Version 2.5 travel demand model development

A Status Report

Ron Milone
Travel Forecasting and Emissions Analysis Program Director

TPB Travel Forecasting Subcommittee
September 22, 2017

Presentation overview

1. Brief review of the model in development
2. Summary of staff activities and findings since July

Background

COG's FY 2017 contract with Cambridge Systematics, Inc. (CS) has resulted in two key deliverables:

1. Final FY 17 Task Orders Report (June 2017)
   - Documents the development of a refined trip-based travel model for the Washington, D.C. region that the consultant has proposed for use by COG (Ver. 2.5)

2. A travel model "application package"
   - CS has integrated modeling improvements into our currently adopted travel demand model: **Version 2.3.66**
   - The refined trip-based model is named: **Version 2.5**
   - Calibration year: 2014*

* 2014 network, but estimation data comes from a variety of sources/years (see next slide)

Version 2.5 development feature: "Spliced" survey file

- 2007/08 HTS
- 2011/2012 Geo-Focused HTS
- 2008 Metrorail On-Board Survey
- 2008 Regional Bus On-Board Survey
- 2007/08 MARC On-Board Survey
- 2005 Virginia Rail Express On-Board Survey

Version 2.5 Refinements:

1. Updated transit network/pathbuilding software
   - From TRNBUILD to Public Transport (PT). See ch. 4, CS 2017.
2. Improved non-motorized model (ch. 3)
   - Used to split total Ps/As among motor./nonmotor. trips
3. Simplified mode choice model (ch. 4)
   - Transit choice set reduced from 11 to 3 modes
4. Highway & transit assignment enhancements (ch. 5)
   - Highway assignment: Uses value-of-time stratification
   - Transit assignment: Includes transit sub-mode choice (e.g., bus, LRT, CR)

Detailed discussion of refinements have been presented / documented previously

What staff accomplished recently?

- Year-2014 V2.5 application “as delivered” has been executed
- 2014 global metrics have been compared with similar results of adopted travel model
- Similar year-2020 application has been executed and is under evaluation

2014 Comparison of Motorized, Non-Motorized Productions: V2.3.66 vs. V2.5 Model

	V2.3.66 Productions			V2.5 Productions		
	Motor.	Non-Motor	Total	Motor.	Non-Motor	Total
HBW	4,451	151	4,602	4,458	129	4,587
HBNW	10,998	1,224	12,221	11,111	1,066	12,178
Total	**15,449**	**1,374**	**16,823**	**15,570**	**1,196**	**16,765**

	Diff (2.5 - 2.3)			Ratio (2.5/2.3)		
	Motor.	Non-Motor	Total	Motor.	Non-Motor	Total
HBW	7	-22	-15	1.00	0.86	1.00
HBNW	114	-157	-44	1.01	0.87	1.00
Total	**121**	**-179**	**-58**	**1.01**	**0.87**	**1.00**

Values in thousands, except for ratios

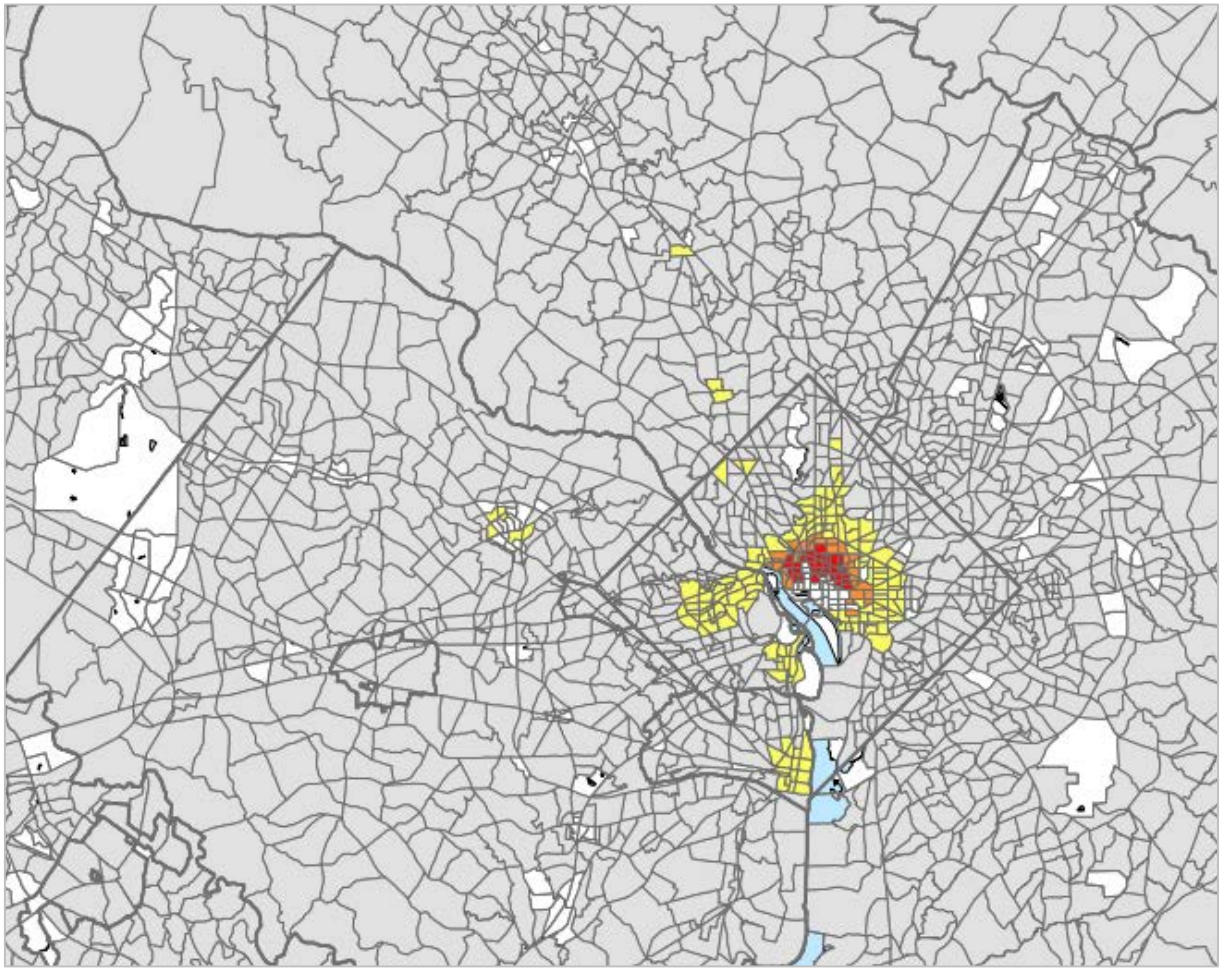
2014 Comparison of Motorized, Non-Motorized Attractions: V2.3.66 vs. V2.5 Model

