Item #3

Validation of the Version 2.3 Travel Model to year-2010 Conditions

Presentation to the Travel Forecasting Subcommittee
July 19, 2013

Ronald Milone, COG/TPB staff
National Capital Region Transportation Planning Board (TPB)
Metropolitan Washington Council of Governments (COG)

Overview

- The Version 2.3 travel model validation is completed
  - Pre-validation model: Version 2.3.**39**
  - Post-validation model: Version 2.3.**52**
- The V2.3.52 model has been applied in the latest air quality conformity assessment of the 2013 CLRP
  - Officially adopted by the TPB on July 17
- The validation effort has been documented in a technical memorandum
  - Included as Appendix D of AQ conformity report

Today's presentation topics

1. A review of the validation process
2. A discussion on recent trends
3. A review of the validated travel model results

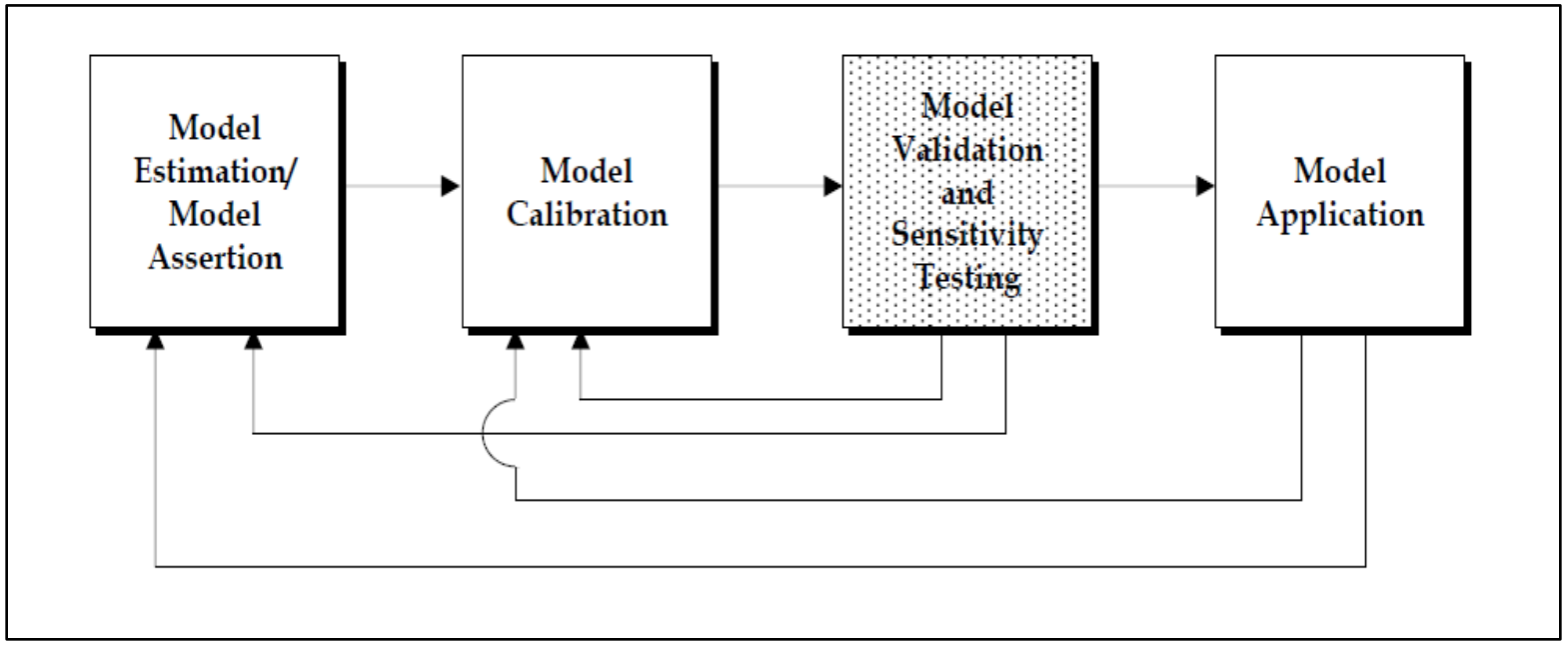
Purpose of a validation

- A comparison of a travel model to real-world data
- An objective basis for "tuning-up" the model
- A demonstration of the model's accuracy and reasonability

"…all models are wrong, but some are useful…the practical question is how wrong do they have to be to not be useful"

- George Box

Travel model development process

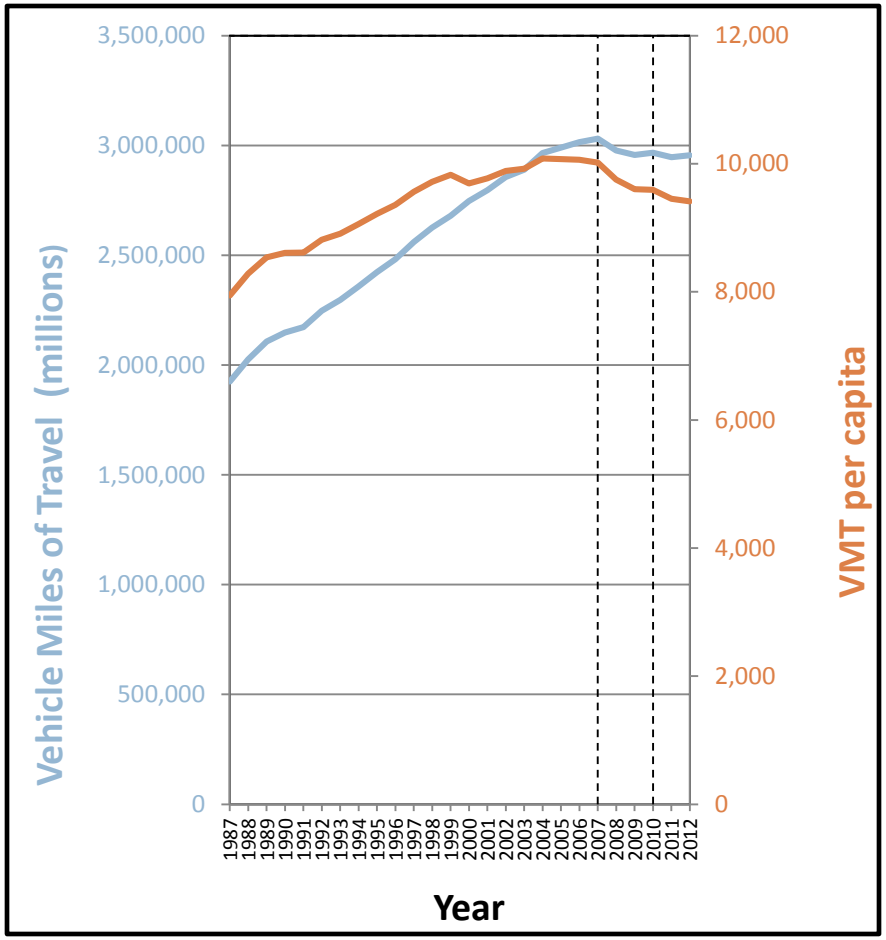


Source: Travel Model Validation and Reasonability Checking Manual, TMIP, 9/24/2010

