TransForM—A New Regional Travel Demand Model Developed for Prince George's County

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Project Objectives

- A regional model with greater detail and accuracy in Prince George's County
- Conversion to TransCAD
- Modeling Refinements
- Year 2000 Update and Validation

Model Development Tasks

- Conversion of MWCOG model to TransCAD
- Additional Traffic Zones in PGC
- Greater Network Detail in PGC
- Year 2000 Trip Generation Models
- Year 2000 Trip Distribution Models
- Year 2000 Mode Choice Analysis
- Traffic Assignment
- Model Calibration
- Model Validation

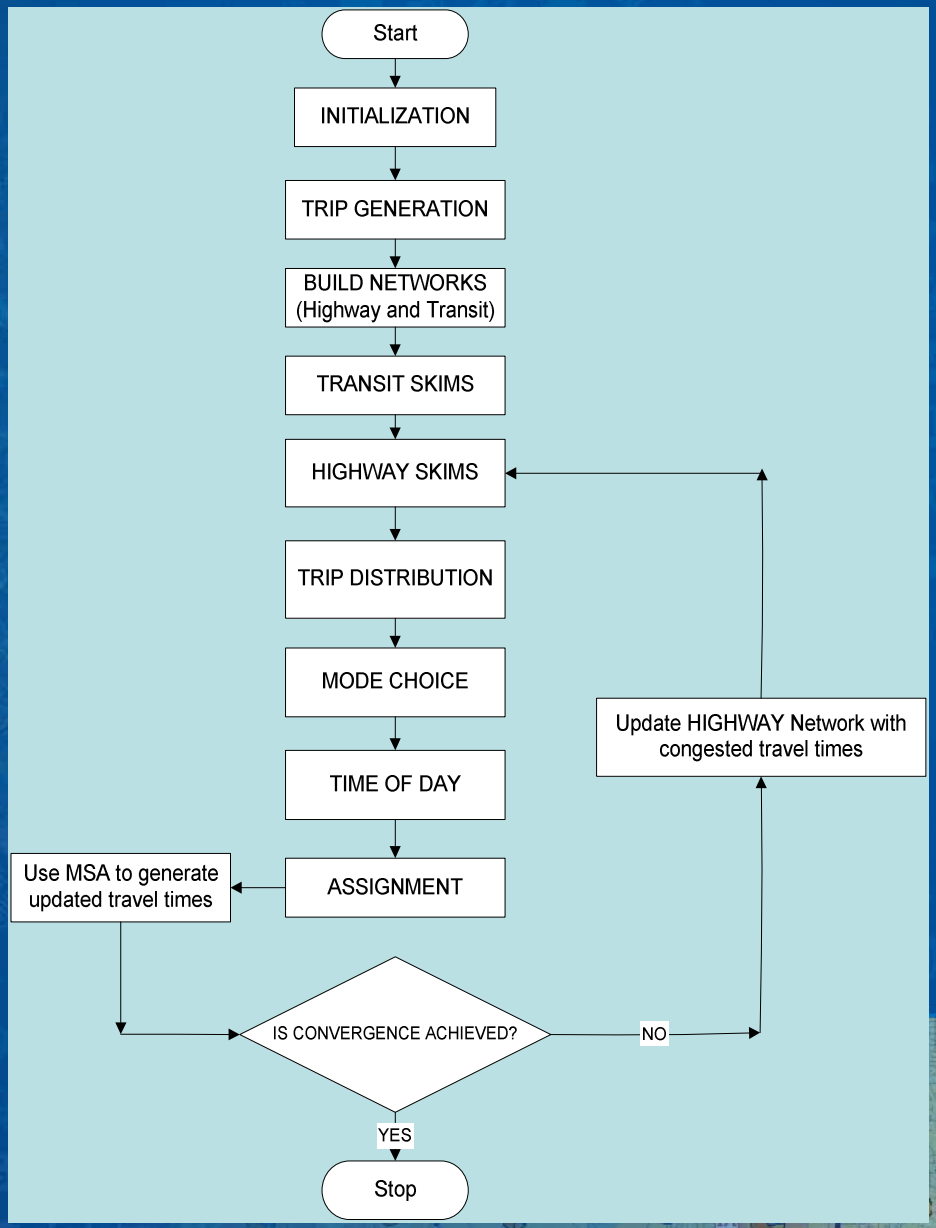
Model Conversion

- Pre-validated, expanded model not available
- Straight conversion of the MWCOG Model from TP+ to TransCAD performed
- Results replicated fairly closely
- Some discrepancies in transit pathfinding and model convergence
- Integration of System II network data accomplished with TransCAD

Model Development Considerations

- Use greater geographic detail
- Retain similar model structure to accommodate future MWCOG updates
- Make use of Windows, GIS-based software
- Update to a 2000 Base Year using available data
- Use better algorithms for transit pathfinding, trip distribution, and traffic assignment and achieve higher convergence and closer calibration
- Consideration of TRB Review Criticisms

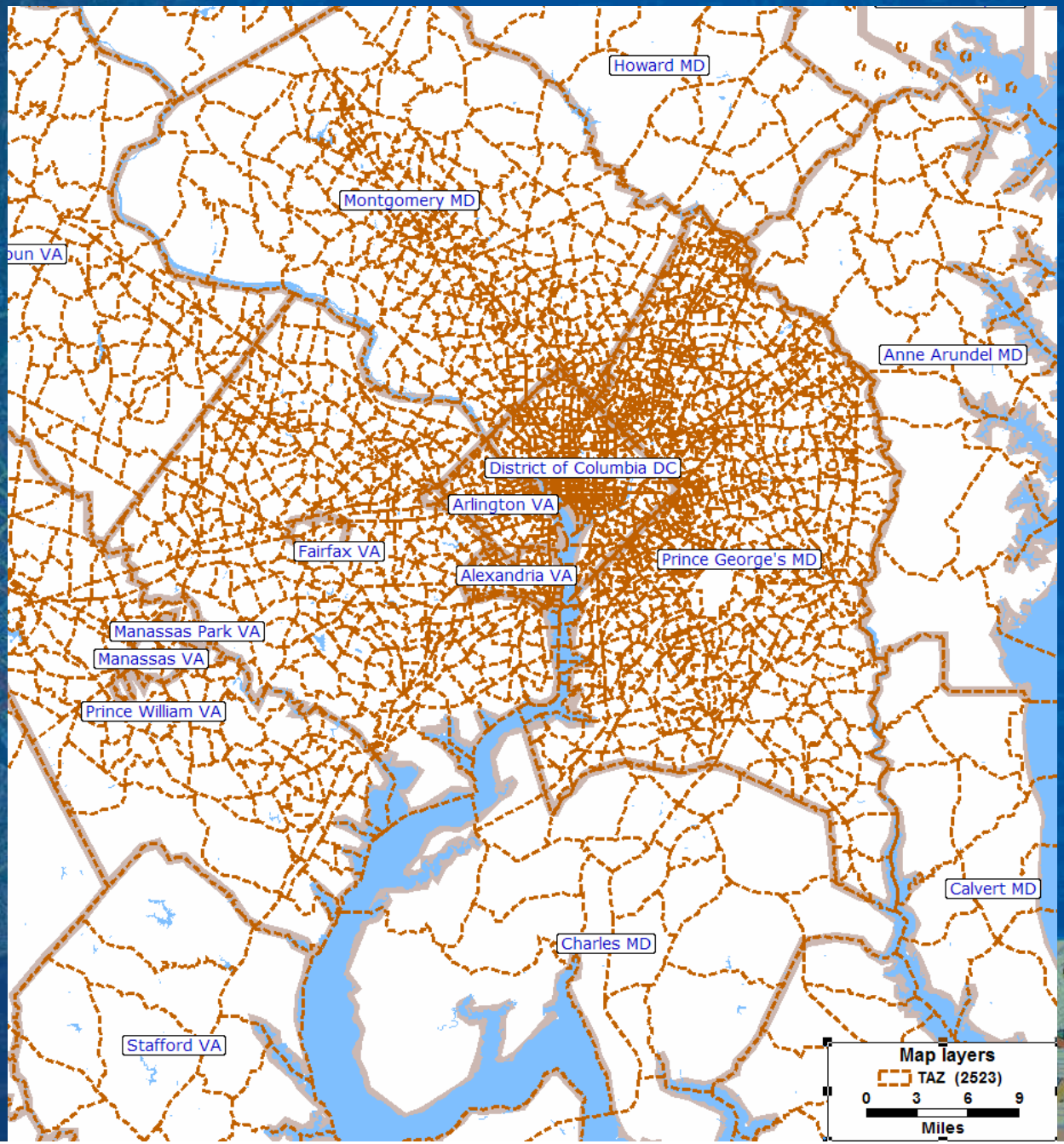
TransForM Model Structure



Expanded Zone System

- 2,523 Zones
- 2,476 internal and 47 external
- 885 zones in PGC instead of 381
- Demographics from population synthesis except for employment which was disaggregated from MWCOG estimates

