Item #4

Version 2.3 Travel Model 2010 Validation

Presentation
to the
Travel Forecasting Subcommittee

January 25, 2013

Ron Milone

National Capital Region Transportation Planning Board (TPB)
Metropolitan Washington Council of Governments (MWCOG)

2010 Validation findings in November:
Land use and demographic checks

- Household analysis (jurisdiction level):
  - Round 8.1 HHs, HH pop., HH Size vs. Census HHs

- Demographic analysis (state level)
  - HHs by size: Model vs. ACS
  - HHs by income: Model vs. ACS
  - HHs by vehicles available: Model vs. ACS

- Conclusion: Comparisons are reasonable

2010 Validation findings in November:
Transit checks

- Est. linked Metrorail trips vs. WMATA counts
  - Line (station group) level
  - Station level

- Est. Metrobus linked trips vs. WMATA counts
  - System level
  - Bus line group level

- Conclusion:
  - System-level comparisons are reasonable
  - Station-level, bus-line-level comparisons from the regional model will require additional refinement for project planning work

2010 Validation findings in November:
Highway checks

- Est. VMT at jurisdictional level vs. HPMS
- Est. highway screenline crossings vs. ground counts
- Conclusions: A few issues to investigate
  - Over-estimation of VMT in the District, Alexandria, Loudoun
  - 42% over-estimation of highway crossings over the Potomac River (screenline 20)
  - Over-estimation of radial highway crossings within the District (screenlines 2 and 4)
  - Notable over-estimations of highway screenline crossings at "outer" screenlines crossings

Assessment of findings

- Reasons for over–estimation of VMT in DC
  - Model not accurately capturing travel behavior of young professionals moving into the District
    - Lower need/want of auto ownership
    - More inclined to consider non-motorized modes
    - More inclined to substitute internet activity for travel
    - A change in attitude that transcends transportation
  - Model not capturing other considerations
    - Bridge rehab work temporarily constricted capacity
    - Fuel price volatility
    - Highway capacity coding in the District over-represented

Principal work activities since November

1. Staff generated and reviewed **zonal maps** displaying 2010 demographic data and various estimated travel metrics from the Version 2.3 travel model

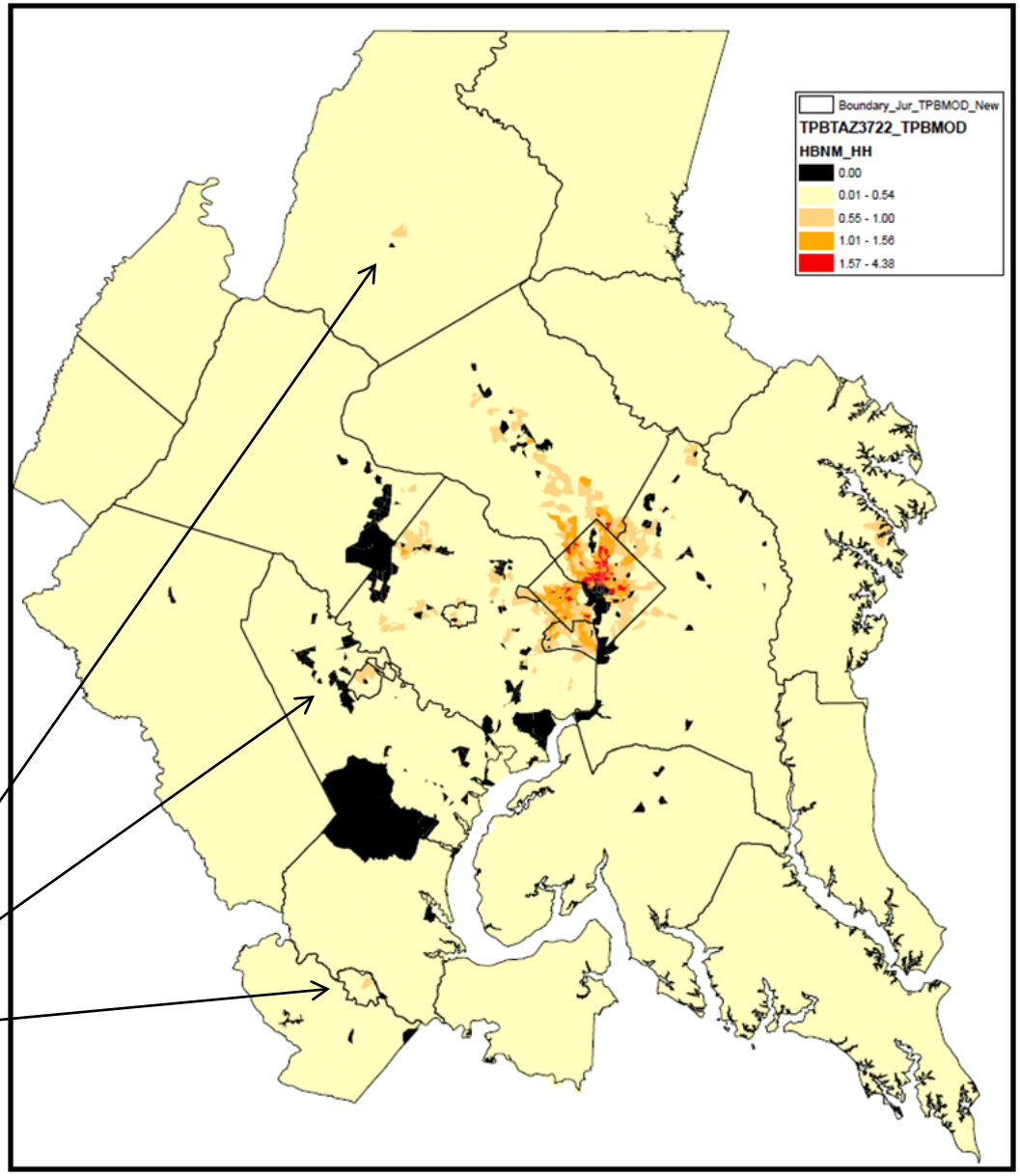
2. Staff compared modeled travel distributions (non-motorized travel in particular) against the **geographically focused areas** that TPB staff has recently **surveyed**

