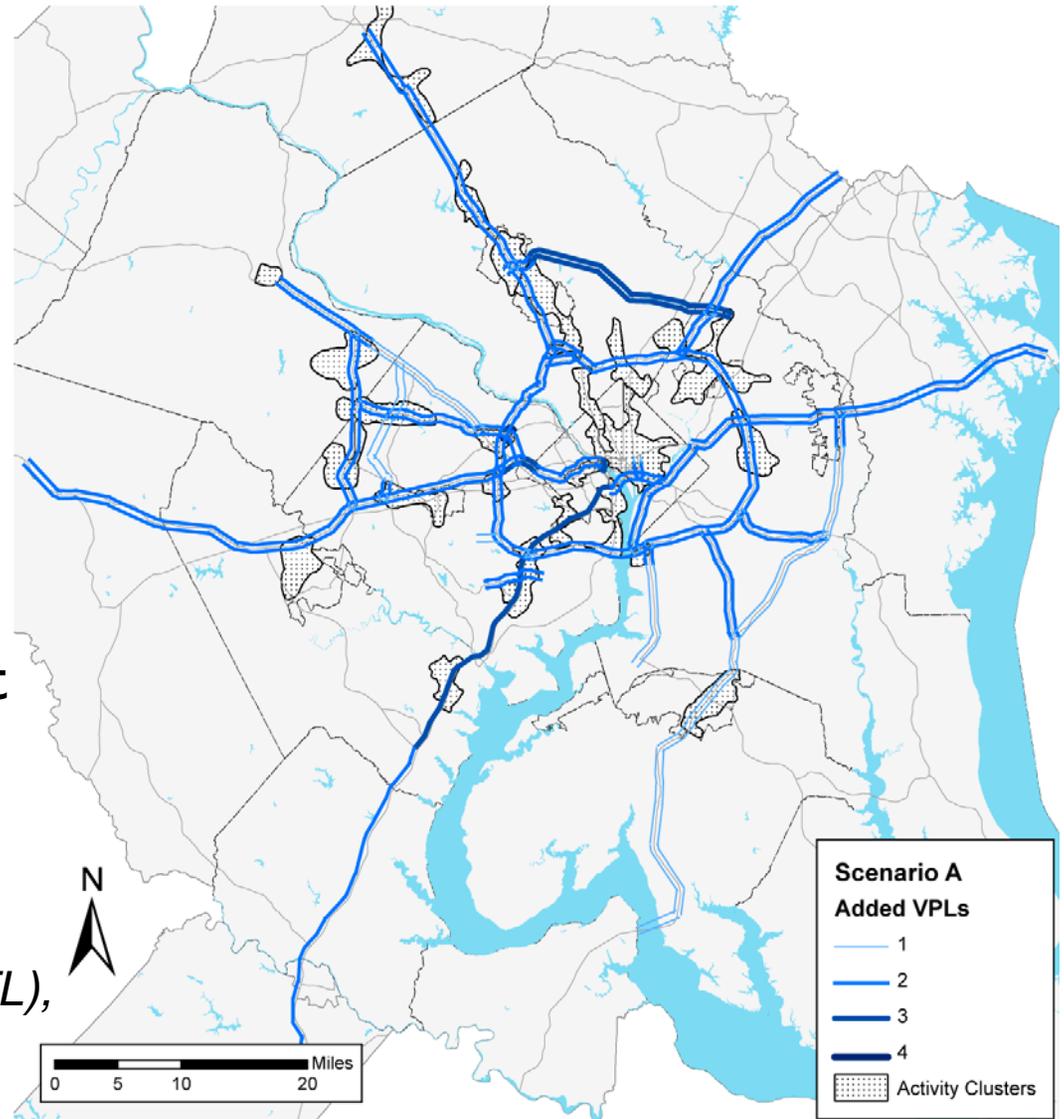
# First Round Scenarios – Scenario A

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):*

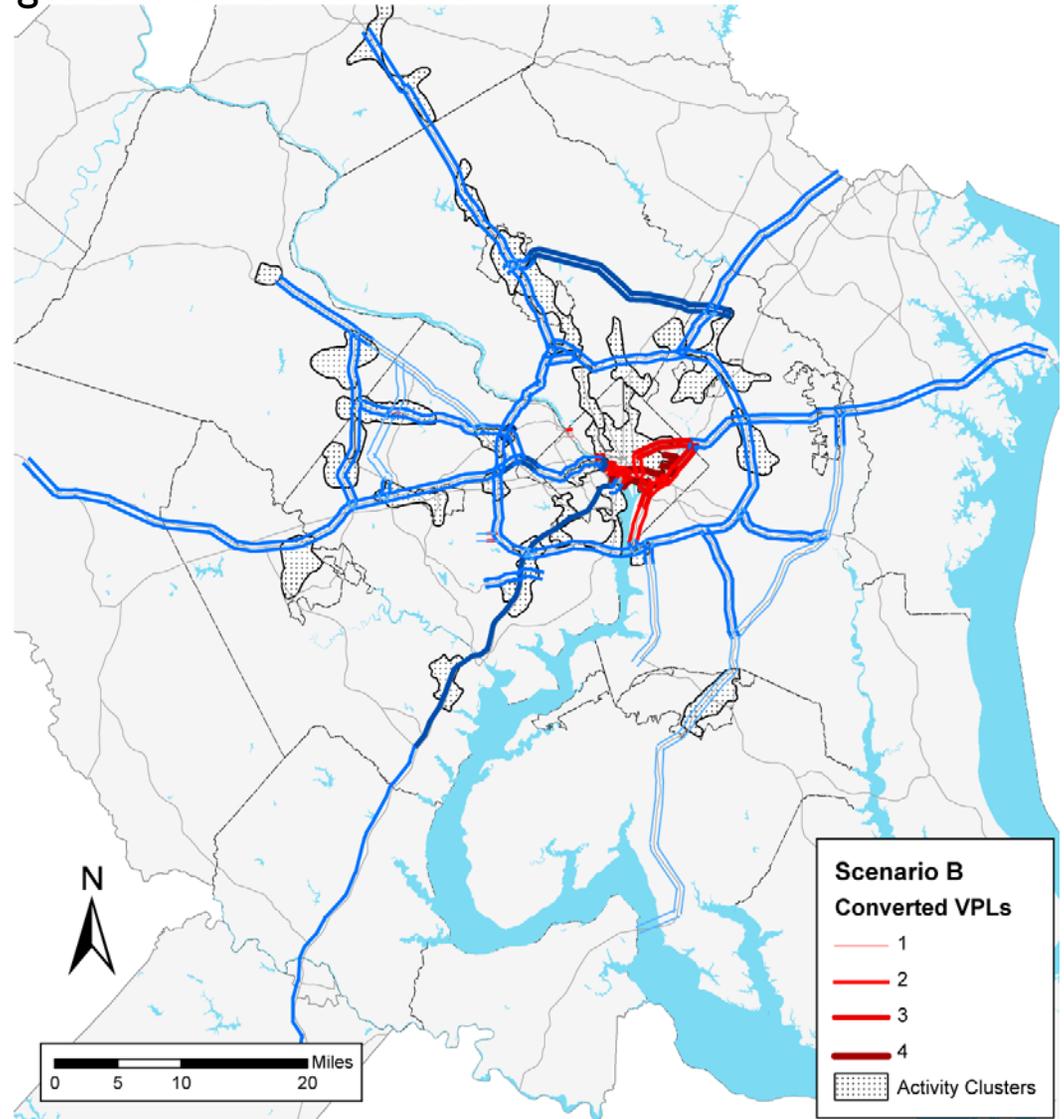
- *VA: HOT lanes, HOV 3+ free*
- *DC, MD: Express Toll Lanes (ETL), all pay*



# First Round Scenarios – Scenario B

## Add Variable Pricing to Existing DC Bridges and Other Facilities

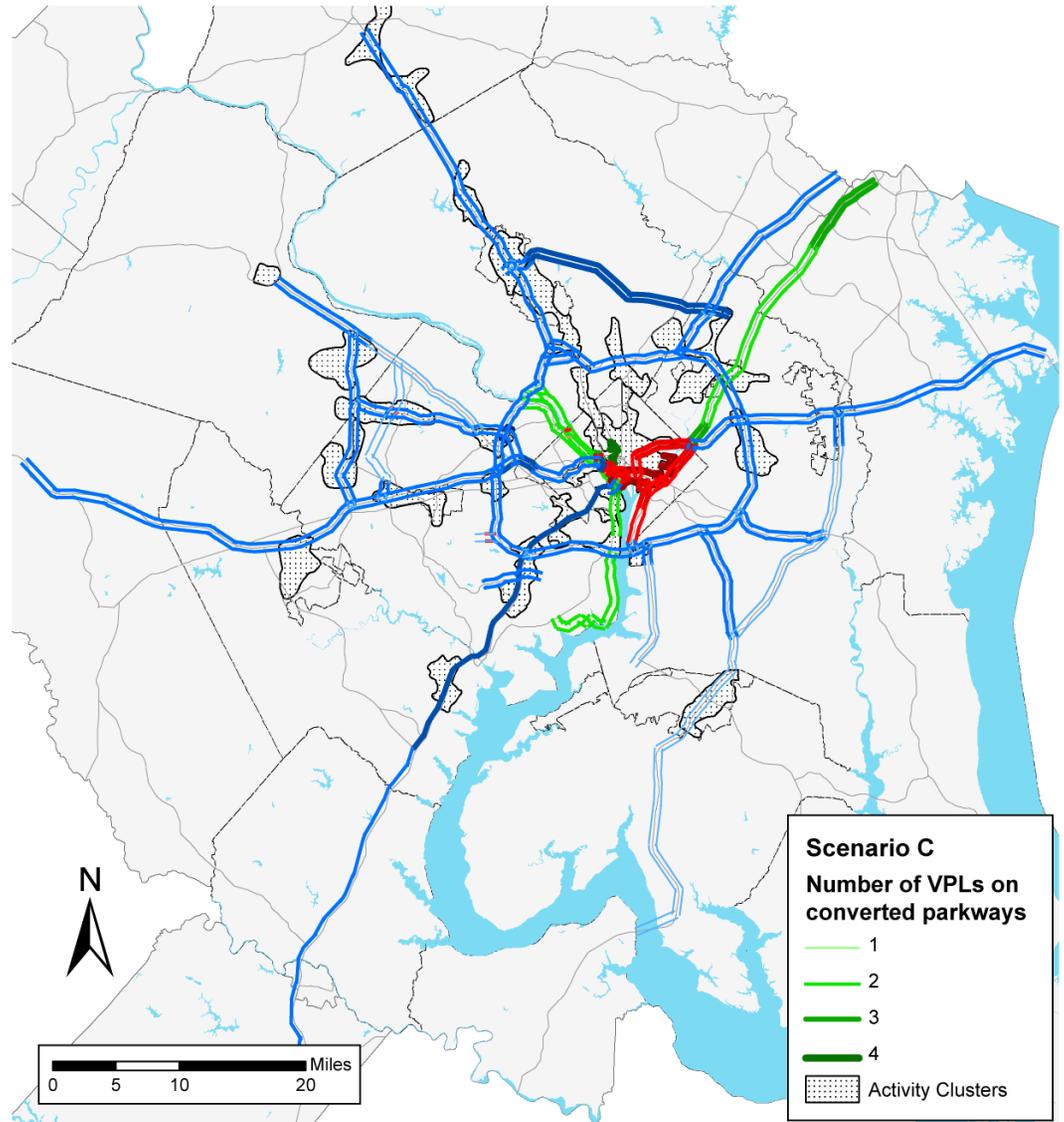
- **DC Bridges (Existing Capacity)**
  - Chain Bridge
  - Key Bridge
  - Memorial Bridge
  - South Capitol Street (Frederick Douglas) Bridge
  - Pennsylvania Avenue (John Phillip Sousa) Bridge
  - East Capitol Street (Whitney Young Memorial) Bridge
  - Benning Road Bridge
- **Other DC Facilities (Existing Capacity)**
  - New York Avenue from the District line to I-395 at 4<sup>th</sup> 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