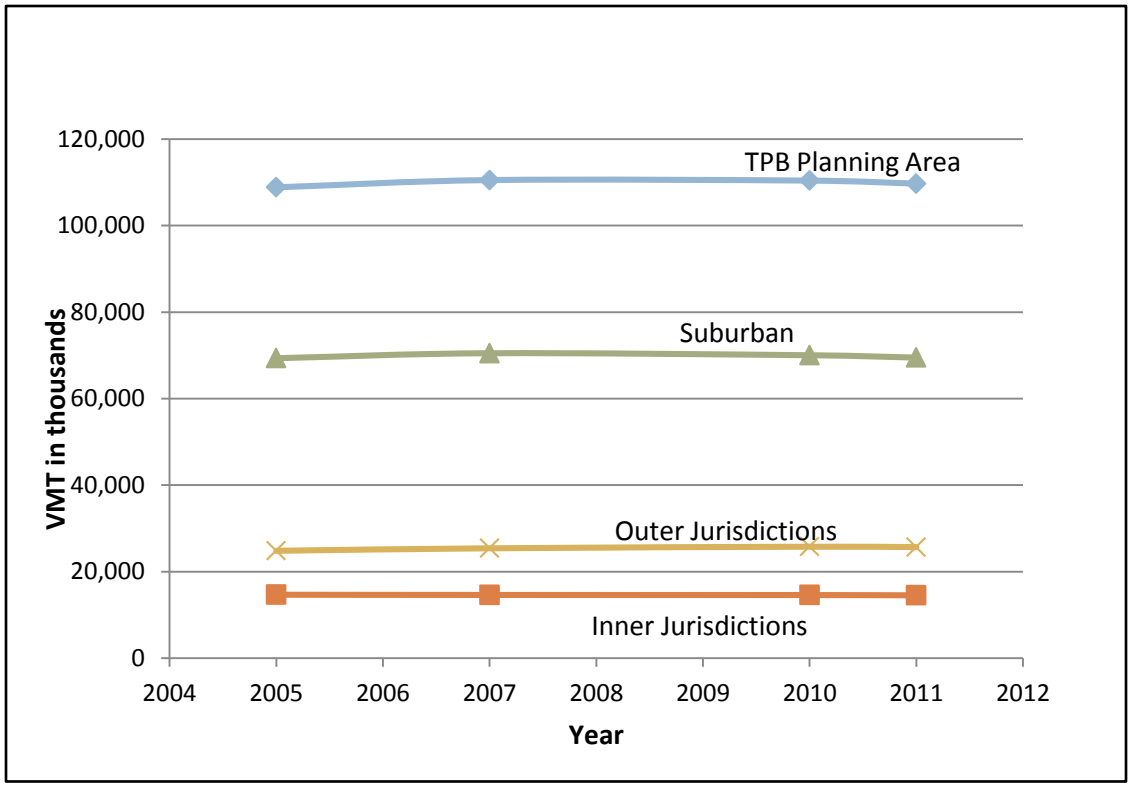
- Version 2.3 model estimation and calibration: 2007/08 HTS and other data
- Version 2.3 model validation: 2010 data

Recent trends: U.S. VMT & VMT/Capita

- National VMT has fallen back in recent years
- National VMT per capita has fallen even more
- National VMT has increased each year, with few exceptions, since the end of WW II
- The recent **sustained** decline in VMT and VMT per capita is unprecedented



Local VMT trend, 2005-2011

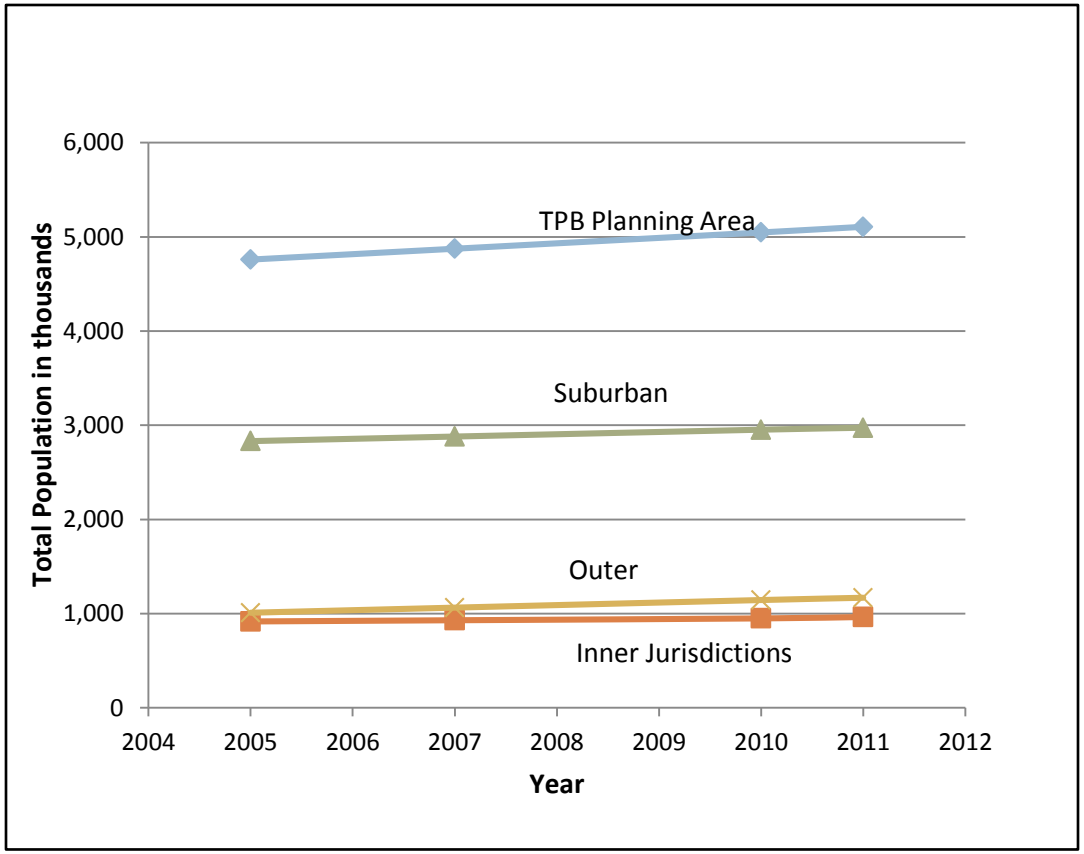


- VMT between 2005 and 2011 has been essentially **"flat"**
- VMT data shown is reflects average weekday traffic (AWDT) for non-local facilities in the TPB planning area