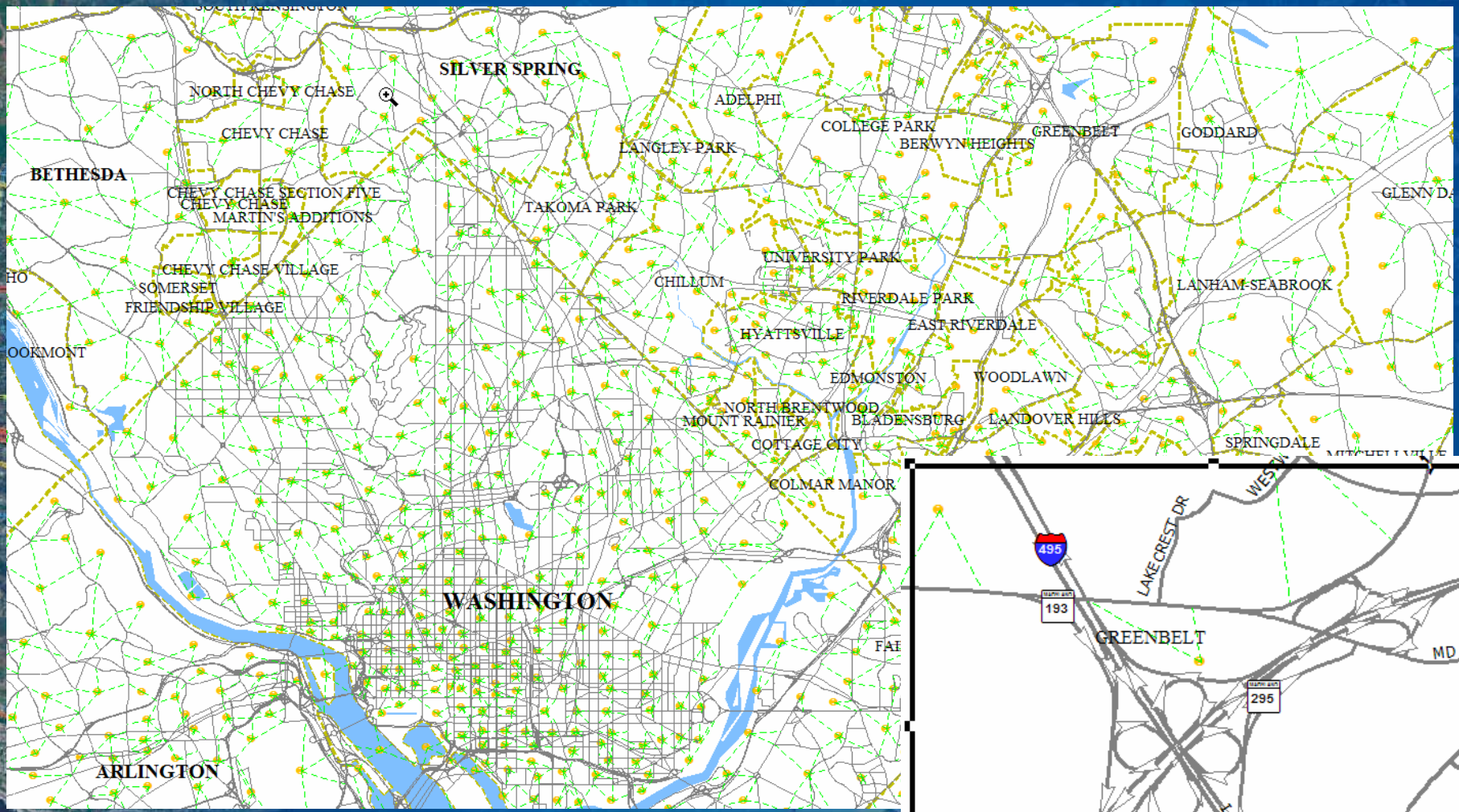
TAZ Geography

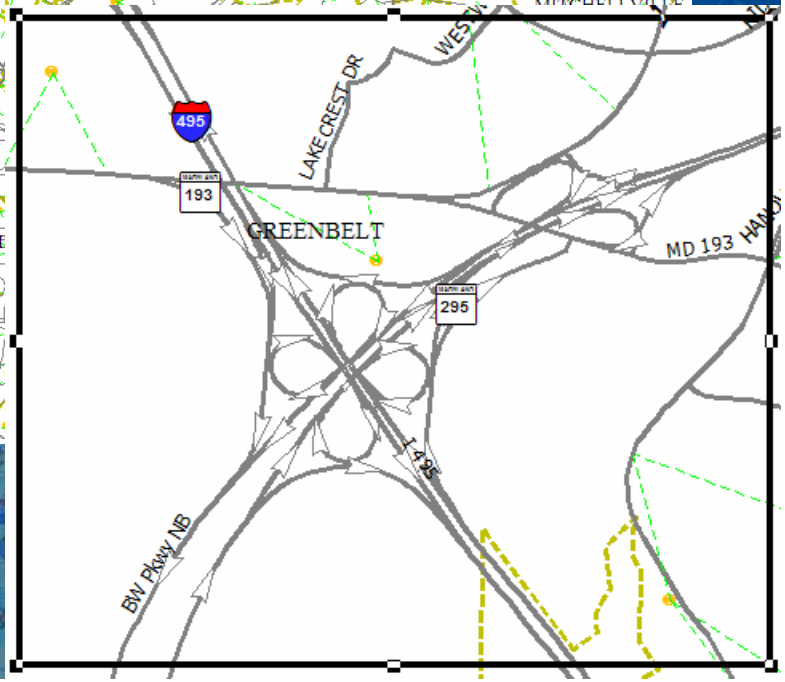


Highway Network Development

- A new regional network was used that is geographically aligned over aerial photography throughout the entire region
- Divided highways are “dualized” and ramps and connectors were added. The prior System II network for PGC was also realigned and augmented.
- New centroid connectors throughout
- The resulting network has 36,272 links and 22,284 nodes

Highway Network in TransCAD





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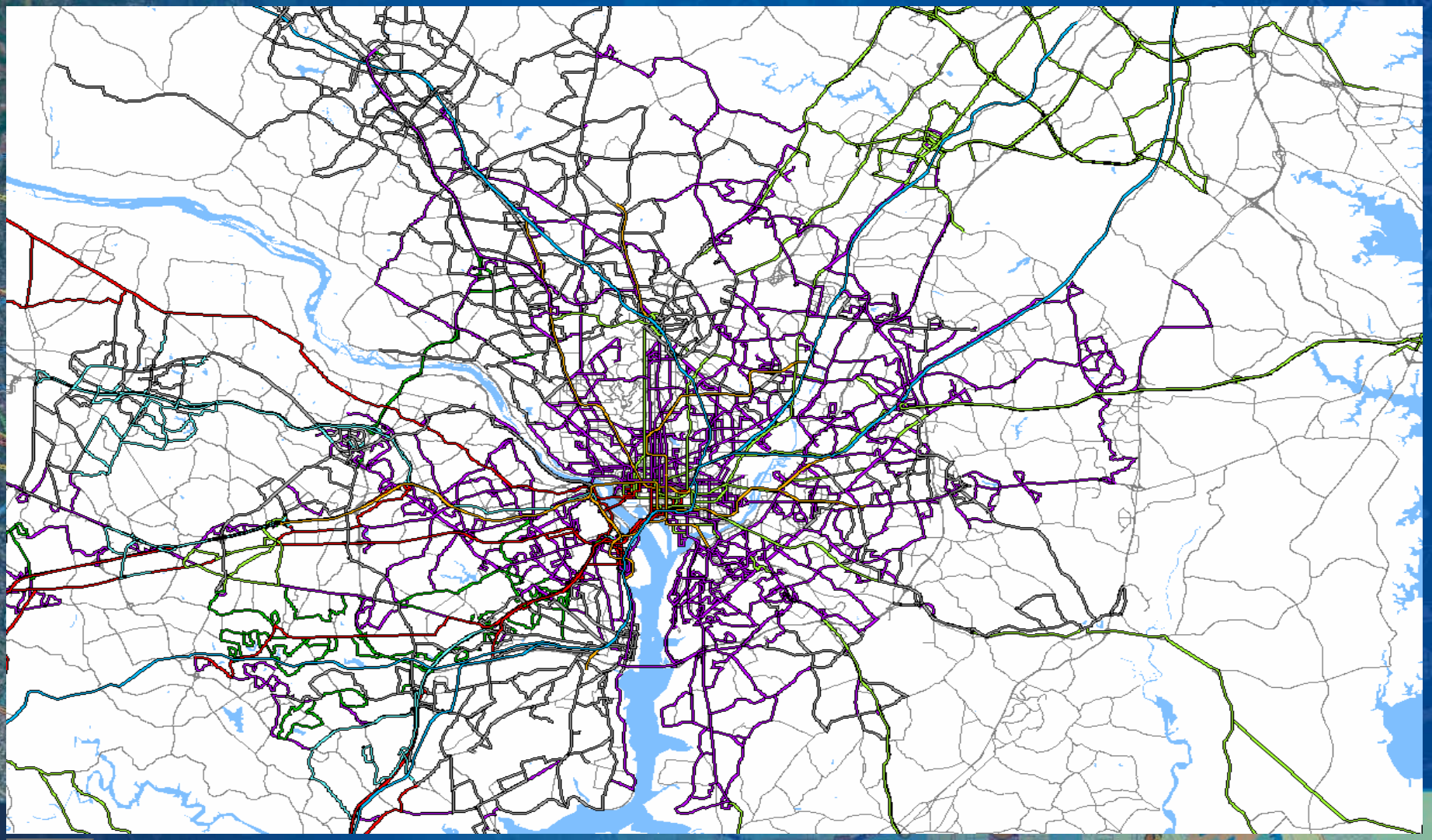
Transit Network Development