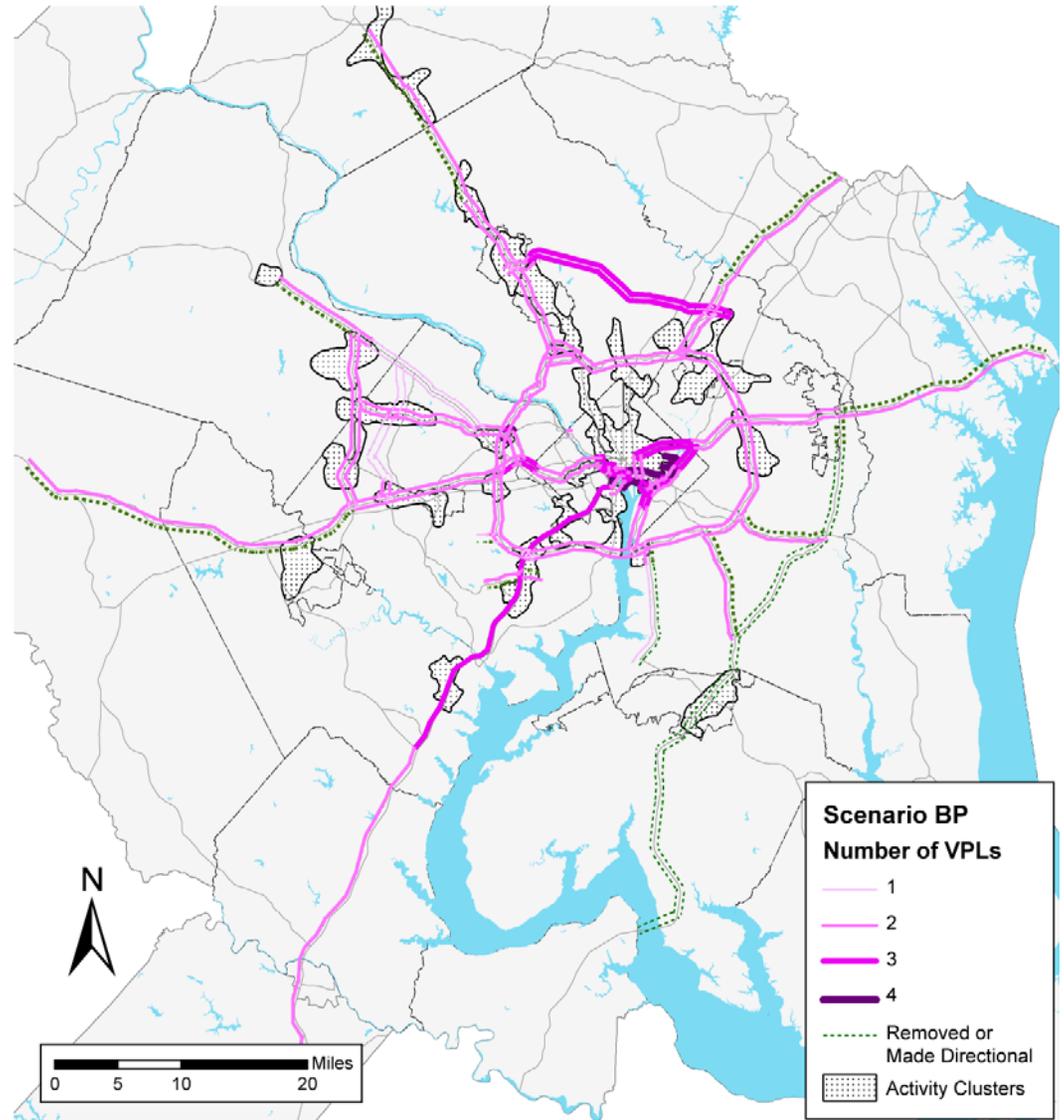
- Baltimore Washington Parkway (MD-295)
- George Washington Parkway
- Rock Creek and Potomac Parkway
- Clara Barton Parkway
- Suitland Parkway