3. Staff implemented several **sensitivity tests** of the Version 2.3 travel model to investigate ways to refine the model

Zonal plots examined

- 2010 model input/output metrics mapped & examined:
  1. Average HH size
  2. Home-based trips per HH
  3. Home-based trips per capita
  4. Home-based non-motorized trips per HH
  5. Home-based non-motorized trips per capita
  6. Home-based transit pct.
  7. HBW trips per HH
  8. HBW trips per capita
  9. HBW non-motorized trips per HH
  10. HBW non-motorized trips per capita
  11. HBW transit pct.

Example plot: Total Home-Based non-motorized trips per HH



Observations:

-Rates vary from 0.1 to 4.4

-Highest rates are correlated with dense, mixed-use areas

-Non-motorized trip rates display a reasonable geographic pattern

-Notice detection of non-motorized trips in “outer” jurisdictions; a benefit of the new TAZ system

Background on Geographically- Focused Household Travel Surveys

- Follow-on to the 2007/08 HTS conducted for the purpose of travel model development

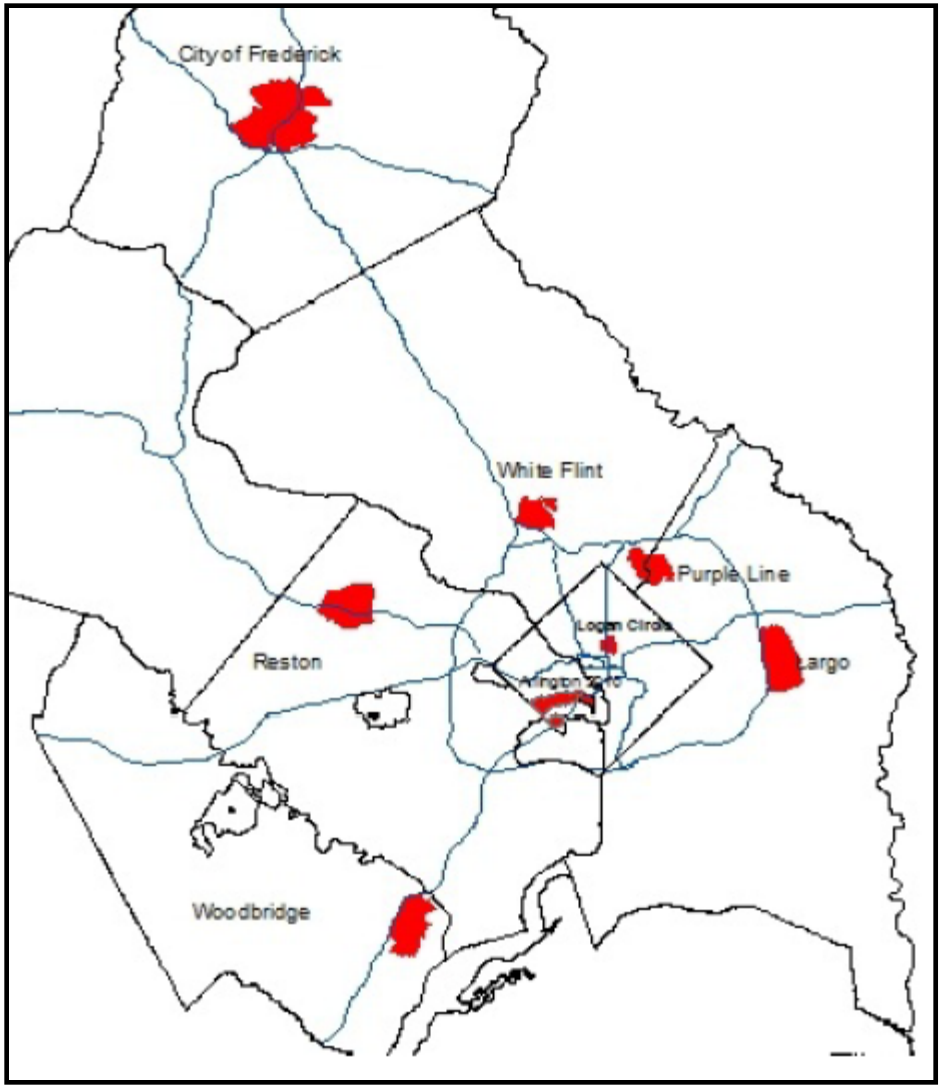
- Requested by local planners to examine case studies of travel behavior at the neighborhood level, varying by:
  - Density
  - Built environment
  - Transportation options