Inner: DC, Arlington, Alexandria; Suburban: Montgomery, Fairfax, Pr. George's; Outer: Loudoun, Pr. William, Frederick, Charles

Source: HPMS jurisdictional reports from the state DOTs

Local population trend, 2005-2011

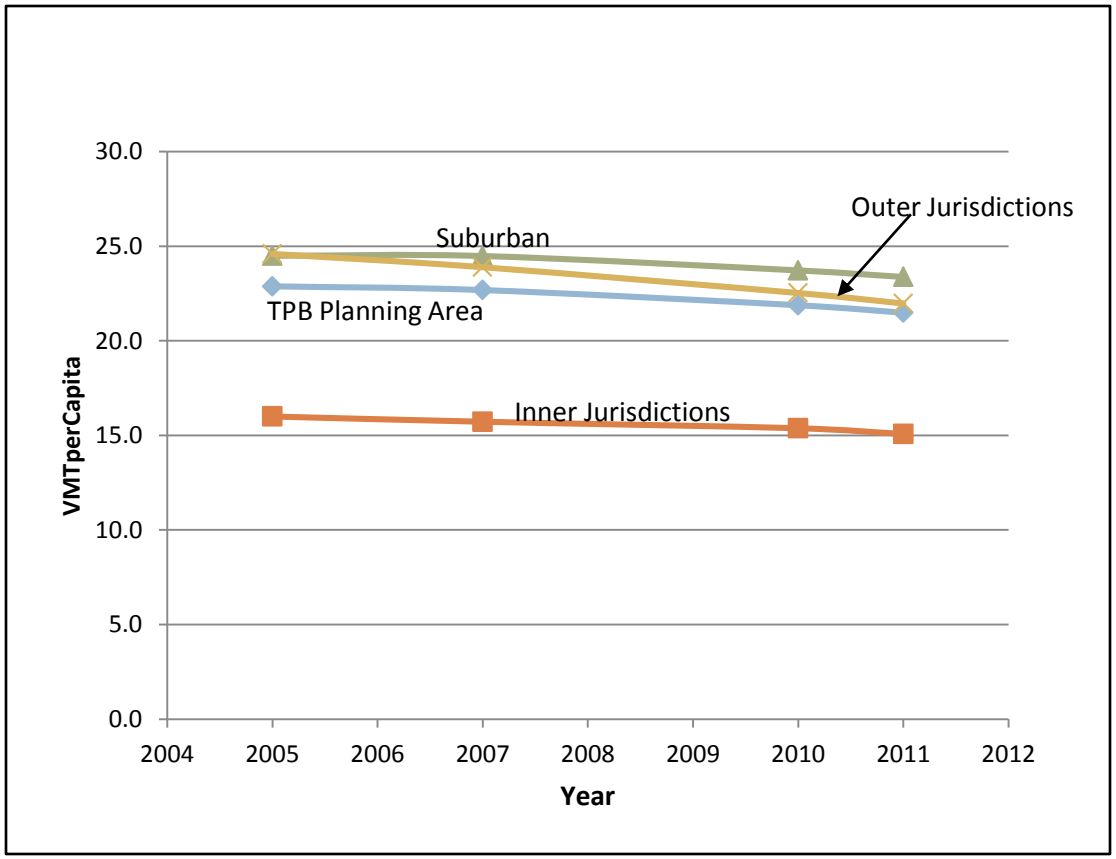


- Population between 2005 and 2011 has risen by 7%
- 2007 and 2011 figures are linearly interpolated between standard forecast years 2005, 2010, and 2015

Inner: DC, Arlington, Alexandria; Suburban: Montgomery, Fairfax, Pr. George's; Outer: Loudoun, Pr. William, Frederick, Charles

Source: COG Round 8.2 Cooperative Forecasts

Local VMT/capita trend, 2005-2011



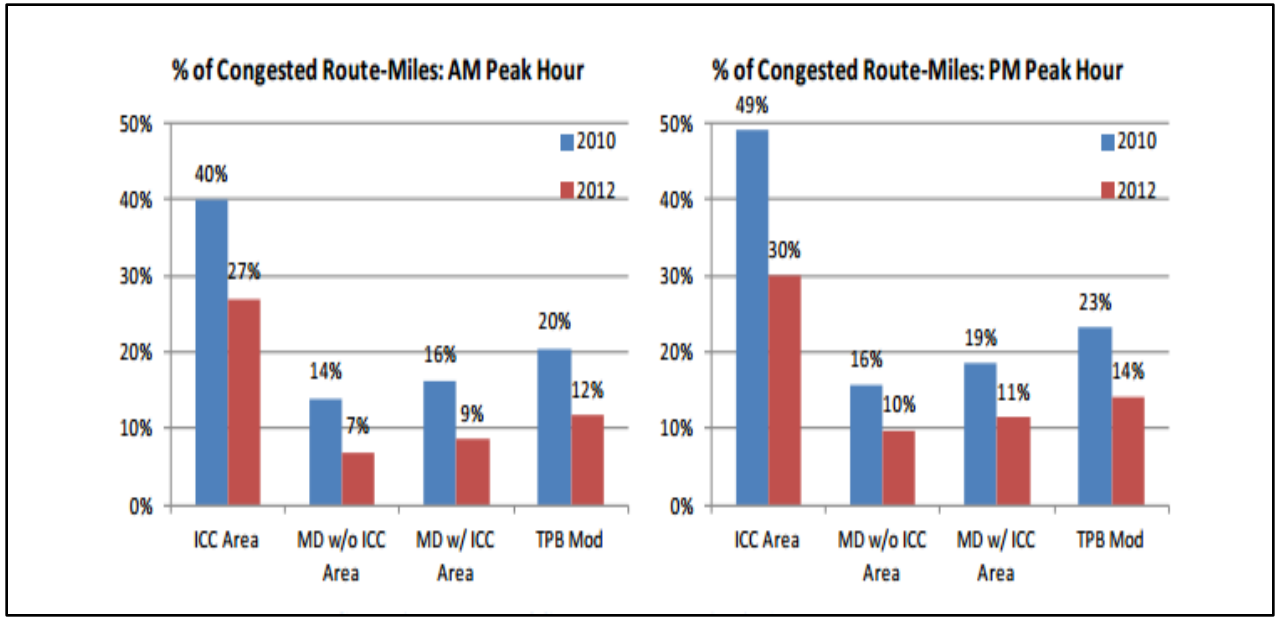
- VMT per capita between 2005 and 2011 has decreased by 6%
- The largest decline has been in the "outer" jurisdictions of the planning area