# Prioritized Scenarios – Scenario BP

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

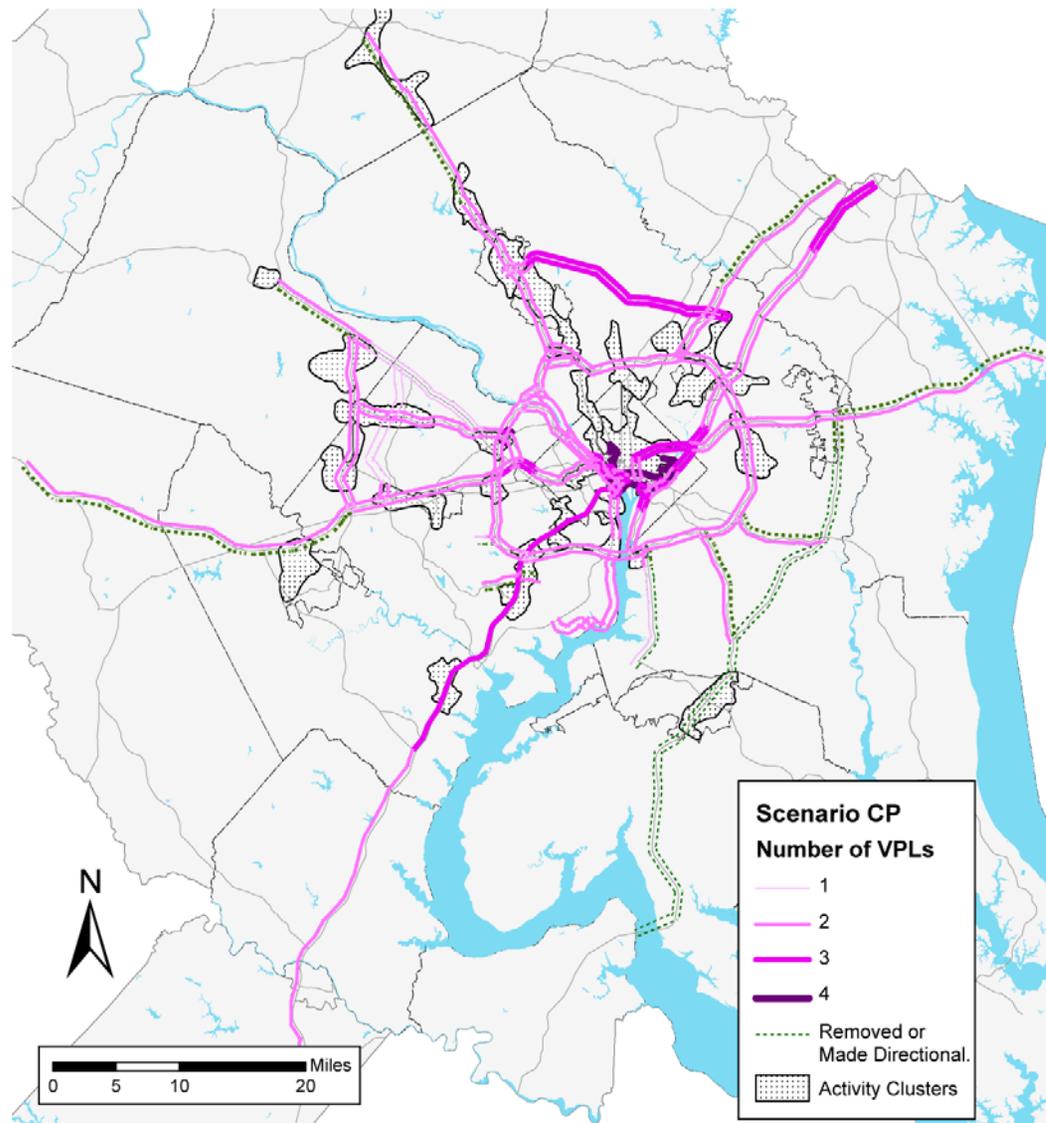
- 2030 Scenario B network pared back where demand is low, as indicated by low toll rates:
  - Segments that have high toll rates in the peak direction only are changed to directional toll lanes
  - Segments with low toll rates in both directions are removed from the network