Geo-Focused HT Survey target areas:

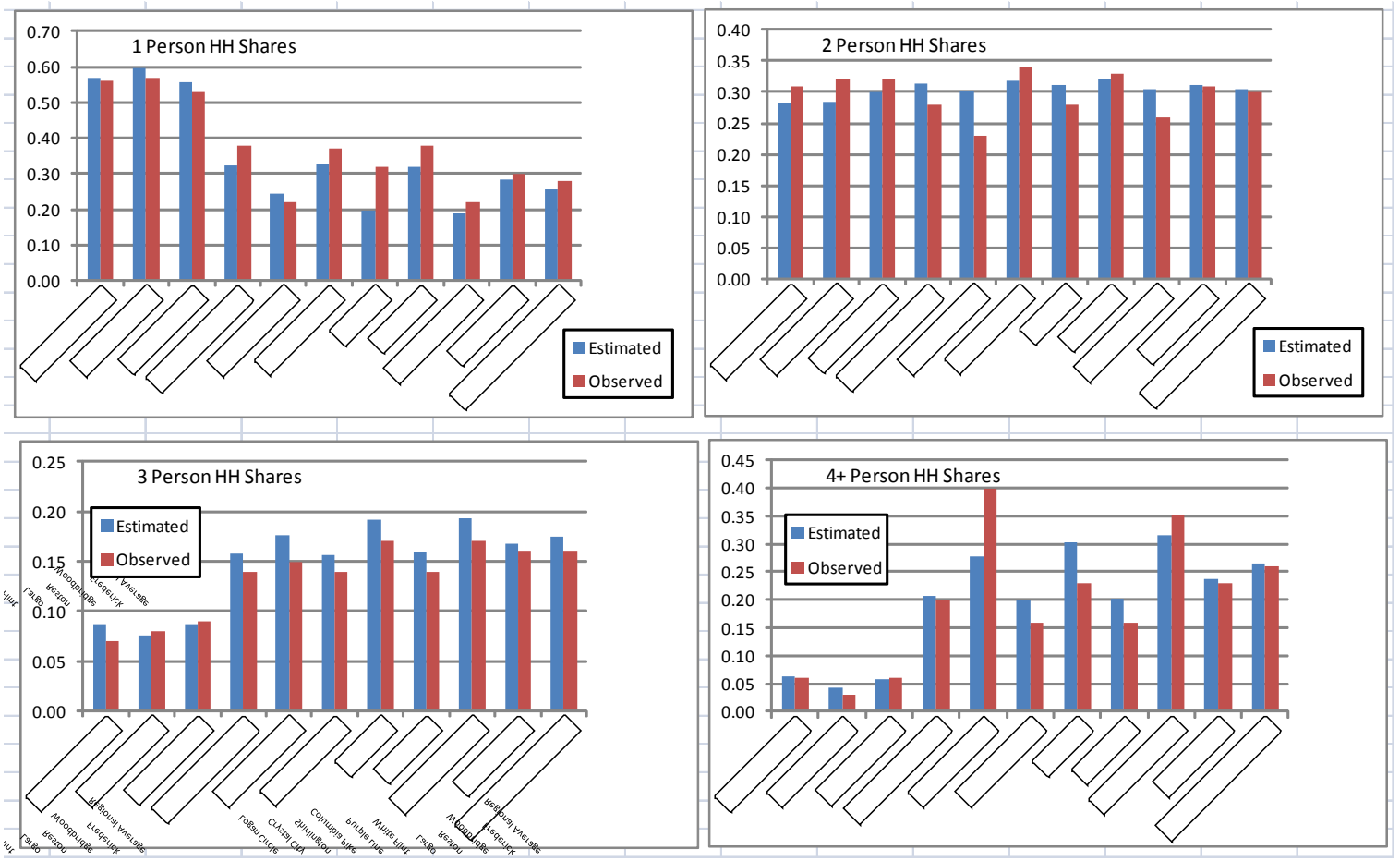
- Data collected at 10 locations (thus far)

- Spring 2010 data collection:
  - Crystal City area
  - Shirlington
  - Columbia Pike Corridor