Inner: DC, Arlington, Alexandria; Suburban: Montgomery, Fairfax, Pr. George's; Outer: Loudoun, Pr. William, Frederick, Charles

Why has VMT per capita declined?

- Economy: Recession and fuel price volatility have depressed commercial activity and have spurred a reduction in discretionary HH trip-making
- Technology:
  - Internet-based commerce substitutes for shop trips
  - communications technology substitutes for social trips
  - telecommuting reduces commuting travel
- Behavior:
  - The “Millennials” (ages 18-34) are less inclined to drive
  - “Baby Boomers” (ages 49-67) are retired, or are about to

Decrease in regional driving has been evident from recent INRIX data analysis



Source: Pu, W. (2013, March 15). INRIX Data Analysis for the Intercounty Connector (ICC) Before and After Study. Memorandum. Retrieved from http://www.mdta.maryland.gov/ICC/Documents/Memo_ICC%20Before%20and%20After%20Study_2013-03-15-3.pdf

The driving decline is now a visible issue in the news and in the blogs

Washington Post
June 29, 2013

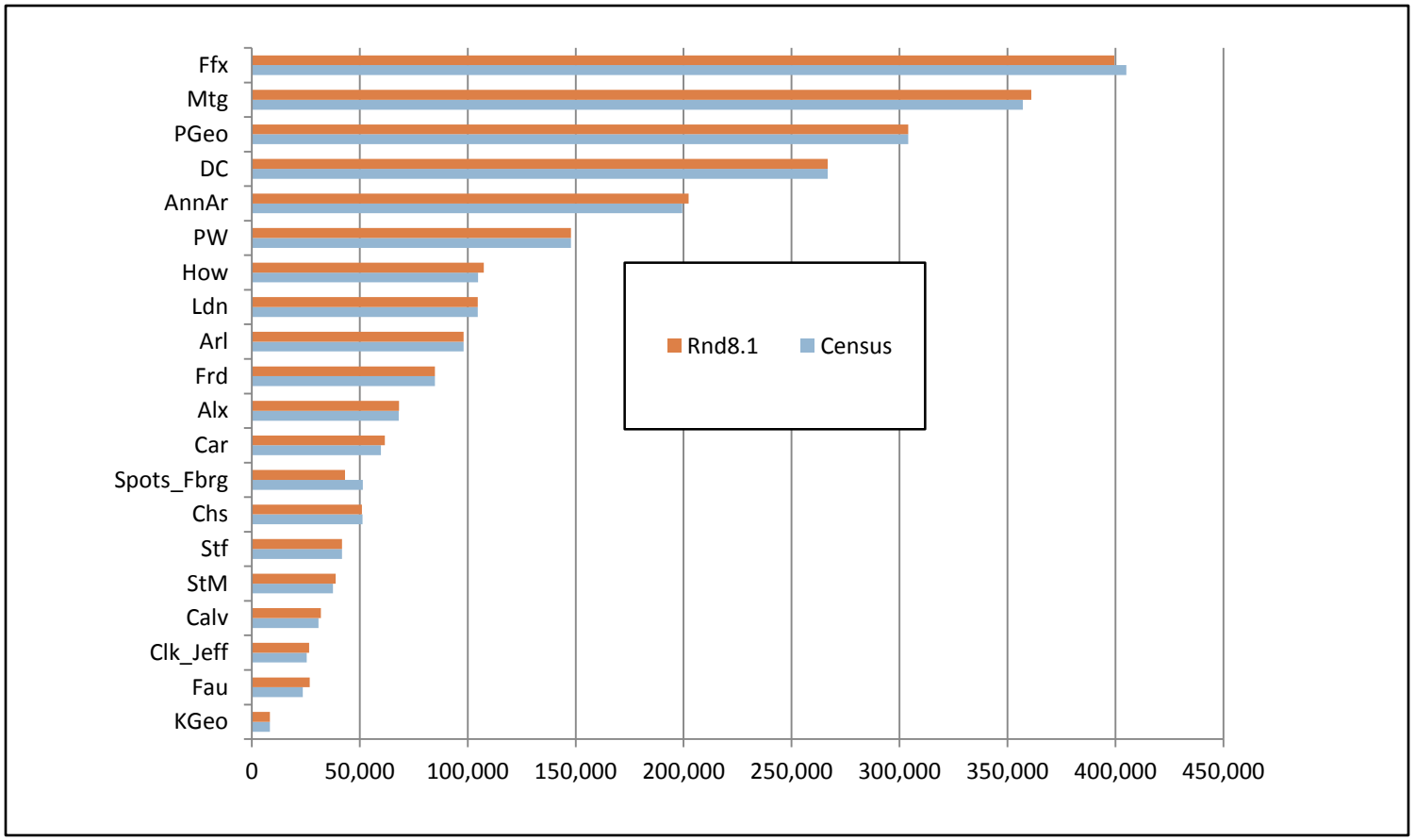
2010 Validation data assembled

Data Source	Data Elements Assembled	Level of Analysis
2010 Census	Households and Household Population	Jurisdiction level
2010 American Community Survey (ACS)	Share of households by size and vehicles available	Jurisdiction and state level
2010/11 TPB Geographically-Focused Household Travel Survey (HTS)	Share daily trips made by mode	Geographically-focused areas
2010 HPMS reports	Vehicle-miles traveled (VMT)	Jurisdiction level
2010 HPMS traffic counts	Daily link volumes	Screenline and facility levels
2010 Metrorail faregate counts	Station Boardings	Metrorail station level