- Used GPS Points from WMATA
- Stop Locations and Schedules
- GIS processing
- Links added to the road network for transit
- Comparison with TP+ routes with manual revisions
- Names matched and transferred
- A separate route system created for rail
- Access and egress links use streets for walking and roads for park and ride

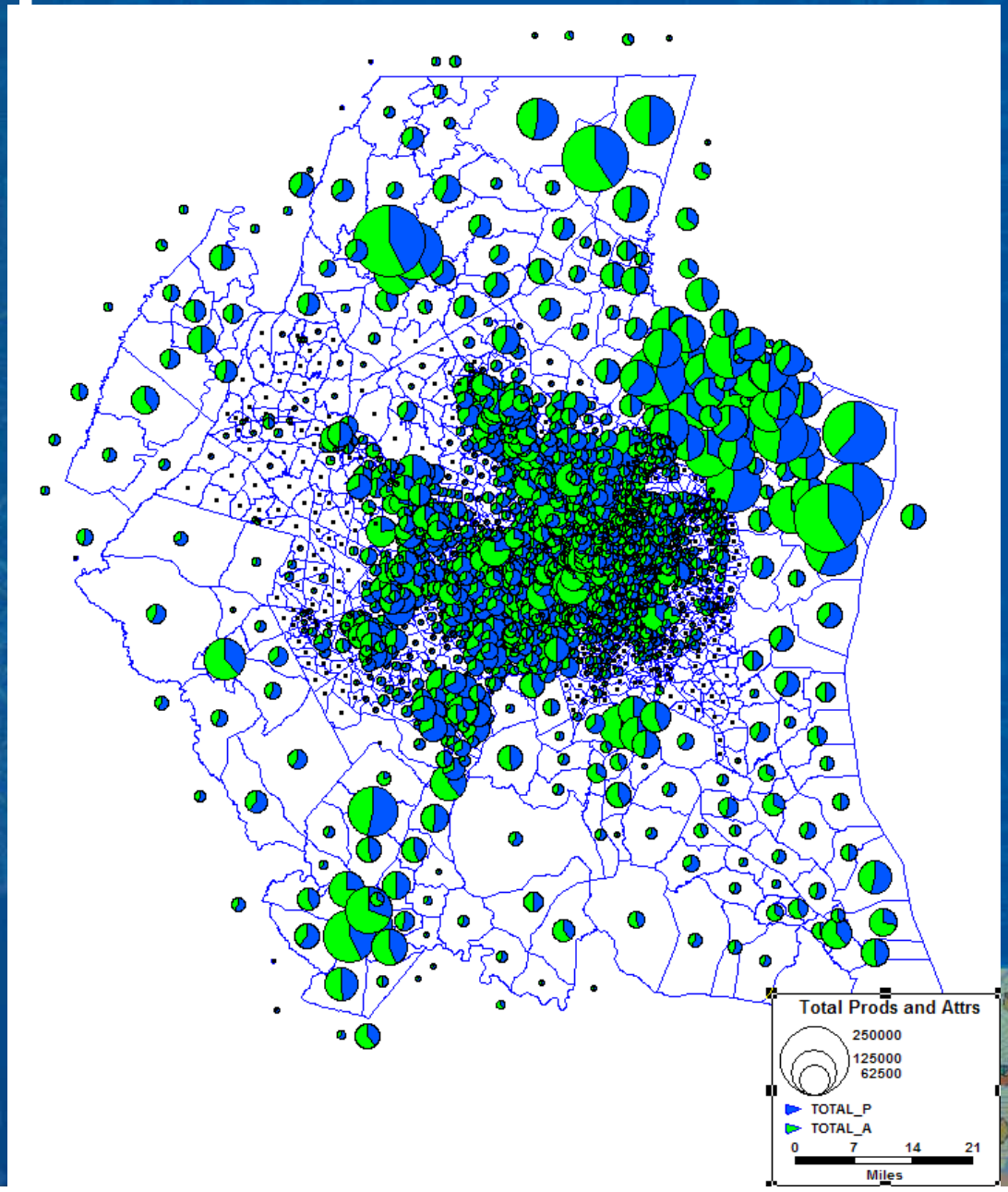
Transit Network Map



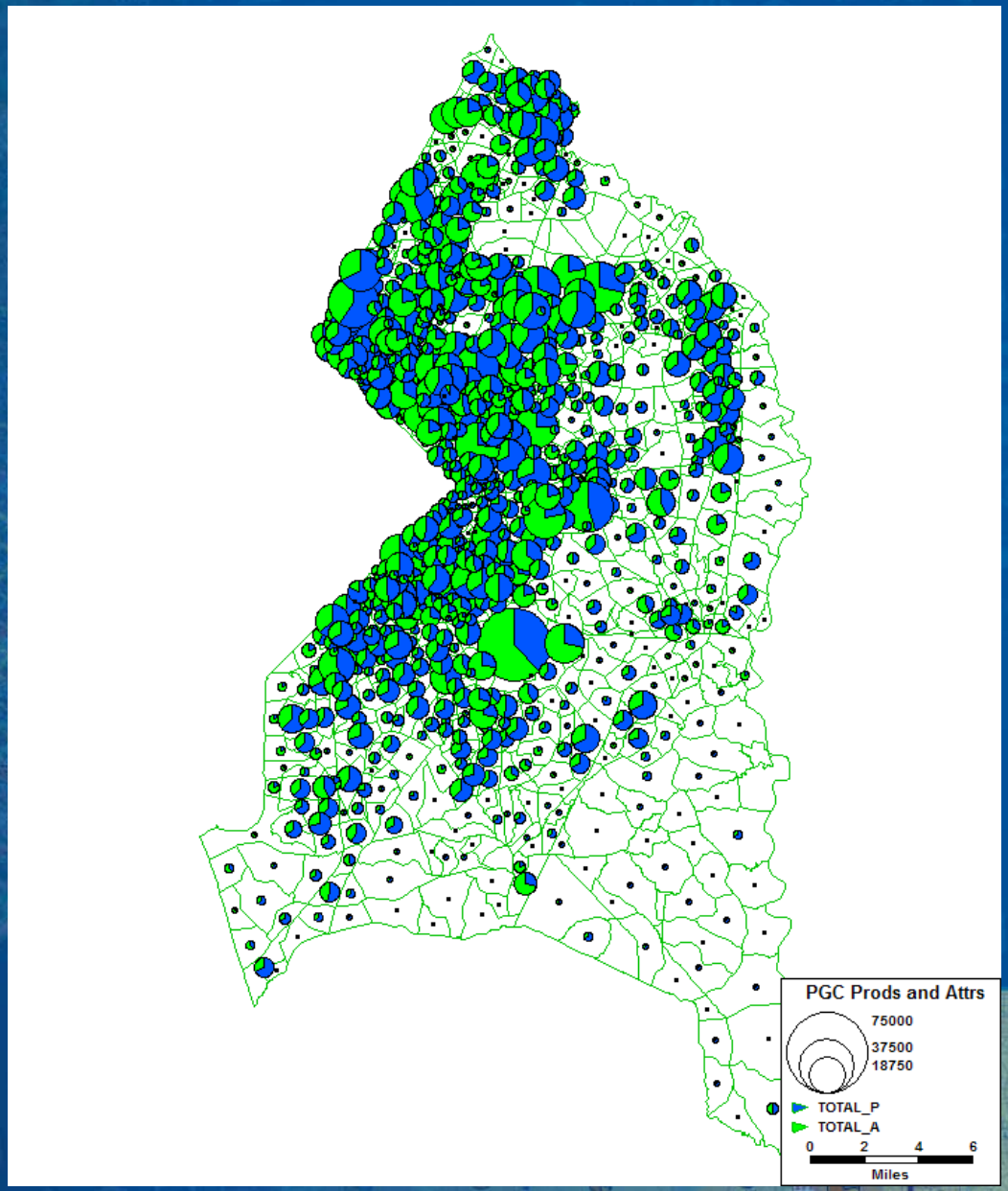
Trip Generation

- Based upon Year 2000 Wave 3 COG Panel Survey
- Statistical Analysis of Trip Making
- Trip Rates by Jurisdiction
- Cross classification by Worker status, Auto availability, and #persons >16 in HH
- Application with population synthesis
- Attraction rates from the MWCOG model
- MWCOG latest demographics