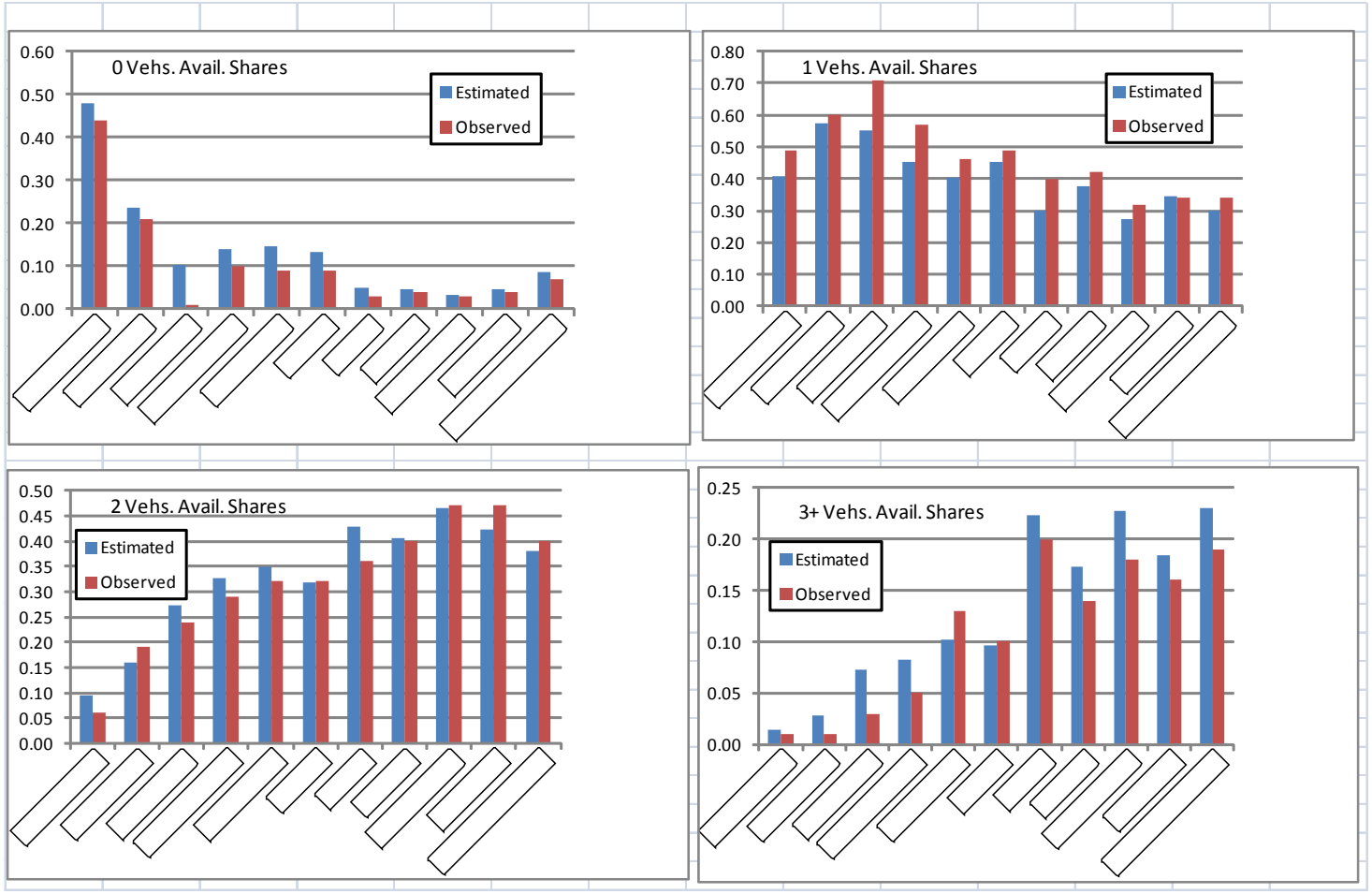
- Fall 2011 data collection:
  - Logan Circle area
  - Purple Line/Intl. Corridor
  - White Flint area
  - Largo area
  - Reston area
  - Woodbridge area
  - City of Frederick



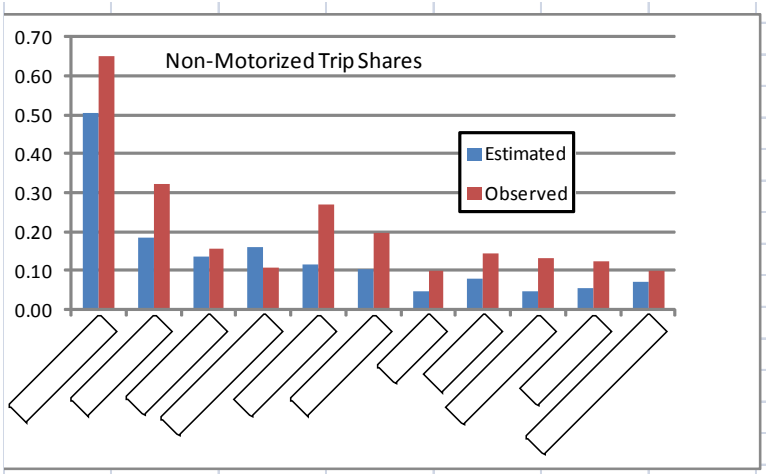
Est. & obs. HH size shares by focus area: Generally reasonable