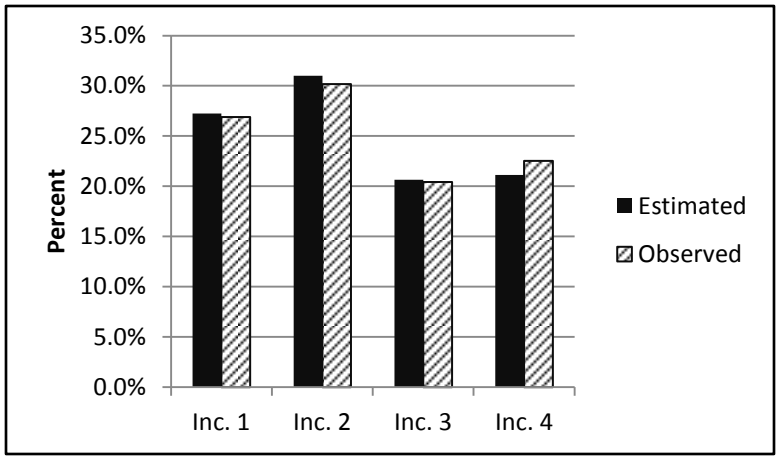
Validation Preparation

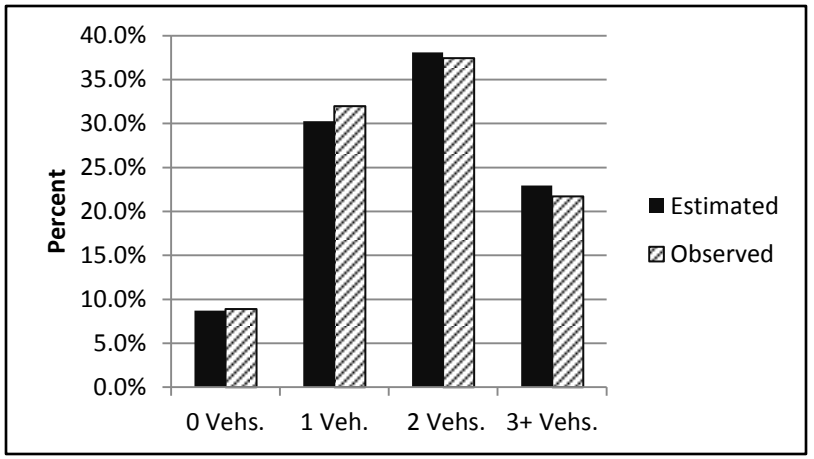
- Highway network update
  - Review of facility type codes
  - Review of zonal access
  - Global conversion of facilities in/near the District of Columbia from freeways to expressways
    - Expressways are more accurate in terms of operating characteristics
    - Practical way of addressing the VMT over-estimation in the District, particularly on freeways
- Traffic counts vetted

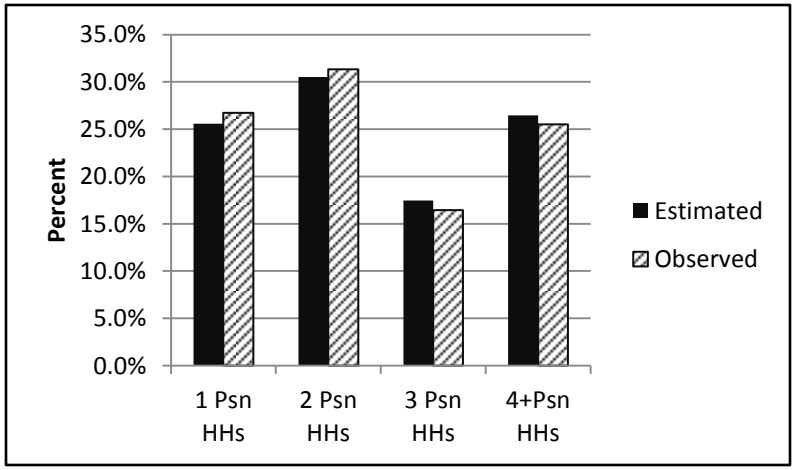
Validation of 2010 HHs by Jurisdiction Round 8.1 vs. 2010 Census



Validation of 2010 HHs by demographic strata: Model vs. ACS







Non-motorized validation

TPB staff decided to use data thus far obtained from the ongoing Geographically-Focused Household Travel Survey

The survey consists of household samples from 10 areas:

	Geo-Focused Area	Jurisdiction	When Surveyed	Total HHs in Area	Land Area (Sq mi)	No. of TAZs
1	Shirlington	Arlington	Spring 2010	4,200	0.6	3
2	Crystal City Area	Arlington	Spring 2010	9,600	0.7	8
3	Columbia Pike Corridor	Arlington	Spring 2010	15,000	2.5	12
4	Frederick City	Frederick Co.	Fall 2011	26,500	19.8	22
5	Largo	Prince Geo.	Fall 2011	12,200	9.4	20
6	Logan Circle	DC	Fall 2011	23,900	1.1	17
7	Purple Line	Montgom./Prince Geo.	Fall 2011	16,100	4.9	21
8	Reston	Fairfax County	Fall 2011	15,700	8.2	19
9	White Flint	Montgomery Co.	Fall 2011	12,500	4.6	11
10	Woodbridge	Pr. William	Fall 2011	12,900	8.0	19