# Prioritized Scenarios – Scenario CP

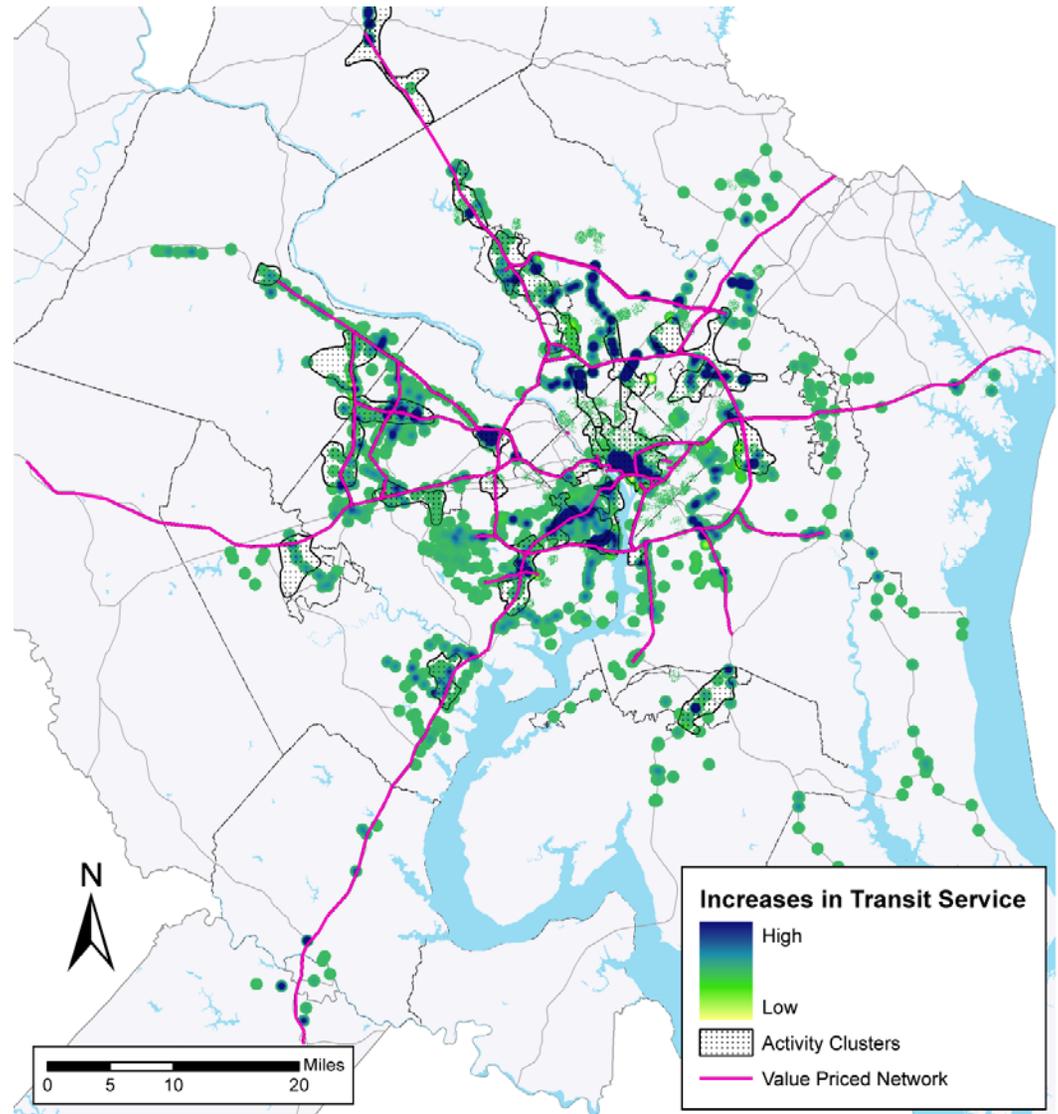
Prioritizing from C, Drop facilities/directions with low toll rates

- 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



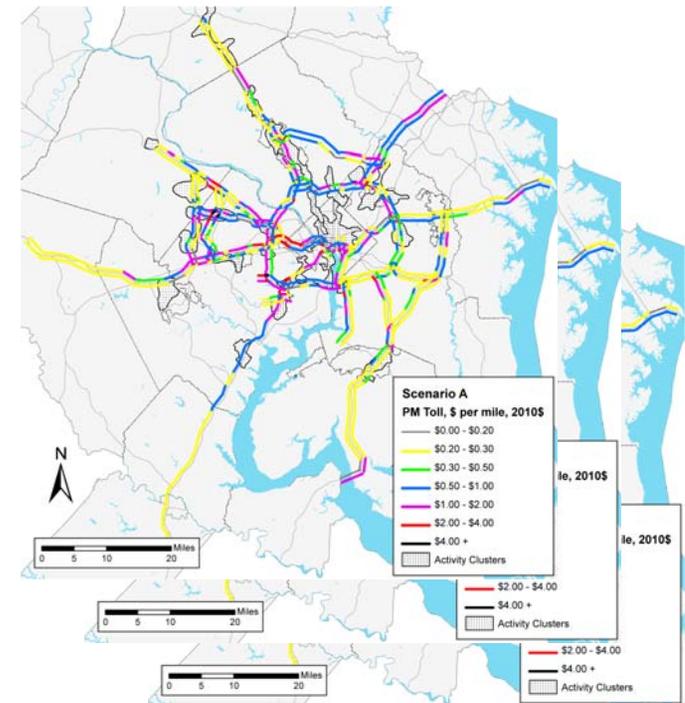
# Scenarios with Enhanced Transit

- 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 A, Scenario B, Scenario C

- Scenario A: To ensure free flow, toll rates vary significantly by segment, direction and time of day
- Scenario B - Compared to Scenario A:
  - High toll rates on DC Bridges (mostly between \$3 and \$10 per mile; between \$1 and \$4.25 per one-way crossing)
  - System-wide toll revenue increases by 33%
  - Small reduction in system-wide VMT (<1%)
  - HOV use decreased by 3%
  - Transit trips increase by 2%
- Scenario C - Compared to Scenario B:
  - System-wide toll revenue increases by 31%
  - Small reduction in system-wide VMT (<1%)
  - HOV use increases slightly (<1%)
  - Small increase in transit trips (1%)