Trip Productions & Attractions



PGC Productions & Attractions



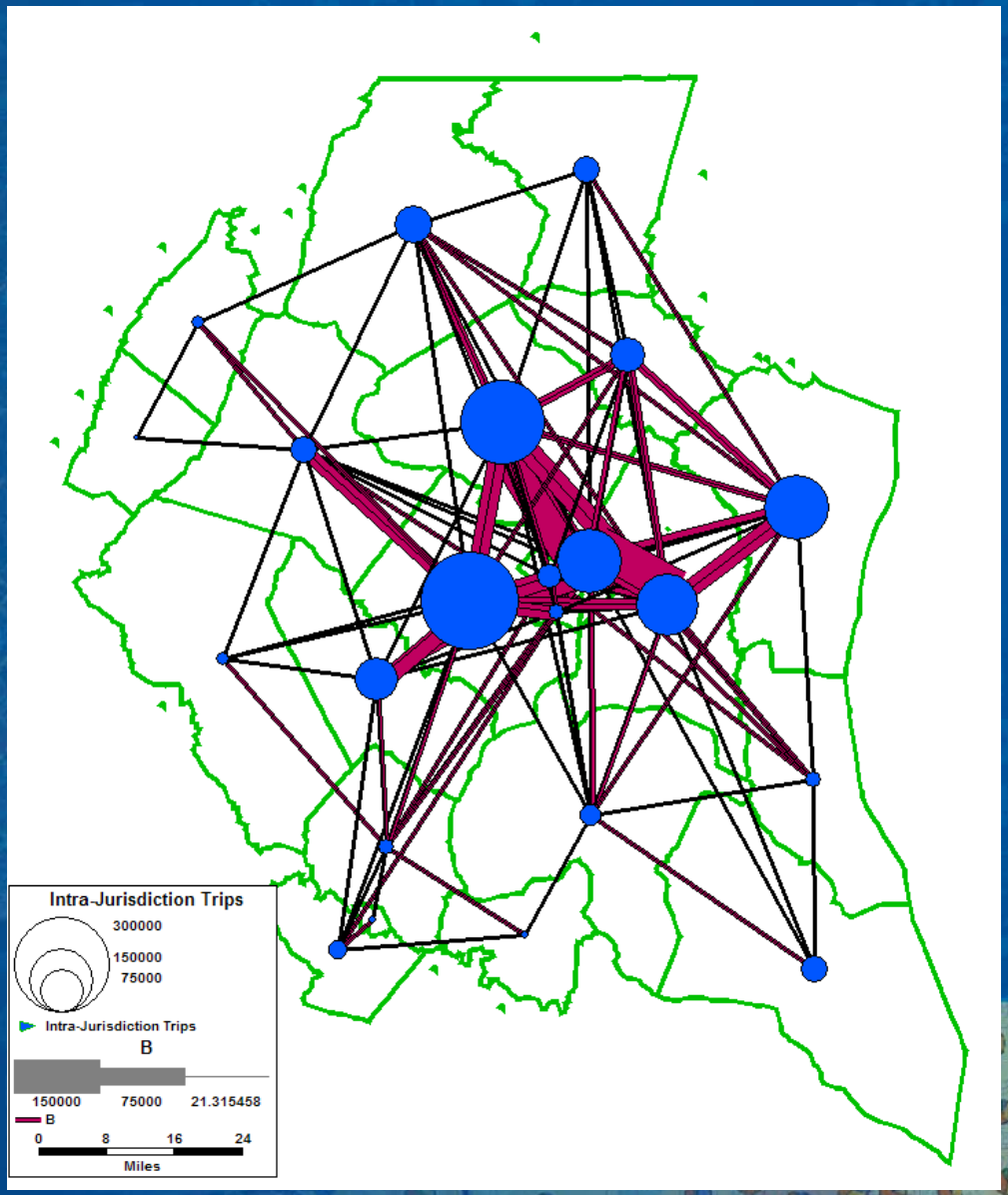
Trip Distribution

- Similar Gravity Models with Gamma Impedance Functions
- Updated Friction Factors consistent with Panel Survey Trip Lengths
- No K factors for person trips (as yet)

Trip Distribution

Trip Purpose	Trips	Intra-zonal Trips	Pct IZ	Avg Dur. (Model) Min.	Avg Dur. (Survey) Min.
HBW - Inc 1	548,113	33,816	6.2	18.9	19.0
HBW - Inc 2	861,414	54,099	6.4	22.0	21.7
HBW - Inc 3	724,651	37,840	5.2	25.0	25.5
HBW - Inc 4	1,300,217	48,600	3.7	26.9	26.0
HBW – Total (with EI and EA trips)	3,755,725	174,355	4.6	26.0	24.3
HBS – Total	2,592,345	345,630	13.3	14.0	11.9
HBO – Total	7,084,164	1,310,540	18.5	14.7	15.5
NHB – Total	4,525,409	705,358	15.6	15.0	13.8
MedTrk – Total	287,976	13,242	4.6	27.3	-
HvyTrk – Total	113,365	3,606	3.2	30.2	-

Trip Distribution from the Model



Mode Choice Models

- Retains the Two-stage Logit Models
- Drive alone, Carpool, & Transit
- Split among HOV2, 3, & 4+
- Market segments by auto availability
- Preliminary estimation tests suggested the coefficients were reasonable
- Constants recalibrated
- Close match to observed mode shares

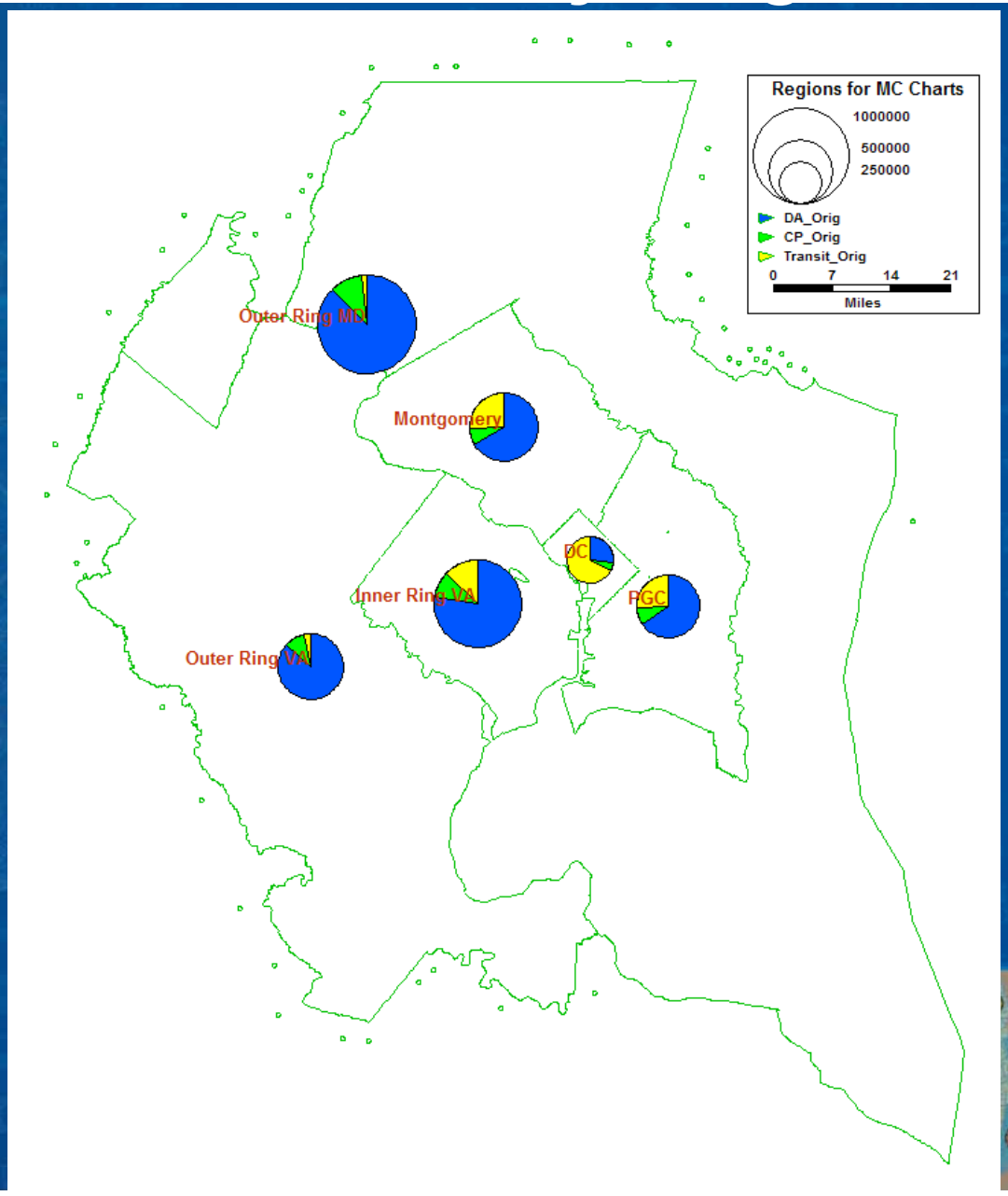
Home-Based Work Mode Shares

Market Segment	Drive Alone	Carpool	Transit	2_Person CP	3_Person CP	4+_Person CP
0 Veh HH	0 (0%)	96,141 (33.5%)	191,186 (66.5%)	32,114	32,013	32,013
1 Veh HH	760,828 (67.6%)	106,853 (9.5%)	257,157 (22.9%)	83,749	19,151	3,952
2+Veh HH	2,031,556 (86.7%)	138,538 (5.9%)	173,463 (7. 4%)	112,596	17,126	8,815
All Segments	**2,792,385 (74.3%)**	**341,553 (9.1%)**	**621,806 (16.6%)**	**228,460**	**68,291**	**44,781**