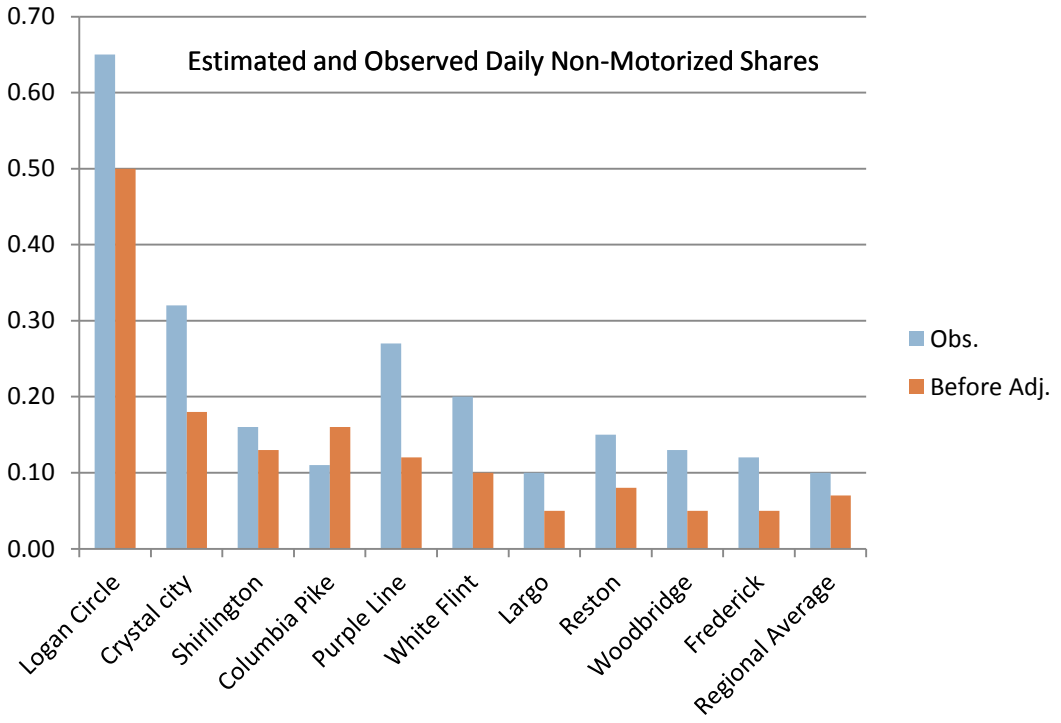
Analysis of daily non-motorized trip shares, observed vs. estimated

Modeled trip shares were found to be uniformly less than observed shares in most cases

The under-estimation was determined to be confined to non-work purposes

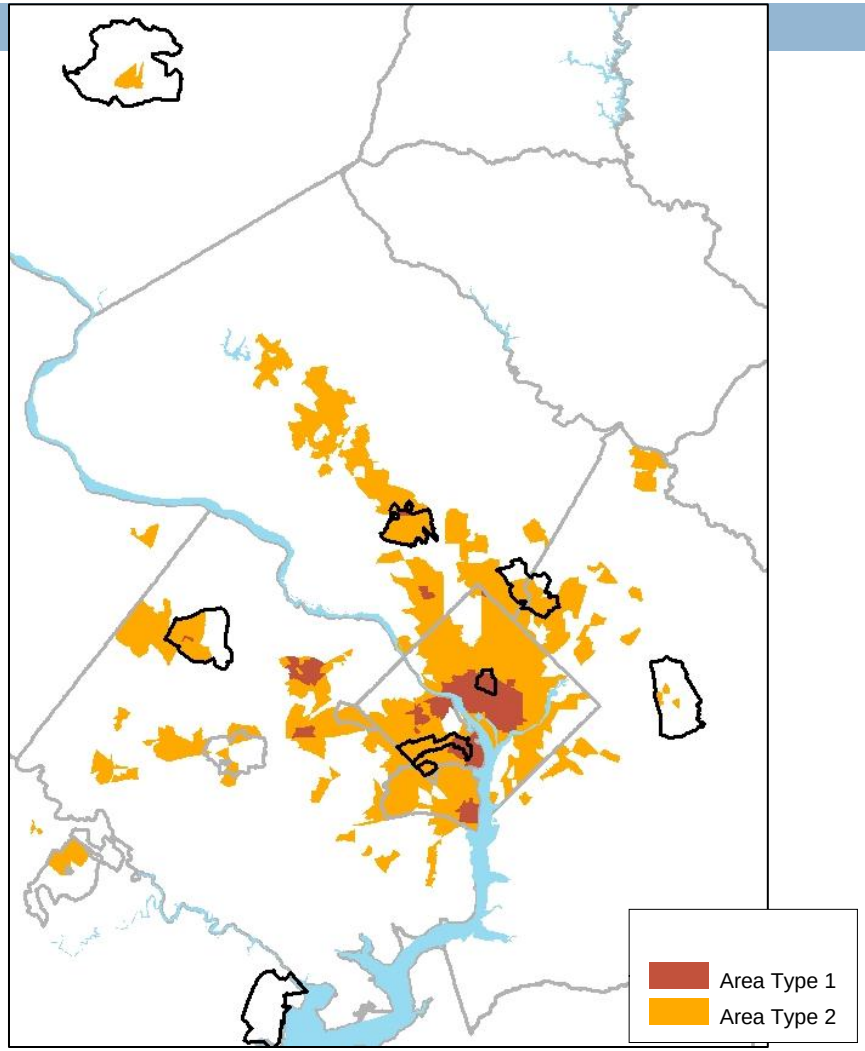
Staff increased non-motorized rates using trial-and-error to improve match

Non-motor. shares were adjusted in Area types 1 and 2



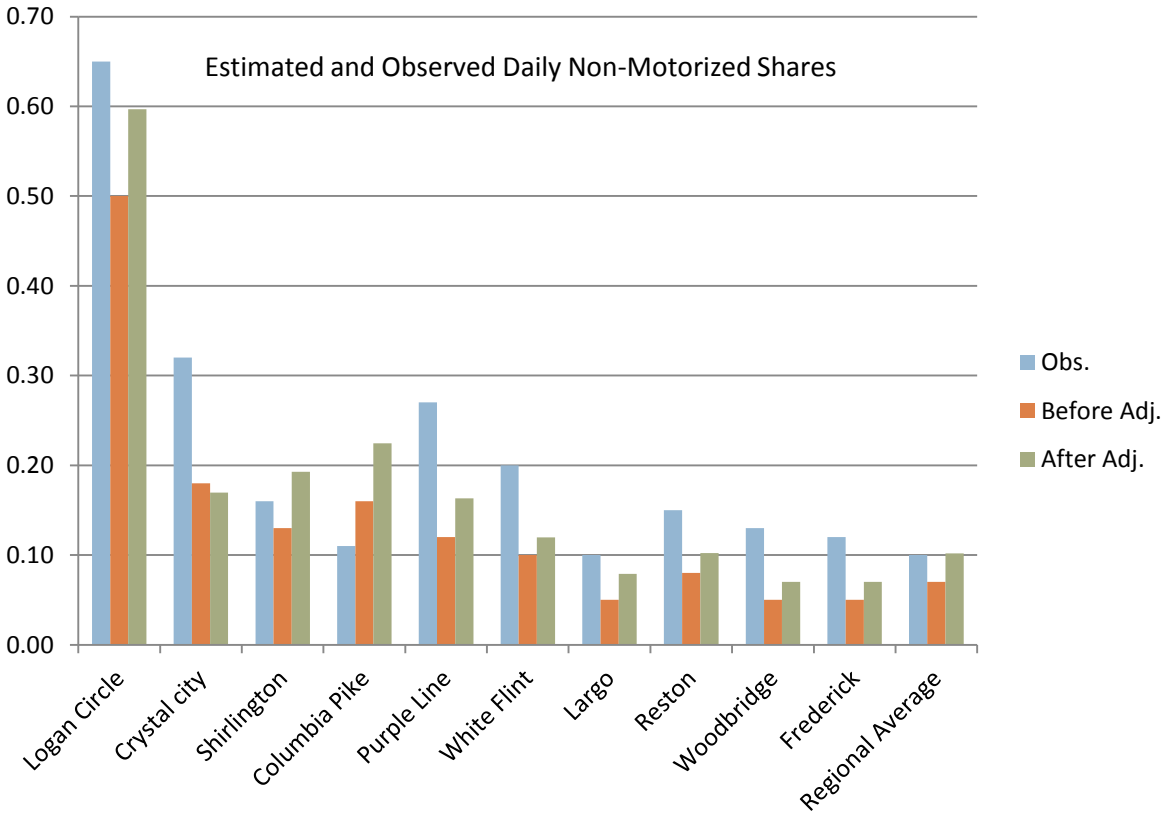
Geo-focused survey areas superimposed over modeled area types 1,2