# Comparison Across Scenarios

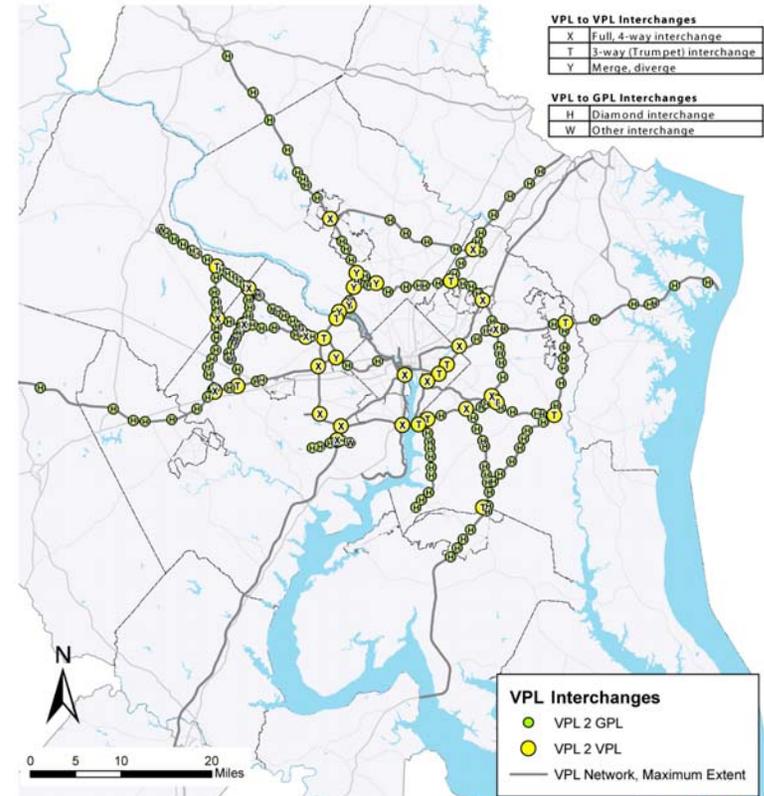
- VPL Network grows across scenarios, but GPL network loses lanes
- VMT, HOV Use and Transit
  - All scenarios increase regional VMT
  - More priced existing lanes result in smaller VMT increase
- System Revenue
  - Revenue increases as pricing of existing lanes increases
- Bridge Tolls
  - Parkways add small increase in bridge tolls.

	Scenario A	Scenario B	Scenario C
<i>PM Priced Lane Miles</i>	1664	1758	1979
<b>Regional VMT*</b>	4%	3%	2%
<b>HOV Use*</b>	12%	9%	9%
<b>Transit Use*</b>	3%	5%	6%
<b>Annual System Toll Revenue, millions</b>	\$1,700	\$2,300	\$3,000
<b>Average Bridge Toll</b>	n/a	\$2.70	\$3.00

\* Compared to base case, 2006 CLRP

# Scenario Cost Estimates

- Determine Extent of Scenario Networks
  - Interchanges, VPL to VPL and VPL to GPL
  - Lane Miles, converted and new



	A	B	BP	C	CP
New VPL to VPL Interchange	35	32	29	32	29
New VPL to GPL Interchange	172	172	152	172	152
New VPL Lane Mile	997	929	633	929	633
Converted Existing Lane Mile	337	481	481	819	819
% Converted Existing Lane	25%	34%	43%	47%	56%

# 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\$

<b>Summary</b>	<b>MDOT</b>	<b>VDOT</b>	<b>Reconciled Costs 2007\$</b>	<b>Reconciled Costs 2010\$</b>
Cost Per New/Major Interchange	\$230	\$175	\$200	<b>\$220</b>
Cost Per Modified/Intermediate Interchange	\$130	\$100	\$120	<b>\$132</b>
Cost Per Non-access/Minor Interchange	\$25	\$25	\$25	<b>\$28</b>
Cost Per Non-Separated New VPL Lane Mile	\$25		\$25	<b>\$28</b>
Cost Per New Separated VPL Lane Mile	\$45	\$11	\$30	<b>\$33</b>
Cost Per Converted Lane Mile	\$4	\$3	\$4	<b>\$4</b>

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 second largest cost component

	A	B	BP	C	CP
New VPL to VPL Interchange	\$7,700	\$7,000	\$6,400	\$7,000	\$6,400
New VPL to GPL Interchange	\$22,700	\$22,700	\$20,100	\$22,700	\$20,100
New VPL Lane Mile	\$32,900	\$30,700	\$20,900	\$30,700	\$20,900
Converted Existing Lane Mile	\$1,500	\$2,100	\$2,100	\$3,600	\$3,600
<b>Total</b>	<b>\$64,800</b>	<b>\$62,500</b>	<b>\$49,500</b>	<b>\$64,000</b>	<b>\$50,900</b>