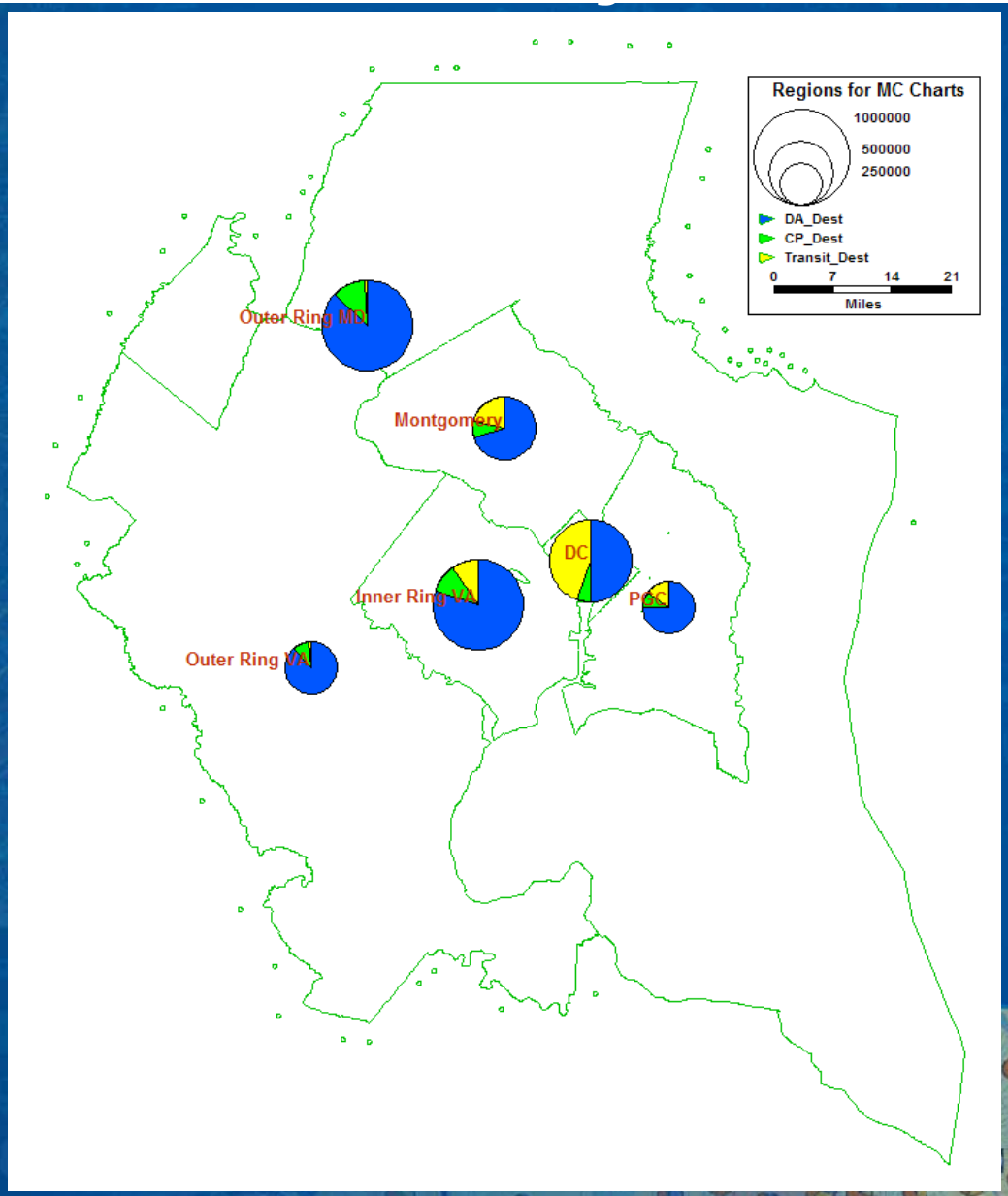
Estimated versus observed mode choice shares

Purpose	Observed Transit Pct	Estimated Transit Pct	Observed Auto-Occ Factor	Estimated Auto-Occ Factor
HBW	16.9	16.6	1.12	1.12
HBS	1.2	1.3	1.23	1.24
HBO	2.1	2.1	1.44	1.43
NHB	2.5	2.8	1.25	1.26

HBW Mode Shares by Origin Area



HBW Mode Shares by Destination



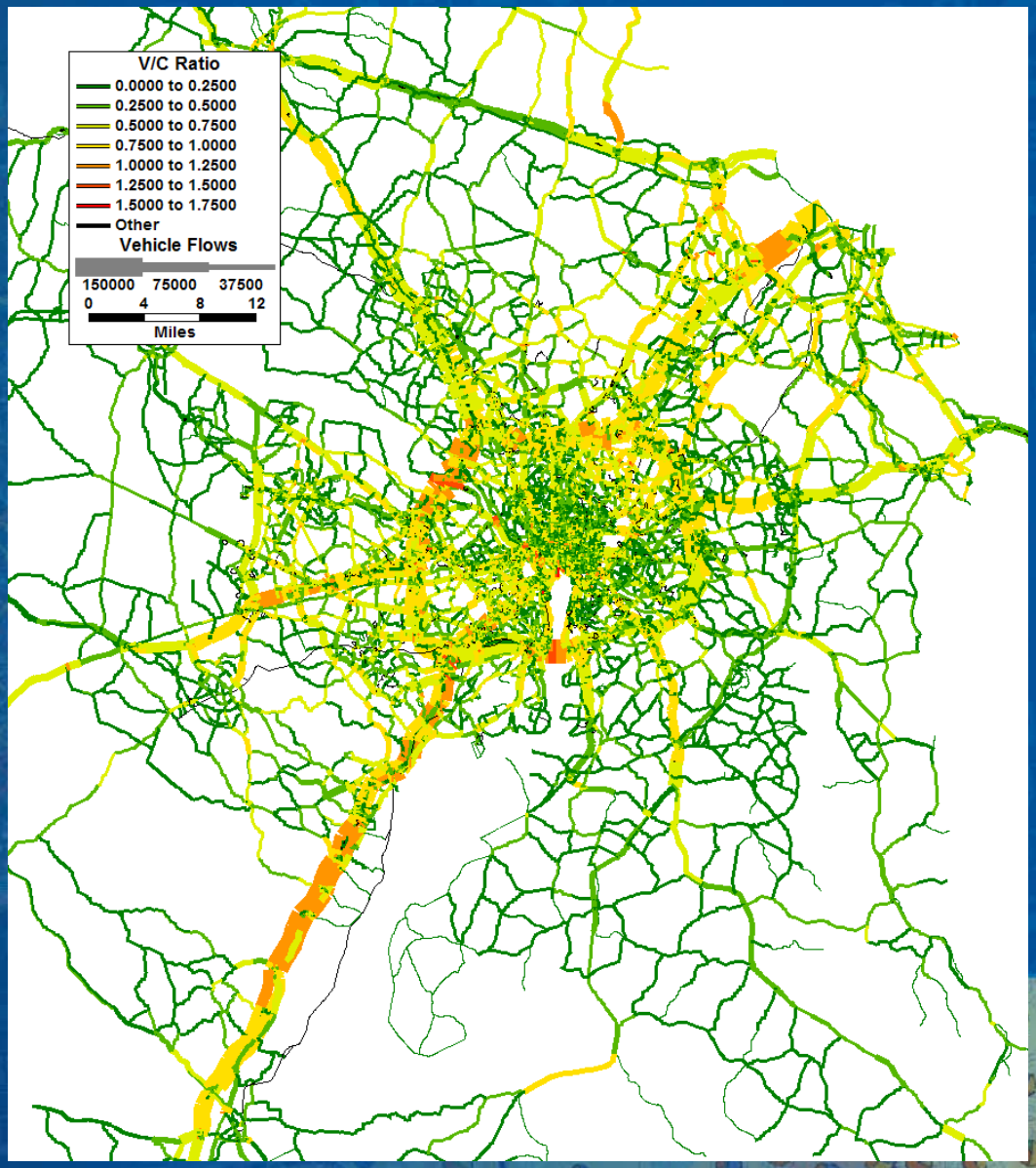
Traffic Assignment

- 5 classes, 3 time periods
- HCM 2000 suggested BPR coefficients by functional class with some adjustments
- Calibration performed with a relative gap of .001 (80-160 iterations)
- Full model feedback with MSA flow combinations (skim difference RMSE<.01)
- Recommend production runs to a gap of .01 or lower for major projects (18-50 iterations)
- Model run time 1.5 hours per loop or 6 hours for 4 loops on this laptop
- More and better counts needed