- There is a reasonable geographic correlation between modeled area types 1 and 2 and the geo-focused survey areas
- Modifications were made to the NM share model for area types 1 and 2
- Adjustments were developed using simple trial and error
- Understanding non-motorized travel on a regional basis is a challenge

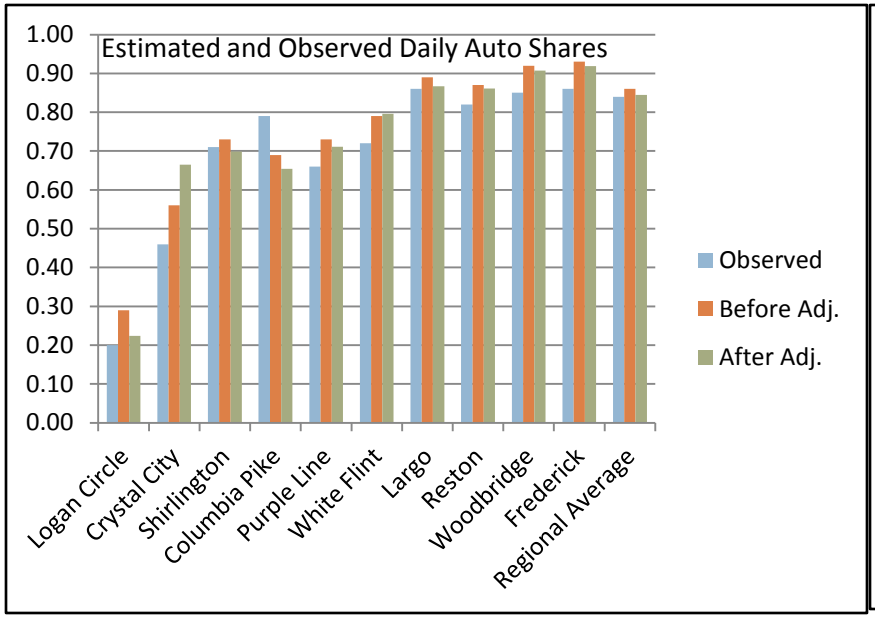


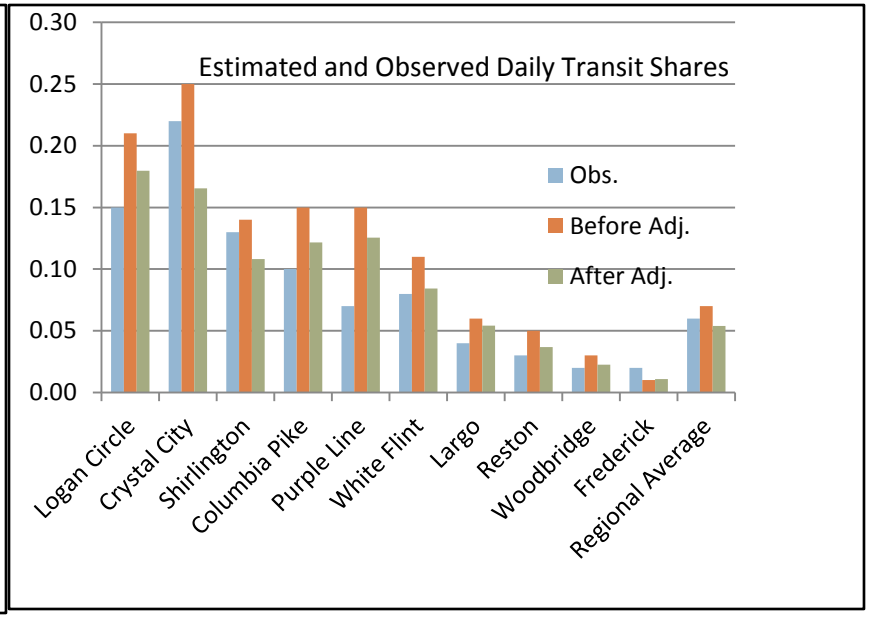
Estimated and observed NM shares after the adjustment

- The adjustment improves the overall est./obs. share match, but, more work needs to be done



Auto, transit shares by focus area before/after NM adjustment





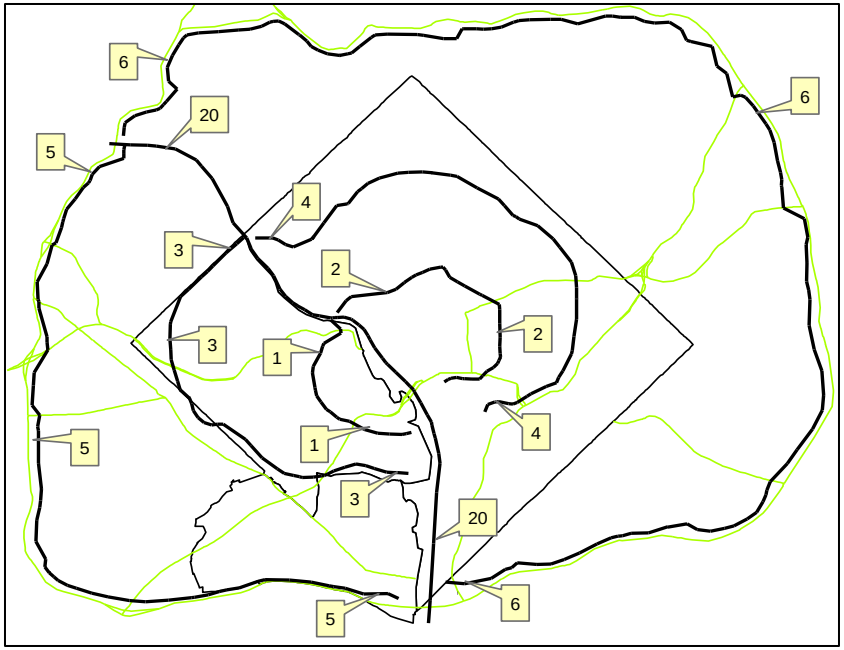
- The overall share patterns generally agree
- The NM adjustment offers slight improvement to the transit and auto shares
- Transit shares still underestimated
- Since the MC model calibration works on large super-district interchange basis, no transit modeling changes have been made; more investigation is likely needed