	V2.3.66 Attractions			V2.5 Attractions		
	Motor.	Non-Motor	Total	Motor.	Non-Motor	Total
HBW	3,986	140	4,126	3,994	132	4,126
HBNW	10,732	1,317	12,049	11,010	1,039	12,049
Total	**14,718**	**1,457**	**16,175**	**15,005**	**1,171**	**16,175**

	Diff (2.5 - 2.3)			Ratio (2.5/2.3)		
	Motor.	Non-Motor	Total	Motor.	Non-Motor	Total
HBW	8	-8	0	1.00	0.94	1.00
HBNW	278	-278	0	1.03	0.79	1.00
Total	**287**	**-287**	**0**	**1.02**	**0.80**	**1.00**

Values in thousands, except for ratios

Est. share of non-motorized trip productions: **HBW, Ver. 2.3.66**



Est. share of non-motorized trip productions: **HBW, Ver. 2.5**

Est. share of non-motorized trip productions: **NHW, Ver. 2.3.66**

Est. share of non-motorized trip productions: **NHW, Ver. 2.5**

2014 Comparison of Mode Choice Model Outputs Purpose: HBW V2.3.66 vs. V2.5 Model

Purpose	Mode	V2.3.66	V2.5	Diff (2.5 -2.3)	Ratio (2.5/2.3)
HBW	SOV	2,651	2,813	162	1.06
	HOV2	345	333	-12	0.97
	HOV3	112	141	29	1.26
	Auto Person Subtotal	**3,108**	**3,286**	**178**	**1.06**
	TrnWalk	531	484	-47	0.91
	TrnPNR	224	134	-90	0.60
	TrnKNR	65	39	-26	0.60
	Transit Subtotal	**820**	**658**	**-162**	**0.80**
	TrnPct	20.87	16.68	-4.19	0.80
	Total Person	**3,928**	**3,944**	**16**	**1.00**
	Auto Occupancy	1.09	1.09	0.00	1.00

Values in thousands, except for ratios

2014 Comparison of Mode Choice Model Outputs
Purpose: Non-HBW
V2.3.66 vs. V2.5 Model

Purpose	Mode	V2.3.66	V2.5	Diff (2.5 -2.3)	Ratio (2.5/2.3)
NonHBW	SOV	6,696	6,804	108	1.02
	HOV2	4,397	5,048	651	1.15
	HOV3	3,789	3,147	-642	0.83
	Auto Person Subtotal	**14,882**	**14,999**	**117**	**1.01**
	TrnWalk	279	288	9	1.03
	TrnPNR	30	66	36	2.20
	TrnKNR	15	36	21	2.40
	Transit Subtotal	**325**	**390**	**65**	**1.20**
	TrnPct	2.14	2.53	0.40	1.19
	Total Person	**15,207**	**15,389**	**182**	**1.01**
	Auto Occupancy	1.49	1.47	-0.03	0.98