Regional VMT Estimates

Region	Daily VMT (in thousands)
TOTAL	152,024
DC	8,410
VA	58,545
MD	85,069

Daily Regional Traffic Flow Map



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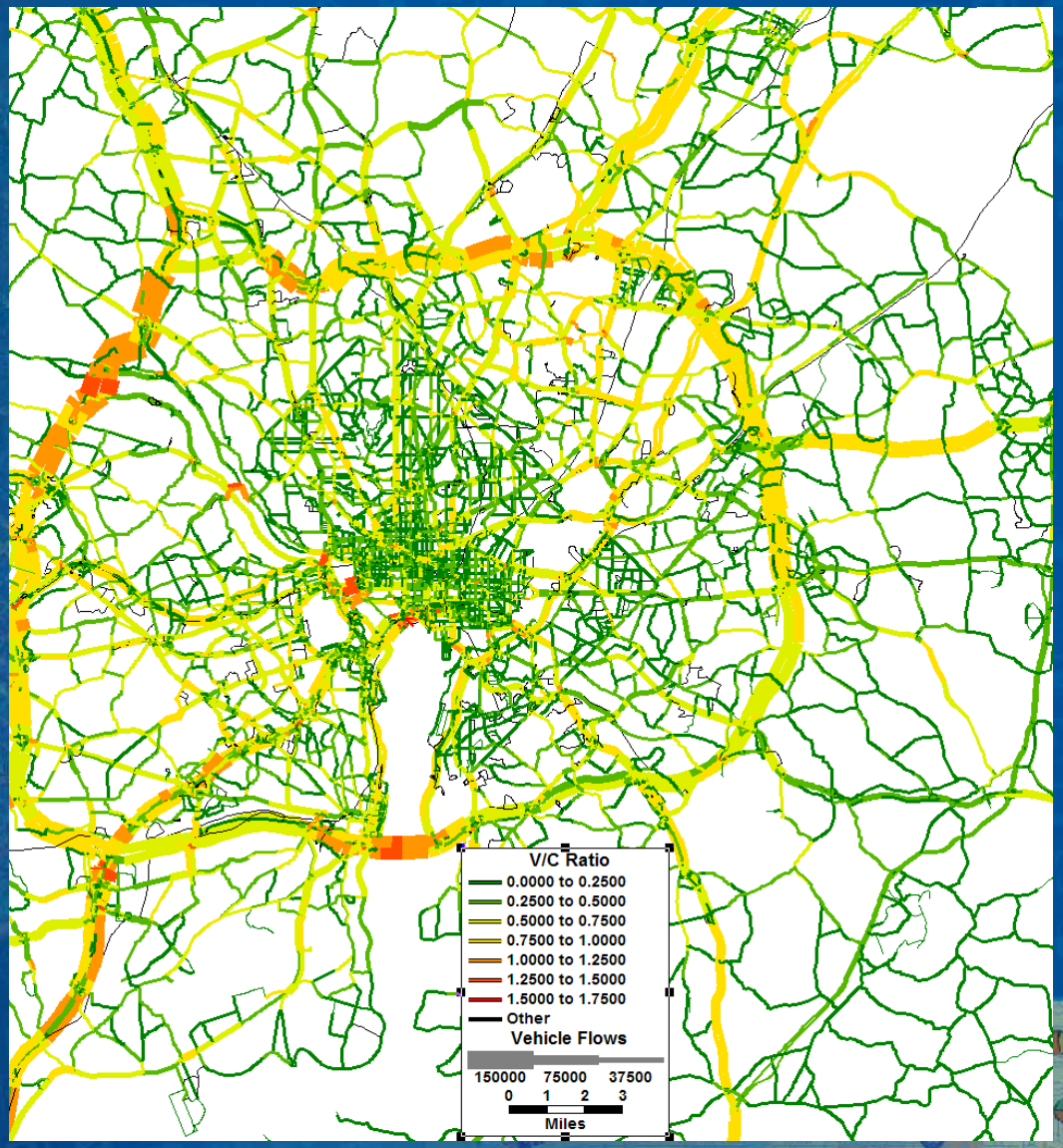
Daily Flows: Beltway, DC, & PGC



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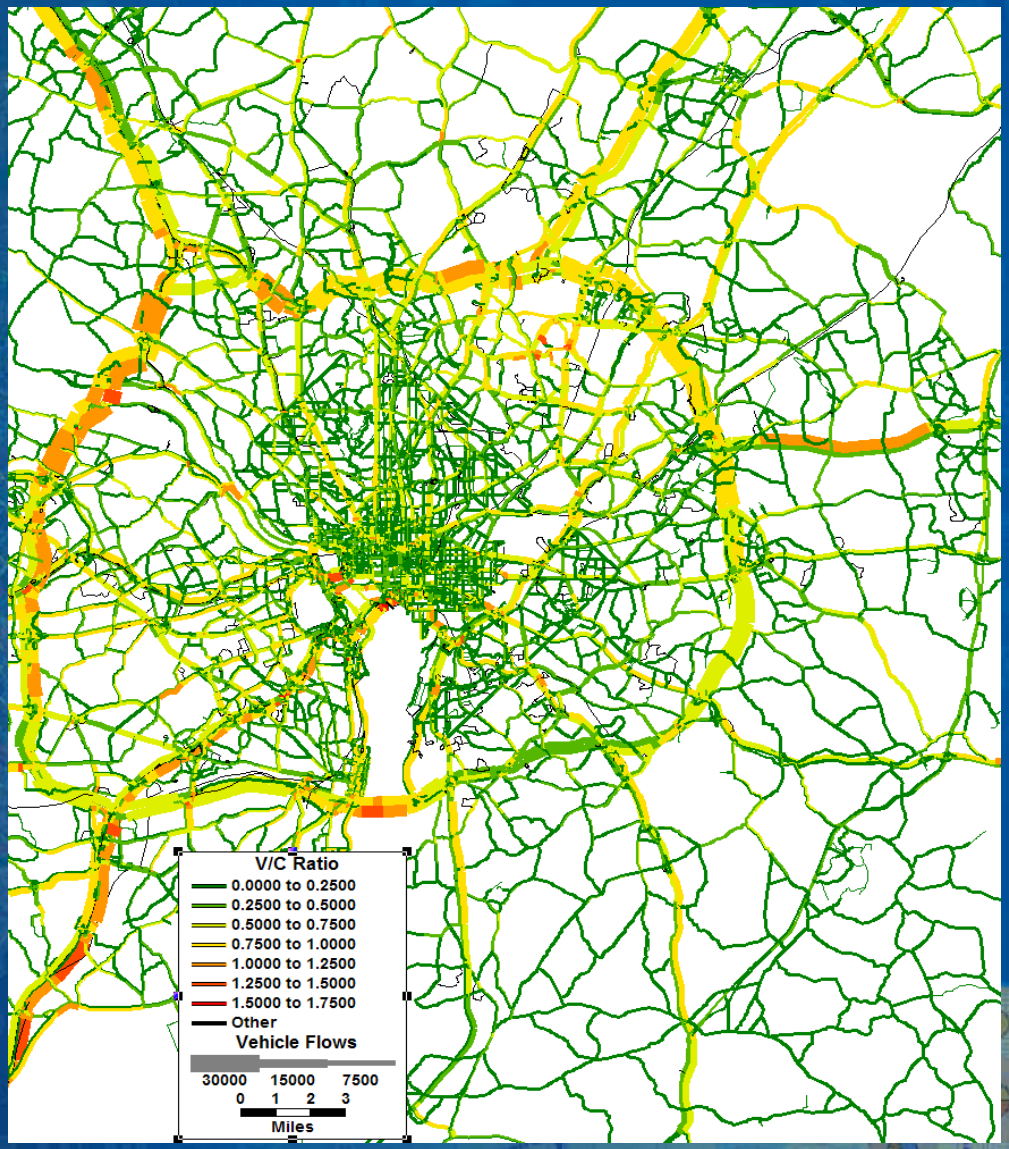
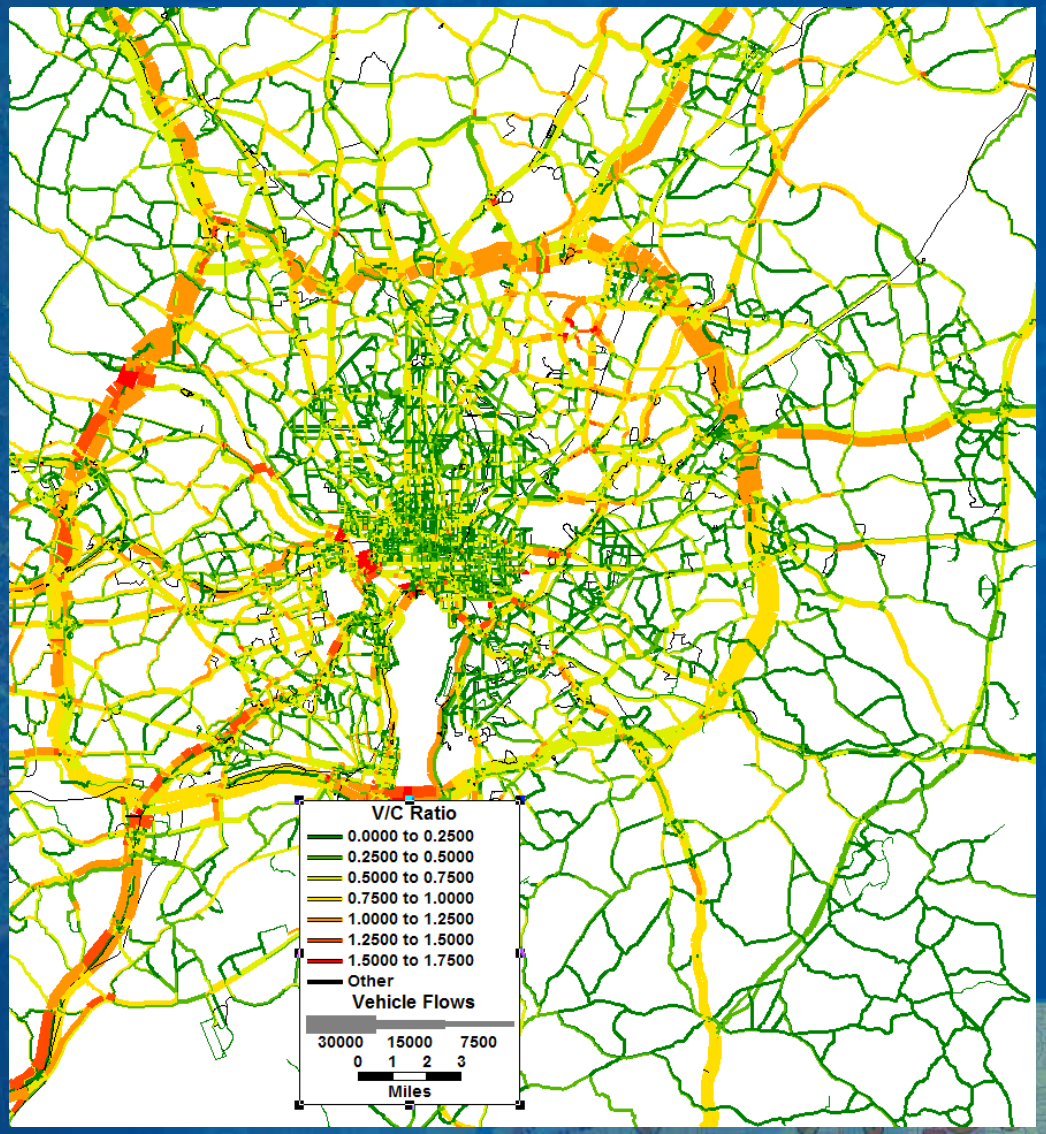
AM Flows: Beltway, DC, & PGC