Costs in millions

## Scenario Financial Feasibility - % Revenue/Cost

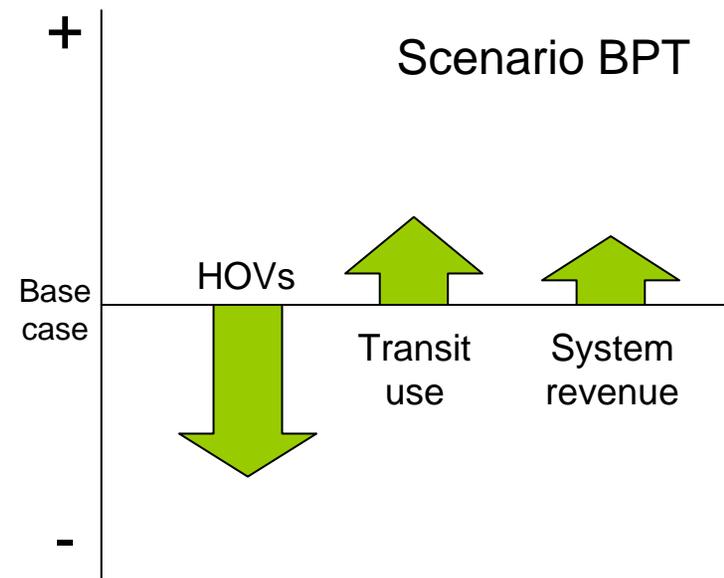
- Only CP has revenues in excess of costs
  - Parkways are low-cost revenue generators
- Virginia HOV-3 free policy impacts revenues and feasibility

	A	B	BP	C	CP
<b>Regional</b>	<b>53%</b>	<b>73%</b>	<b>84%</b>	<b>93%</b>	<b>112%</b>
DC	26%	1600%	1572%	1637%	1656%
MD	55%	61%	74%	86%	113%
VA	52%	53%	53%	61%	64%

# Impact of Transit on Performance of the Scenarios

## Scenario BPT

- Increasing Transit Service on the Value Priced Network Results In:
  - Decrease in HOV use: 12%
  - Increase in total system transit use: 4.6%
  - Negligible increase in total VMT
  - Total system revenue increased by 3.6%
- 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.
- Analysis of CPT still in progress.