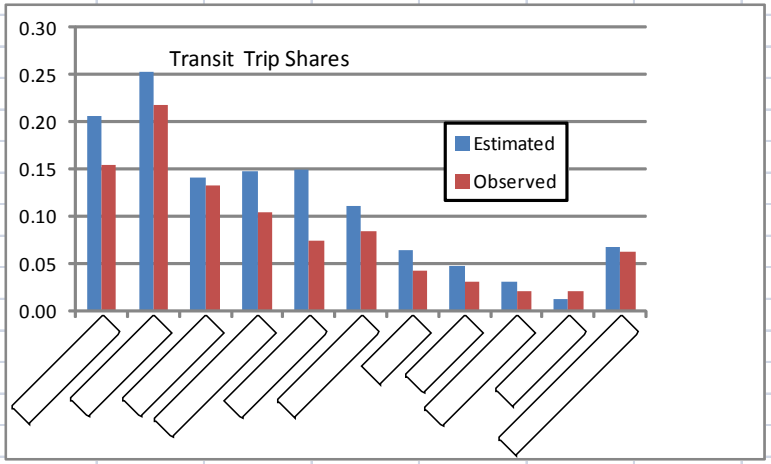


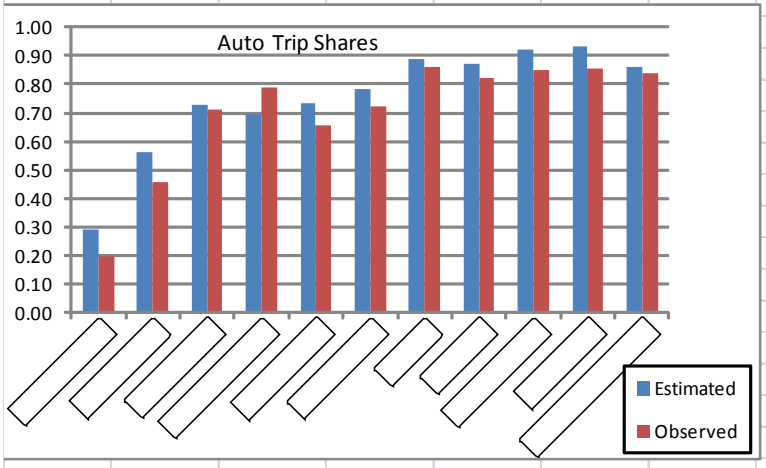
Est.& obs. HH veh. available shares by focus area: Generally reasonable



Est. & obs. person modal trip shares by focus area
Purpose: Daily Home-Based trips







Observations:

-Non-motorized shares almost uniformly under-estimated by the model

- Transit/auto shares almost uniformly over-estimated

Sensitivity tests

Model#	Test Name	Test Description	Model Steps Modified
V2.3.47	Base	(No Test)	(None)
V2.3.47.2	BridgePen15	Apply 15 minute time penalty to Potomac River bridges/Screenline 20 (Penalty added to path impedance and to highway skims)	Highway Network Building Highway Skimming Highway Assignment
V2.3.47.4	UpHBO/SNonMot	Double HB-non-work non-motorized trip in Area Types 1 and 2 (i.e., high density areas)	Trip Generation
V2.3.47.5	ExpBridgePen_12	Apply 12 minute time penalty to Potomac River bridges /Screenlines 20 and 36	Highway Network Building Highway Skimming Highway Assignment

Impact of sensitivity tests on trip-related metrics

	Land Use and Travel Statistics				Difference (Test - Base)		
	Base	BridgePen15	UpHBO/SNonMot	ExpBridgePen_12	BridgePen15	UpHBO/SNonMot	ExpBridgePen_12
	Ver2.3.47	Ver2.3.47.2	Ver2.3.47.4	Ver2.3.47.5	V2.3.47.2-v2.3.47	V2.3.47.4-v2.3.47	V2.3.47.5-v2.3.47
Households	2,474,631	2,474,631	2,474,631	2,474,631	0	0	0
Jobs	3,902,756	3,902,756	3,902,756	3,902,756	0	0	0
Total Non-Motorized Trips	1,828,064	1,827,909	2,383,125	1,827,920	-155	555,061	-144
Total Transit Trips	1,160,278	1,156,026	1,097,776	1,155,312	-4,252	-62,502	-4,966
Total Transit Percentage	6.17	6.15	6.03	6.14	-0.02	-0.14	-0.03
Total Auto Person Trips (Intl)	17,644,890	17,652,909	17,119,318	17,652,643	8,019	-525,572	7,753
Total Auto Driver Trips (Intl)	12,552,406	12,573,941	12,195,490	12,572,472	21,535	-356,916	20,066
Total Auto Occupancy	1.41	1.4	1.4	1.4	-0.01	-0.01	-0.01
Total Vehicle Trips Assigned	16,312,891	16,368,557	15,956,349	16,357,799	55,666	-356,542	44,908
Total Vehicle Miles	160,558,143	157,904,494	159,164,255	157,799,530	-2,653,649	-1,393,888	-2,758,613