PM Flows: Beltway, DC, and PGC



Comparison of Daily Model Flows & Counts

County	FClass	Pct RMSE	Num Obs	Total Flow	Total Count	Pct Diff
ALL Counties	**ALL Classes**	**41.69**	**2086**	**28,498,288**	**27,817,345**	**2.45**
ALL Counties	Freeways	15.52	105	7,310,503	7,508,328	-2.63
ALL Counties	Major Arterials	43.99	718	12,212,285	11,011,901	10.90
ALL Counties	Minor Arterials	53.26	671	4,527,832	4,324,570	4.70
ALL Counties	Collectors	89.00	411	1,051,347	1,407,578	-25.31
ALL Counties	Expressways	26.90	125	3,169,006	3,256,646	-2.69
ALL Counties	Ramps	74.42	36	222,974	227,187	-1.85

Comparison of Flows v. Counts for Prince George's County

County	F Class	RMSE	Obs.	Tot. Flow	Tot. Count	Pct
PGC	**ALL Classes**	**35.74**	**992**	**12,617,466**	**12,423,373**	**1.56**
PGC	Freeways	12.69	46	3,433,705	3,497,144	-1.81
PGC	Major Arterials	37.69	238	3,419,712	3,153,986	8.43
PGC	Minor Arterials	52.93	468	2,960,056	2,761,817	7.18
PGC	Collectors	74.02	118	239,706	336,000	-28.66
PGC	Expressways	26.03	97	2,421,836	2,506,410	-3.37
PGC	Ramps	36.37	17	138,111	135,566	1.88

Comparison of Flows v. Counts for Montgomery County

County	F Class	RMSE	Obs.	Tot. Flow	Tot. Count	Pct Diff
Montgomery	**ALL Classes**	25.19	80	2,665,174	2,814,693	-5.31
Montgomery	Freeways	15.67	20	1,708,204	1,846,695	-7.50
Montgomery	Major Arterials	29.17	32	725,423	708,744	2.35
Montgomery	Minor Arterials	69.58	2	17,847	12,600	41.65
Montgomery	Collectors	56.14	2	7,020	11,598	-39.47
Montgomery	Expressways	28.27	5	121,814	143,435	-15.07
Montgomery	Ramps	123.41	19	84,863	91,621	-7.38

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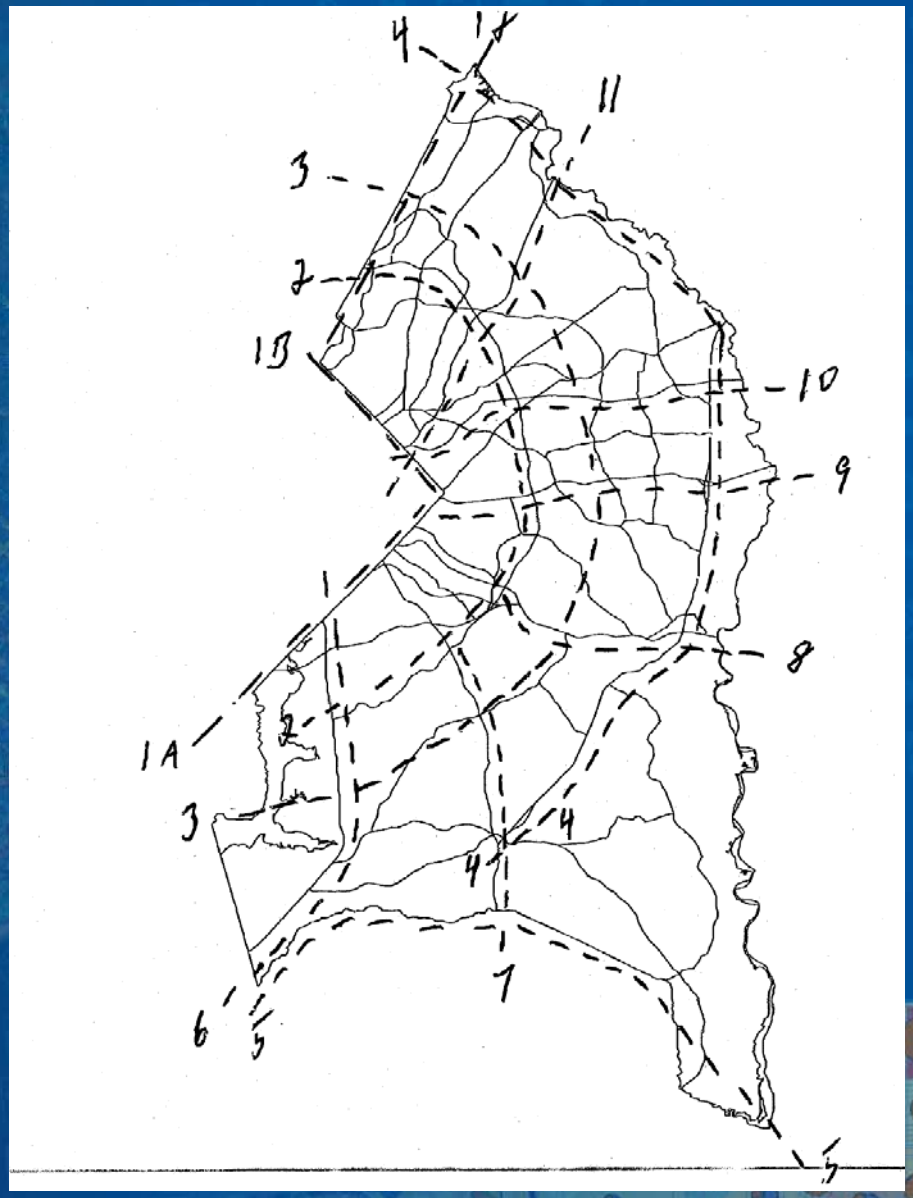
Comparison of Counts and Flows by Time Period

- Similar RMSEs by Time Period
- AM a little worse, PM and Off-Peak closer than the Daily Flows
- Indicates a Stronger Validation

VMT Comparisons

Region	Model Daily VMT (thousands)	Count Daily VMT (thousands)	Ratio (Mod/Count)
Overall	15,795	15,031	1.05
DC	1,338	1,172	1.14
VA	2,498	2,754	0.91
MD (including PGC)	11,959	11,105	1.07
Prince George's County, MD	5,824	5,776	1.01