Summary of model updates

- Highway network refinements
  - Facility type changes
  - Facility type and lane refinements implemented throughout the modeled area
- 11-minute time penalties used on the Potomac River bridges to address an over-estimation of traffic crossing the river
- Non-work, non-motorized trip shares in high density areas increased by 30% to improve the match between modeled shares and observed shares determined from the recent geographically focused household travel survey
- Added technical improvements made (discussed at the May TFS meeting)

Screenline performance inside the Beltway

Screenline	Observed	Estimated Before Adj	Estimated After Adj.	E/O Ratio (Before)	E/O Ratio (After)
1	544	573	478	1.05	0.88
2	759	1,012	920	1.33	1.21
3	830	934	829	1.13	1.00
4	738	877	896	1.19	1.21
5	998	1,095	1,030	1.10	1.03
6	1,464	1,607	1,537	1.10	1.05
20	846	1,206	903	1.42	1.07
Subtotal	**6,179**	**7,304**	**6,593**	**1.18**	**1.07**



Observations:

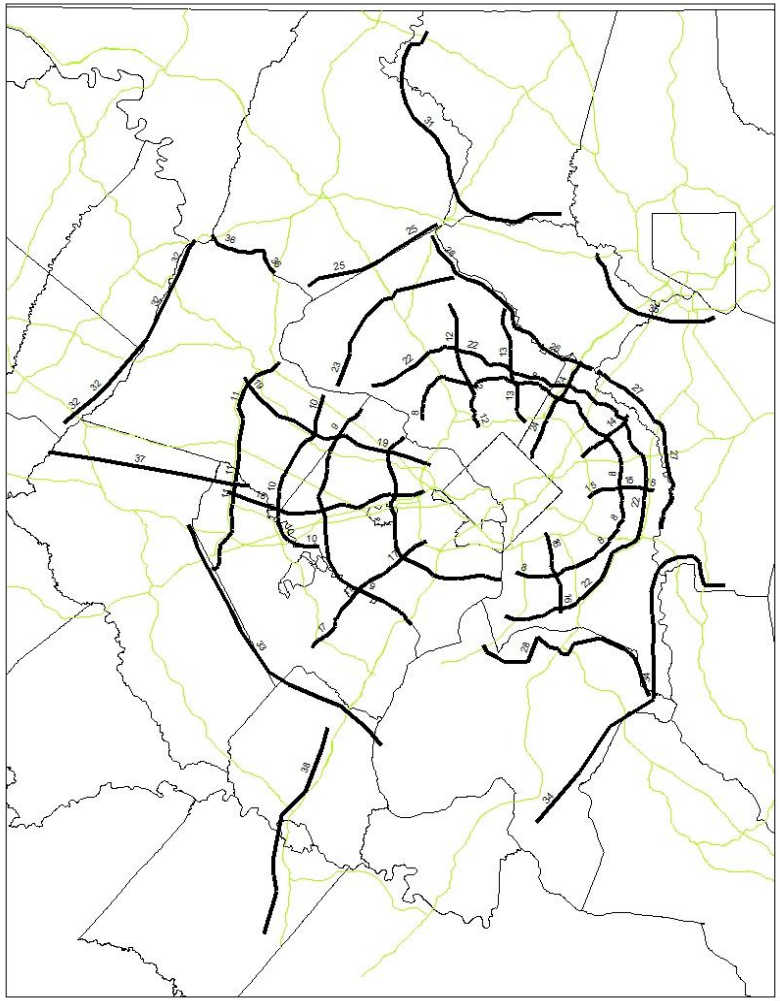
- The Potomac River screenline (#20) is substantially improved

- Screenlines 3, 5, 6 are markedly improved

-Note: Counts do not exist on all screenline links

Screenline performance Outside of the Beltway

Screenline	Observed	Estimated Before Adj	Estimated After Adj.	E/O Ratio (Before)	E/O Ratio (After)
7	1,203	1,209	1,158	1.01	0.96
8	1,396	1,564	1,551	1.12	1.11
9	856	871	844	1.02	0.99
10	459	501	499	1.09	1.09
11	293	291	294	0.99	1.00
12	456	449	450	0.98	0.99
13	386	493	501	1.28	1.30
14	333	277	292	0.83	0.88
15	331	271	282	0.82	0.85
16	158	146	147	0.92	0.93
17	487	493	485	1.01	1.00
18	719	671	658	0.93	0.92
19	719	665	640	0.92	0.89
22	1,423	1,561	1,550	1.10	1.09
23	184	229	231	1.24	1.25
24	433	386	376	0.89	0.87
25	99	128	127	1.29	1.28
26	37	73	75	1.94	2.01
27	235	291	288	1.24	1.22
28	177	140	137	0.79	0.78
31	76	170	174	2.24	2.29
32	89	87	123	0.98	1.37
33	261	315	315	1.21	1.21
34	133	138	153	1.04	1.15
35	951	854	855	0.90	0.90
36	47	59	77	1.25	1.64
37	24	34	35	1.45	1.48
38	264	176	177	0.67	0.67
	12,229	**12,542**	**12,494**	**1.03**	**1.02**
All Screenlines	**18,408**	**19,846**	**19,087**	**1.08**	**1.04**



Concluding remarks

- TPB staff is preparing a transmittal package of the adopted V2.3.52 model and inputs
  - Will be ready in August
  - Analysis years:
    - 2010, 2015, 2017, 2020, 2025, 2030, 2040
- TPB staff is preparing a report documenting the network inputs to the V2.3.52 model
- TPB staff will present global travel demand forecasts results of the AQC study in September