Observations:

- Regional VMT is reduced for all tests, as expected
- Bridge penalty tests effect larger change in regional VMT that the increase in non-motorized trips, as expected

Impact of sensitivity tests on Jurisdictional VMT

		Estimated VMT				Est/Obs Ratio			
		Base	BridgePen15	UpHBO/SNonMot	ExpBridgePen_12	Base	BridgePen15	UpHBO/SNonMot	ExpBridgePen_12
Jurisdiction	**Observed VMT**	**Ver2.3.47**	**Ver2.3.47.2**	**Ver2.3.47.4**	**Ver2.3.47.5**	**Est47**	**Est47.2**	**Est47.4**	**Est47.5**
District of Columbia	8,218,979	9,277,286	8,826,730	8,796,268	8,886,073	1.13	1.07	1.07	1.08
Montgomery Co., Md.	19,693,973	21,105,942	20,591,672	20,840,136	20,752,607	1.07	1.05	1.06	1.05
Prince George's Co., Md.	23,123,014	23,118,892	22,691,178	22,950,976	22,751,741	1.00	0.98	0.99	0.98
Arlington Co., Va.	4,256,249	4,529,161	3,945,580	4,338,470	4,013,998	1.06	0.93	1.02	0.94
City of Alexandria, Va.	2,122,476	2,642,544	2,373,242	2,545,791	2,413,912	1.25	1.12	1.20	1.14
Fairfax Co.. Va.	26,736,352	26,320,633	25,406,983	25,997,462	25,676,090	0.98	0.95	0.97	0.96
Loudoun Co., Va.	5,412,448	6,802,826	7,088,170	6,814,277	6,866,501	1.26	1.31	1.26	1.27
Prince William Co., Va.	8,416,630	8,979,517	9,009,032	9,000,984	9,012,591	1.07	1.07	1.07	1.07
Frederick Co., Md.	7,738,356	8,630,040	8,663,260	8,632,253	8,219,241	1.12	1.12	1.12	1.06
Howard Co., Md.	10,491,370	10,400,008	10,441,167	10,401,816	10,408,633	0.99	1.00	0.99	0.99
Anne Arundel Co., Md.	14,984,795	14,578,753	14,572,034	14,563,683	14,576,436	0.97	0.97	0.97	0.97
Charles Co., Md.	3,253,562	3,129,606	3,115,852	3,151,769	3,120,464	0.96	0.96	0.97	0.96
Carroll Co., Md.	3,354,247	3,931,758	3,929,551	3,941,981	3,924,843	1.17	1.17	1.18	1.17
Calvert Co., Md	2,036,712	1,868,404	1,862,675	1,892,281	1,864,681	0.92	0.91	0.93	0.92
St. Mary's Co., Md.	2,192,055	2,075,399	2,060,843	2,094,202	2,063,830	0.95	0.94	0.96	0.94
King George Co., Va.	819,433	722,614	749,633	724,530	744,130	0.88	0.91	0.88	0.91
City of Fredericksburg, Va.	919,376	824,063	825,620	824,303	824,712	0.90	0.90	0.90	0.90
Stafford Co., Va.	3,920,132	4,139,957	4,190,468	4,155,180	4,178,598	1.06	1.07	1.06	1.07
Spotsylvania Co., Va.	3,303,754	2,202,562	2,205,947	2,204,919	2,205,148	0.67	0.67	0.67	0.67
Fauquier Co., Va.	3,133,312	3,162,081	3,187,698	3,170,541	3,186,398	1.01	1.02	1.01	1.02
Clarke Co., Va.	727,408	870,279	903,403	873,375	926,271	1.20	1.24	1.20	1.27
Jefferson Co., WVa.	1,094,762	1,245,818	1,263,758	1,249,059	1,182,632	1.14	1.15	1.14	1.08
Total	**155,949,393**	**160,558,143**	**157,904,494**	**159,164,255**	**157,799,530**	**1.03**	**1.01**	**1.02**	**1.01**

Observations:

-Each test, in isolation, improves the over-estimation of VMT in problem jurisdictions, but does not eliminate problem

-The bridge penalty approach is about as effective at reducing VMT in DC as the increase in non-motorized trips