Values in thousands, except for ratios

2014 Comparison of Mode Choice Model Outputs Total (HBW + non-HBW) V2.3.66 vs. V2.5 Model

Purpose	Mode	V2.3.66	V2.5	Diff (2.5 -2.3)	Ratio (2.5/2.3)
Total	SOV	9,346	9,617	271	1.03
	HOV2	4,743	5,381	638	1.13
	HOV3	3,902	3,288	-614	0.84
	Auto Person Subtotal	**17,990**	**18,286**	**295**	**1.02**
	TrnWalk	810	773	-37	0.95
	TrnPNR	254	200	-54	0.79
	TrnKNR	81	75	-6	0.93
	Transit Subtotal	**1,145**	**1,048**	**-97**	**0.92**
	TrnPct	5.98	5.42	-0.56	0.91
	Total Person	**19,135**	**19,333**	**198**	**1.01**
	Auto Occupancy	1.40	1.38	-0.02	0.99

Values in thousands, except for ratios

2014 Comparison of Highway Assignment VMT Outputs: V2.3.66 vs. V2.5 Model

Jurisdiction	Observed	V2.3.66	V2.5	Diff 2.3-Obs.	Ratio 2.3/Obs	Diff 2.5-Obs.	Ratio 2.5/Obs
District of Columbia	7,922	8,179	9,109	257	1.03	1,187	1.15
Montgomery County	19,757	21,650	23,231	1,893	1.10	3,474	1.18
Prince George's County	23,647	23,235	25,358	-412	0.98	1,711	1.07
Arlington County	4,047	3,880	4,512	-167	0.96	465	1.11
City of Alexandria	2,016	2,459	2,911	443	1.22	895	1.44
Fairfax County	26,663	26,220	28,673	-443	0.98	2,010	1.08
Loudoun County	6,624	7,435	7,730	811	1.12	1,106	1.17
Prince William County	9,425	9,380	9,949	-45	1.00	524	1.06
Frederick County	7,799	8,747	9,596	948	1.12	1,797	1.23
Howard County	10,546	11,329	11,911	783	1.07	1,365	1.13
Anne Arundel County	15,494	15,472	16,345	-22	1.00	851	1.05
Charles County	3,277	3,011	3,114	-266	0.92	-163	0.95
Carrol County	3,291	4,104	4,170	813	1.25	879	1.27
Calvert County	1,988	1,741	1,791	-247	0.88	-197	0.90
St. Mary's County	2,247	2,200	2,283	-47	0.98	36	1.02
King George County	871	770	755	-101	0.88	-116	0.87
City of Fredericksburg	930	817	853	-113	0.88	-77	0.92
Stafford County	4,007	4,261	4,582	254	1.06	575	1.14
Spotsylvania County	3,442	2,208	2,274	-1,234	0.64	-1,168	0.66
Fauquier County	3,440	3,562	3,704	122	1.04	264	1.08
Clarke County	810	1,114	1,117	304	1.38	307	1.38
Jefferson County	1,177	1,339	1,472	162	1.14	295	1.25
Total	**159,420**	**163,114**	**175,441**	**3,694**	**1.02**	**16,021**	**1.10**

Values in thousands, except for ratios

Impressions: Modeled results

- The non-motorized and mode choice model results are reasonably consistent with the existing modeling results, and consistent with expectations
- Highway assignment VMT, overall, is somewhat higher than expected and requires further evaluation
- Transit assignment results have not yet been examined
- So far, no need for immediate concerns about V 2.5 base year modeling results

Impressions: Model application - 1

- Enhancements proposed & implemented by CS have advanced the TPB's modeling practice in terms behavioral theory and policy responsiveness

- Computation time of a "full" four-step application is 1.8 times that of currently adopted travel model
  - Highway assignment uses 12 vehicle classes vs. 6 due to VOT segmentation:
    - Result: Highway assignment run times are 2.7 times longer than that of currently adopted model (iteration 4)

Can the process be streamlined to reduce running time?

Impressions: Model application - 2

- Enhanced reporting summaries are needed for quality control and reasonableness checking
  - Mode choice model creates highly segmented trip tables by mode and VOT
- Network documentation supporting the V2.5 model is absolutely vital
  - No significant changes for highway node/link coding
  - Transit link/node coding is quite different
  - The network "link" file will contain both highway links and fixed guideway and exclusive transit links

Next Steps

- Review of modeling outputs & application will continue
- Testing of the 2.5 Model for a future year to be done
- Documentation is under development

Looking ahead

- Quadrennial update of the LRP
  - Staff intends to run the developmental model “in parallel” with the existing application model as a means of evaluating its readiness for production
- Phase 2 of the Strategic Plan
  - Development of the ABM
  - Consultant contract for FY 18 will be delayed

Thank You:

- Models development/Network development staff (especially Meseret Seifu & Ray Ngo)

Ron Milone

Travel Forecasting and Emissions Analysis Program Director
(202) 962-3283
rmilone@mwcog.org

mwcog.org/TPB

Metropolitan Washington Council of Governments
777 North Capitol Street NE, Suite 300
Washington, DC 20002