# Evaluation of Potential Land Use Impacts

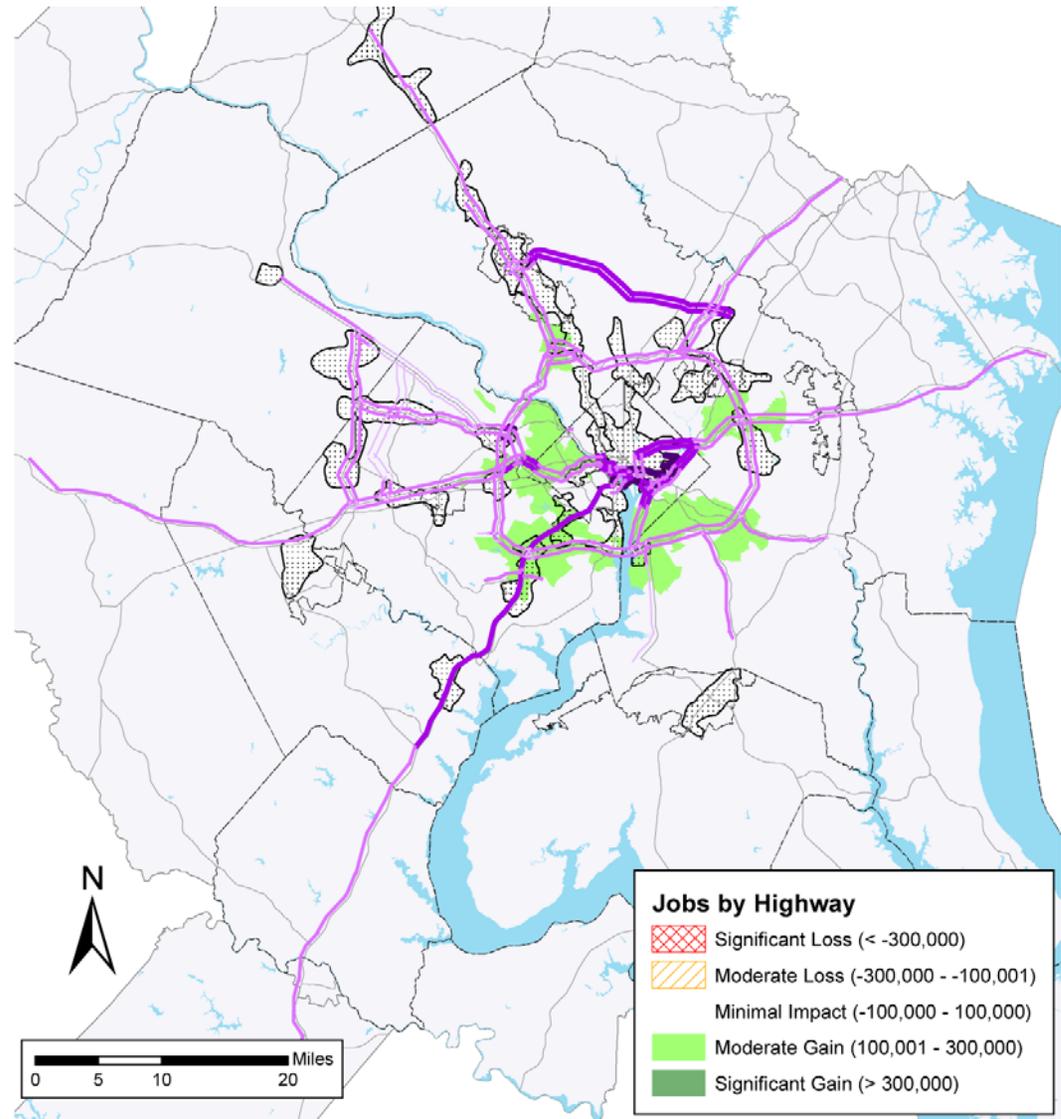
## Rationale

- 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, BPT

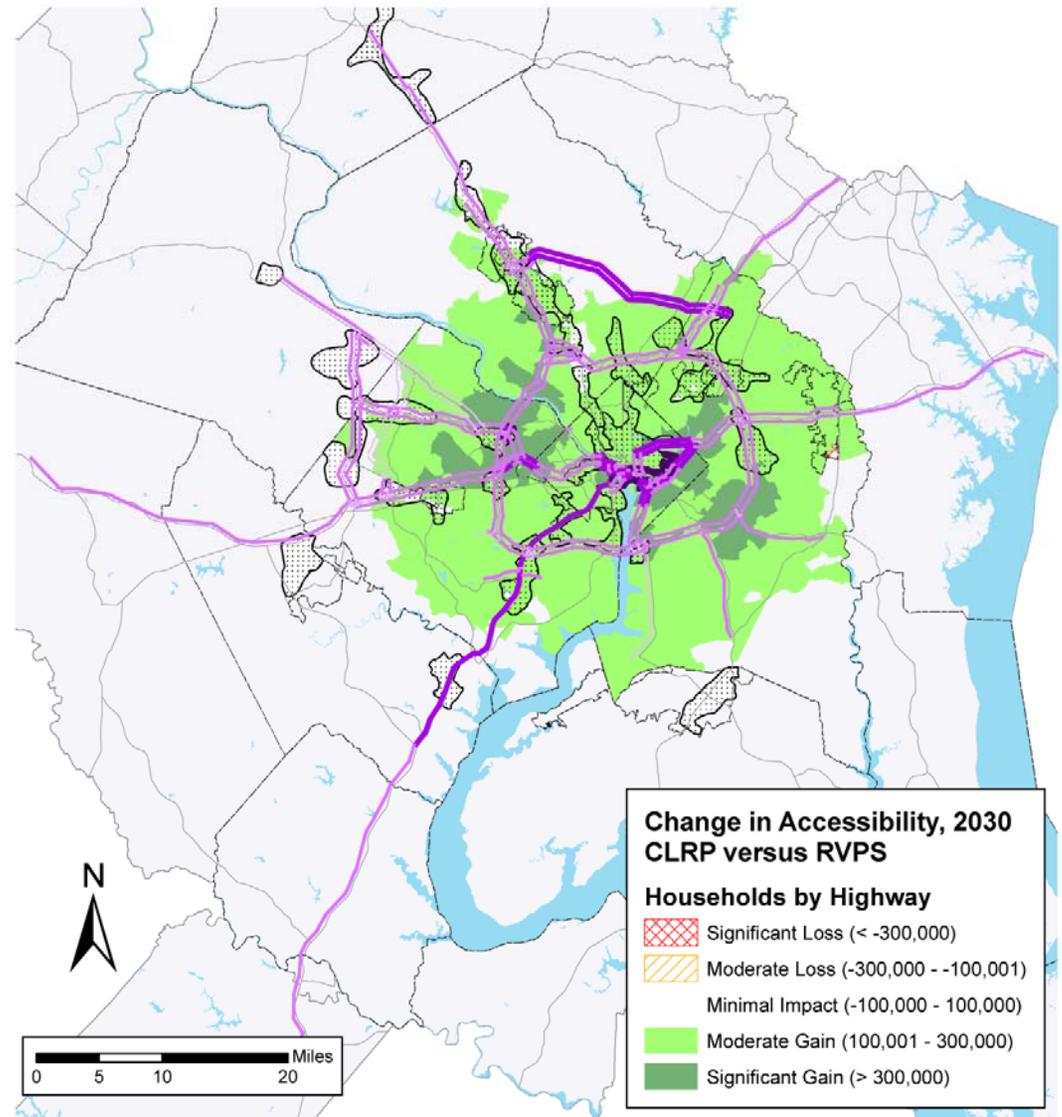
- Moderate impact on accessibility to jobs via highways.
  - Impacts concentrated around major access points in the VPL network.
  - Minimal impact in the exurbs.
- Minimal impact on accessibility to jobs by transit or walk-access transit



# Evaluation of Potential Land Use Impacts

## Location of Jobs, BPT

- Significant gains in accessibility to households near intersections of major roadways in the VPL network.
- Moderate gains throughout the regional core and inner suburbs.
- Minimal impact in the exurbs.



## Assessing the Impact of Tolling Existing Lanes (I)

- 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?
  - 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, I4th 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 to be reviewed by TPB Value Pricing Task Force at its next meeting, 10 AM on January 30, 2008
2. Final report due to VDOT and FHWA on February 28, 2008
3. Presentation to the TPB on February 20 or March 19.

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