Impact of sensitivity tests on the "inner" screenlines

		Base	BridgePen15	UpHBO/SNonMot	ExpBridgePen_12	Est/Obs Ratio			
Screenline	Observed	Ver2.3.47	Ver2.3.47.2	Ver2.3.47.4	Ver2.3.47.5	Est47	Est47.2	Est47.4	Est47.5
1	718	620	526	593	538	0.86	0.73	0.83	0.75
2	695	1,012	991	955	994	1.46	1.43	1.37	1.43
3	1,016	981	887	942	898	0.97	0.87	0.93	0.88
4	784	973	971	917	967	1.24	1.24	1.17	1.23
5	1,157	1,100	1,049	1,072	1,054	0.95	0.91	0.93	0.91
6	1,485	1,616	1,598	1,578	1,602	1.09	1.08	1.06	1.08
20	846	1,206	769	1,183	833	1.42	0.91	1.40	0.98
Subtotal	**6,701**	**7,507**	**6,792**	**7,240**	**6,887**	**1.12**	**1.01**	**1.08**	**1.03**

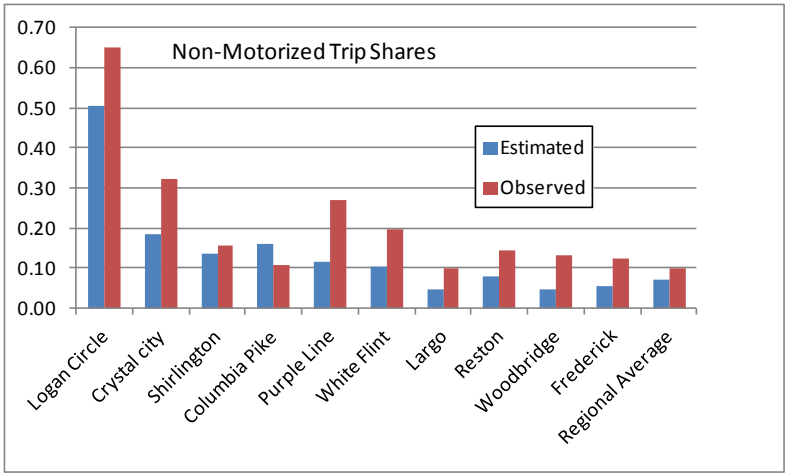
Observations:

-Bridge penalty tests are effective at improving performance of Potomac River screenline (#20) crossings

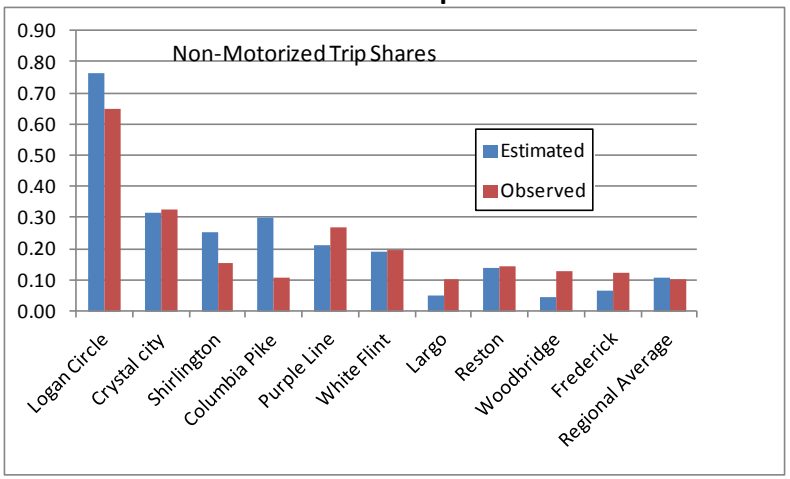
- Increase in non-motorized trips test has no substantial impact on screenline performance

Impact of sensitivity test to increase non-motorized shares by focus area: Daily Home-Based **non-motorized** trips

Base:



Alt.: Increased NM trips

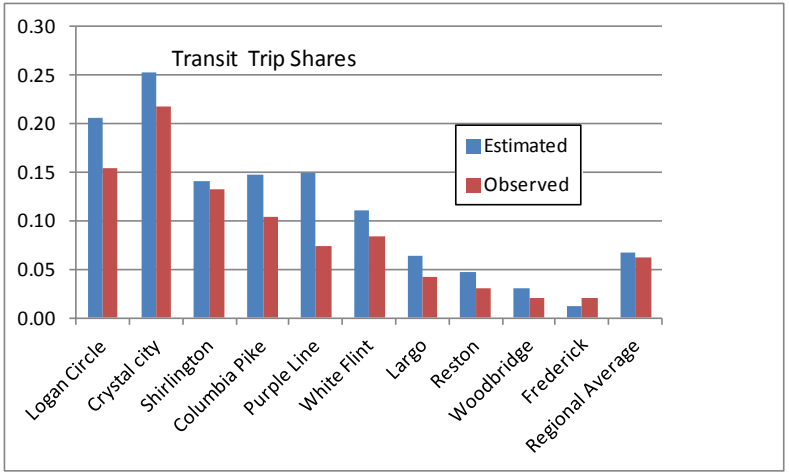


<u>Observations:</u>

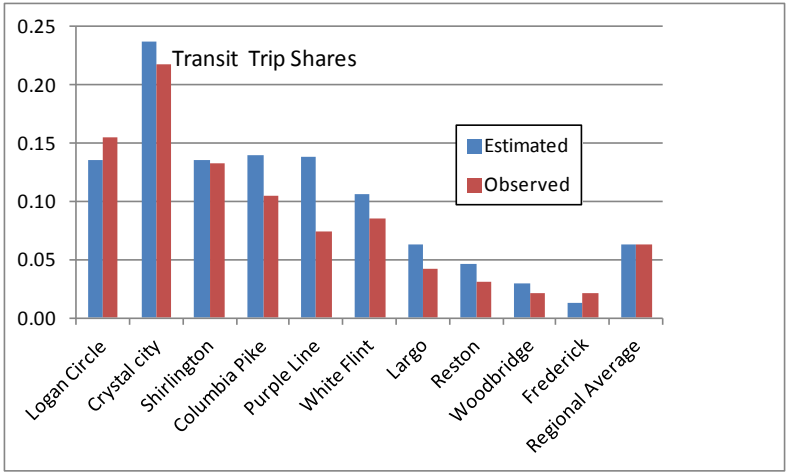
The Alt. scenario addresses the under-estimation of non-motorized shares observed in the Base scenario (Alt. now over-estimates non-motorized travel in dense areas)

Impact of sensitivity test to increase non-motorized shares by focus area:
Daily Home-Based **transit** trips

Base:



Alt.: Increased NM trips

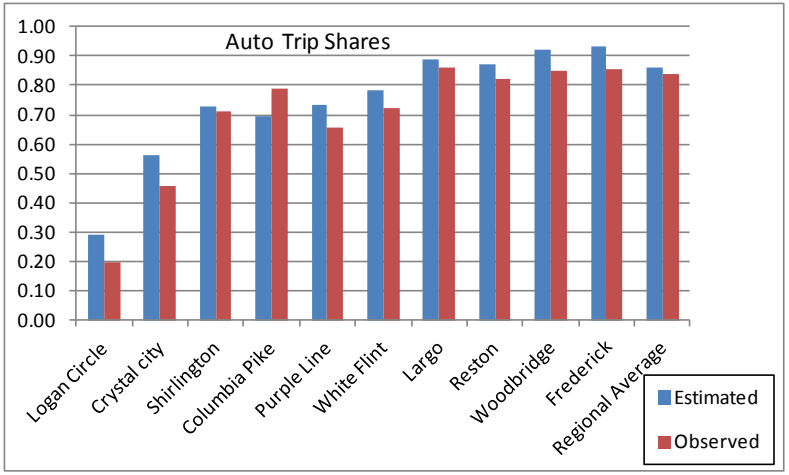


<u>Observations:</u>

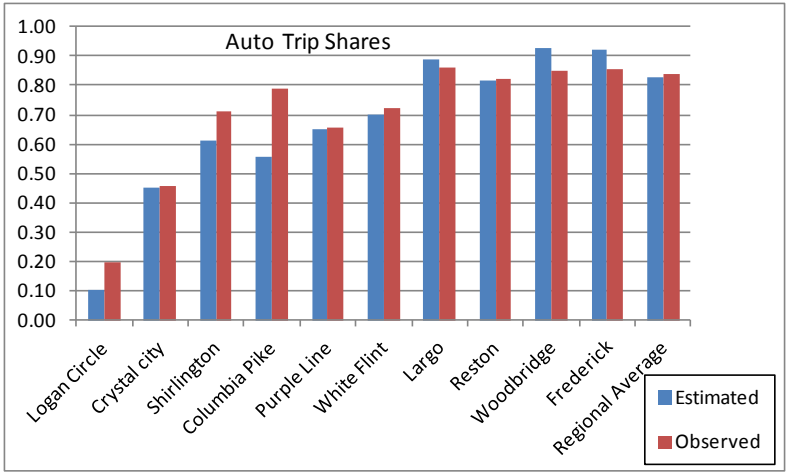
The Alt. scenario reduces over-estimation of transit shares in dense focus areas (Logan Circle, e.g.)

Impact of sensitivity test to increase non-motorized shares by focus area:
Daily Home-Based **auto person** trips

Base:



Alt.: Increased NM trips



<u>Observations:</u>

The Alt. scenario reduces over-estimation of auto person shares in dense areas (Logan Circle, e.g.)

Conclusions

- The use of the GF HTS data is novel way to verify the regional model; it may be useful to evaluate non-motorized travel
- Sensitivity testing has been a useful tool
- Finding the right parameters to change is the challenge
  - The model appears to under-estimate non-motorized travel, based on the GF HTS
  - The use of a bridge penalty appears to be necessary
  - There is still an over-estimation of traffic crossing “outer area” screenlines that will require attention
    - Staff plans to examine the treatment of external trips by purpose (e.g., Is the proportion of work-trips to non-work trips reasonable?)
  - Staff will begin bundling of tests