PGC Screen lines



Screenline 2

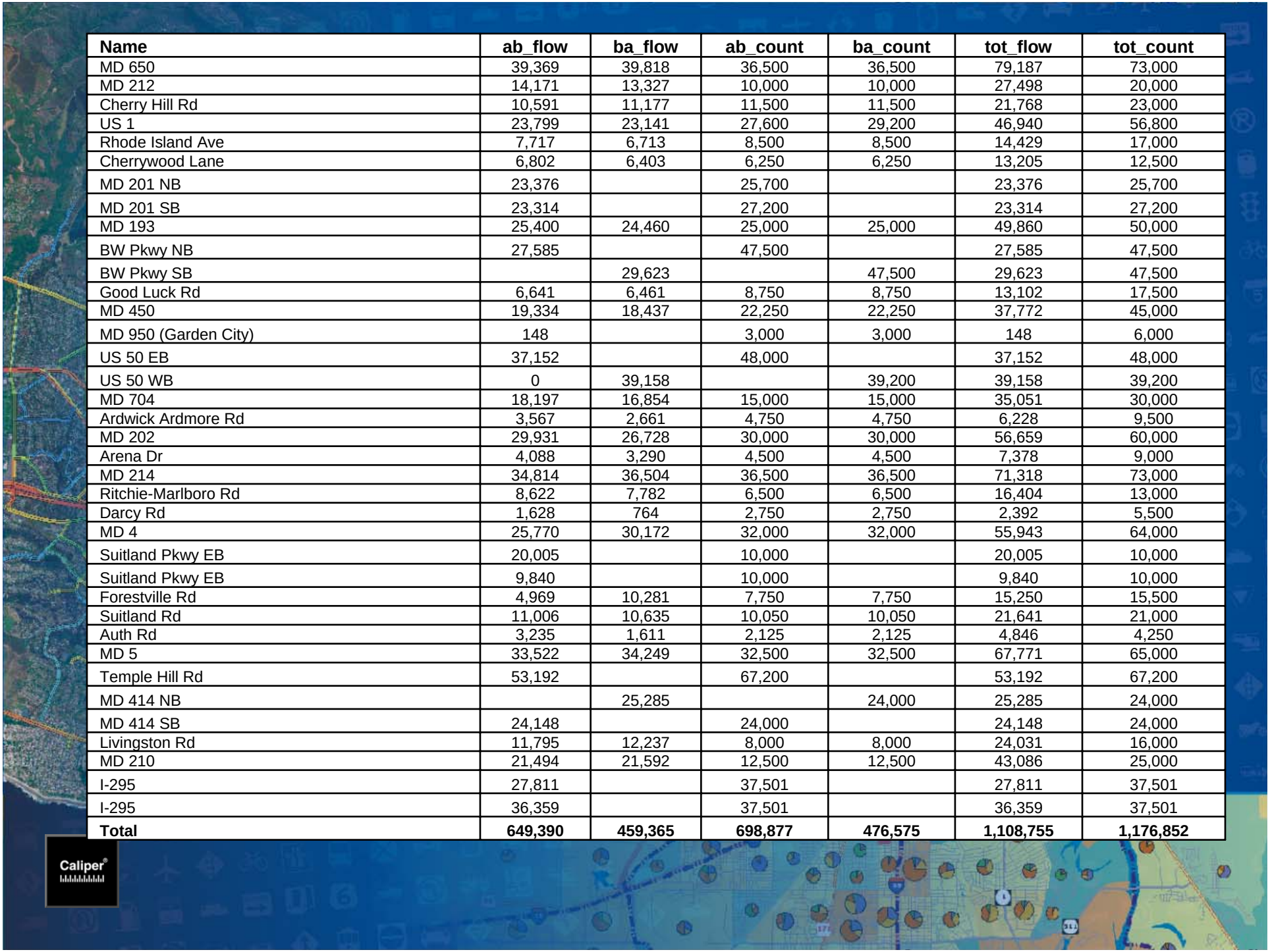
Inside I-95/I-495 concentric ring

Ratio Flow/cnt=.95

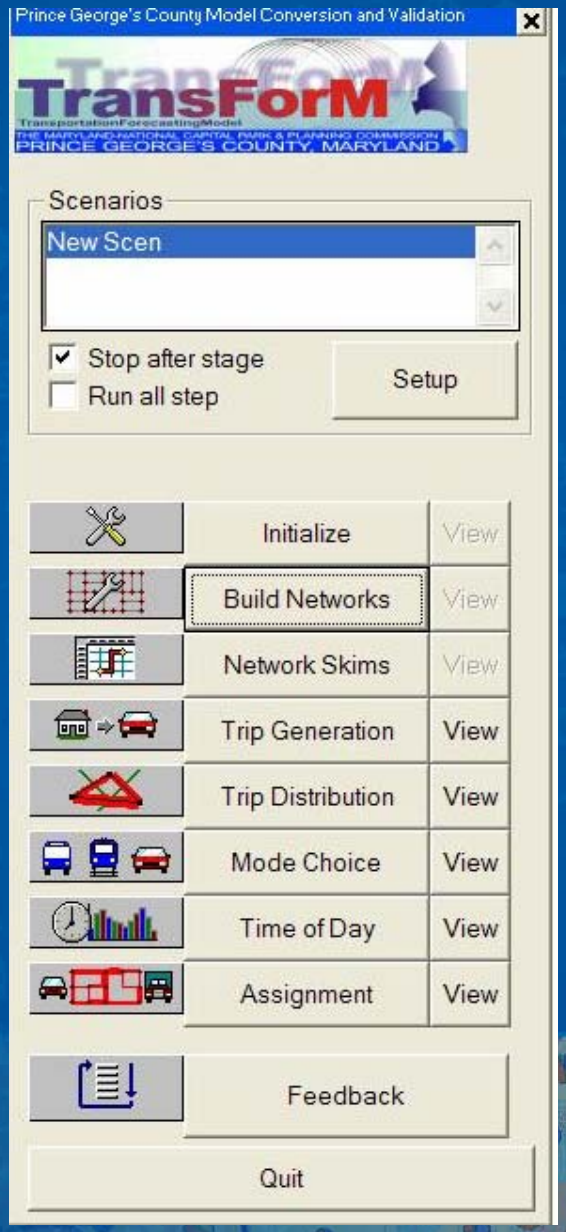
RMSE = 28.0

Details on next slide

Name	ab_flow	ba_flow	ab_count	ba_count	tot_flow	tot_count
MD 650	39,369	39,818	36,500	36,500	79,187	73,000
MD 212	14,171	13,327	10,000	10,000	27,498	20,000
Cherry Hill Rd	10,591	11,177	11,500	11,500	21,768	23,000
US 1	23,799	23,141	27,600	29,200	46,940	56,800
Rhode Island Ave	7,717	6,713	8,500	8,500	14,429	17,000
Cherrywood Lane	6,802	6,403	6,250	6,250	13,205	12,500
MD 201 NB	23,376		25,700		23,376	25,700
MD 201 SB	23,314		27,200		23,314	27,200
MD 193	25,400	24,460	25,000	25,000	49,860	50,000
BW Pkwy NB	27,585		47,500		27,585	47,500
BW Pkwy SB		29,623		47,500	29,623	47,500
Good Luck Rd	6,641	6,461	8,750	8,750	13,102	17,500
MD 450	19,334	18,437	22,250	22,250	37,772	45,000
MD 950 (Garden City)	148		3,000	3,000	148	6,000
US 50 EB	37,152		48,000		37,152	48,000
US 50 WB	0	39,158		39,200	39,158	39,200
MD 704	18,197	16,854	15,000	15,000	35,051	30,000
Ardwick Ardmore Rd	3,567	2,661	4,750	4,750	6,228	9,500
MD 202	29,931	26,728	30,000	30,000	56,659	60,000
Arena Dr	4,088	3,290	4,500	4,500	7,378	9,000
MD 214	34,814	36,504	36,500	36,500	71,318	73,000
Ritchie-Marlboro Rd	8,622	7,782	6,500	6,500	16,404	13,000
Darcy Rd	1,628	764	2,750	2,750	2,392	5,500
MD 4	25,770	30,172	32,000	32,000	55,943	64,000
Suitland Pkwy EB	20,005		10,000		20,005	10,000
Suitland Pkwy EB	9,840		10,000		9,840	10,000
Forestville Rd	4,969	10,281	7,750	7,750	15,250	15,500
Suitland Rd	11,006	10,635	10,050	10,050	21,641	21,000
Auth Rd	3,235	1,611	2,125	2,125	4,846	4,250
MD 5	33,522	34,249	32,500	32,500	67,771	65,000
Temple Hill Rd	53,192		67,200		53,192	67,200
MD 414 NB		25,285		24,000	25,285	24,000
MD 414 SB	24,148		24,000		24,148	24,000
Livingston Rd	11,795	12,237	8,000	8,000	24,031	16,000
MD 210	21,494	21,592	12,500	12,500	43,086	25,000
I-295	27,811		37,501		27,811	37,501
I-295	36,359		37,501		36,359	37,501
Total	**649,390**	**459,365**	**698,877**	**476,575**	**1,108,755**	**1,176,852**



Model User Interface



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Next Steps

- Sensitivity Tests
- Further checking of networks and results
- Further minor adjustments and calibration
- Completion of Final Report & User's Guide