- Status Report -
Version 2.3
Travel Demand Model

Presentation to the
TPB Travel Forecasting Subcommittee

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Version 2.3 Background

- Incremental refinement to the currently adopted Version 2.2 travel model

- Currently a work in progress
  – We had hoped to release the model today, but it is not ready

- <u>Two primary features:</u>
    1. Revised mode choice model
        – 15-choice nested logit (NL) mode choice model replaces the 5-choice sequential multinomial logit (SML) mode choice model
        – Implementation software: COGMC is replaced by AEMS
    2. Revised truck models
        – Updated medium/heavy truck models
        – Commercial vehicle model remains, and it is unchanged

Anticipated Schedule of Events

July 2008	Rollout of <u>draft</u> Version 2.3 model and documentation
Summer/Fall 2008	Ongoing refinements, sensitivity testing, streamlining, etc.
January 2009	Decide whether Ver. 2.3 is application-ready for the next air quality conformity
Post-January 2009	Model recalibration begins using the latest round of surveys and a new zone system

Key Points Regarding Refinements

- Transit paths are more detailed:
  - 4 paths in V2.2 increased to 22 paths in V2.3
  - Related Concerns:
    - Transit accessibility affects auto ownership
    - Transit time is used in the composite impedance functions employed in trip distribution
- Trip tables (auto driver, trucks) are revised
    - Assigned volume and VMT is impacted
- Refined models have been informed by <u>new</u> observed data sources not considered in V2.2
  - 2003 External auto & truck data & 2005 HPMS counts at external stations
  - Transit calibration based on 2000/2002 boardings and surveys

Basic Streamlining Work

Model Input	Version 2.2	Version 2.3
Auto driver percentages used in 'pump-prime' iteration	Based on COGMC-generated output tables	Based on AEMS-generated output tables
Transit accessibility variable used in vehicle availability model	Based on 'best' AM Walk/Drive accessibility	Based on 'best' AM Bus-Metrorail Walk/Drive accessibility
Transit time measure used in composite impedance function in trip distribution	Based on 'best' Walk/Drive access time	Based on 'best' Bus-Metrorail Walk/Drive access time

Note: The vehicle availability model was adjusted given that the transit accessibility variable definition was modified

-Truck Models -

Background

- Two categories modeled:

  1. Medium truck

     - Single unit, 2-axle, 6-tire vehicles (dual rear wheels)
     - Examples: RVs, medium-duty delivery trucks
     - FHWA vehicle classification F5

  2. Heavy truck

     - Single unit vehicle with 3+axles or any multi-unit vehicle.
     - FHWA vehicle classification F6-13

- Trucks account for 2.4% of daily trips (V2.2) in 2005

Truck Model Calibration Data

- Base year: 2005
- Primary data source: MDOT counts
  - 6 permanent count locations
  - 315 short-term (program) count locations
- Secondary data sources:
  - DC class. counts (11)
  - Virginia class. counts (33)
  - TPB 4-hour class. counts (148)
  - (2003) TPB External Truck Survey (10 sites)

Revised Truck Model Components

- Trip generation
- Trip distribution
- Delta matrix application (additive adjustments)
- Time of day
- Traffic assignment modifications
  - Medium/Heavy trips assigned as explicit travel markets (Version 2.2 assigns <u>total</u> trucks as an explicit market).
  - Trucks passenger car equivalents (PCEs) are <u>being considered</u> as part of the traffic assignment.
    - Medium Truck ~ 1.5 vehicles
   - Heavy Truck   ~ 2.0 vehicles

A 'count-driven' calibration approach

1. Available observed class. counts were assembled (~500)
2. Medium & Heavy truck counts were synthesized on all links with daily counts (~5,000) using a truck count model
3. An trip generation/distribution model was applied to create an 'initial' trip table. The initial trip table was then assigned to the highway network.
4. Assigned volumes were systematically compared to the counts and the difference was used to modify the starting trip table ('Adaptable Assignment'). Thus, a 'modified' (or 'observed') trip table resulted from the AA process.
5. Trip generation model was refined based on comparisons with the initial' & 'modified' trip-ends to eliminate bias in land use variables; Steps 3-5 were rerun with refined trip generation model
6. A 'final' trip generation model and a 'final' zonal adjustment matrix (or delta matrix) was developed

Externals have been Updated

- Previously external travel was based on year 2000 observed counts extrapolated to the future, based on assumed growth rates that vary by location

- As per the revised truck model, external travel is based on 2005 observed counts. Truck controls at each station have also been reestablished

2005 observed count is higher than volume extrapolated from 2000

Existing & Revised External Forecasts

2005 AAWDT
Existing 1.351 million
Revised 1.406 million
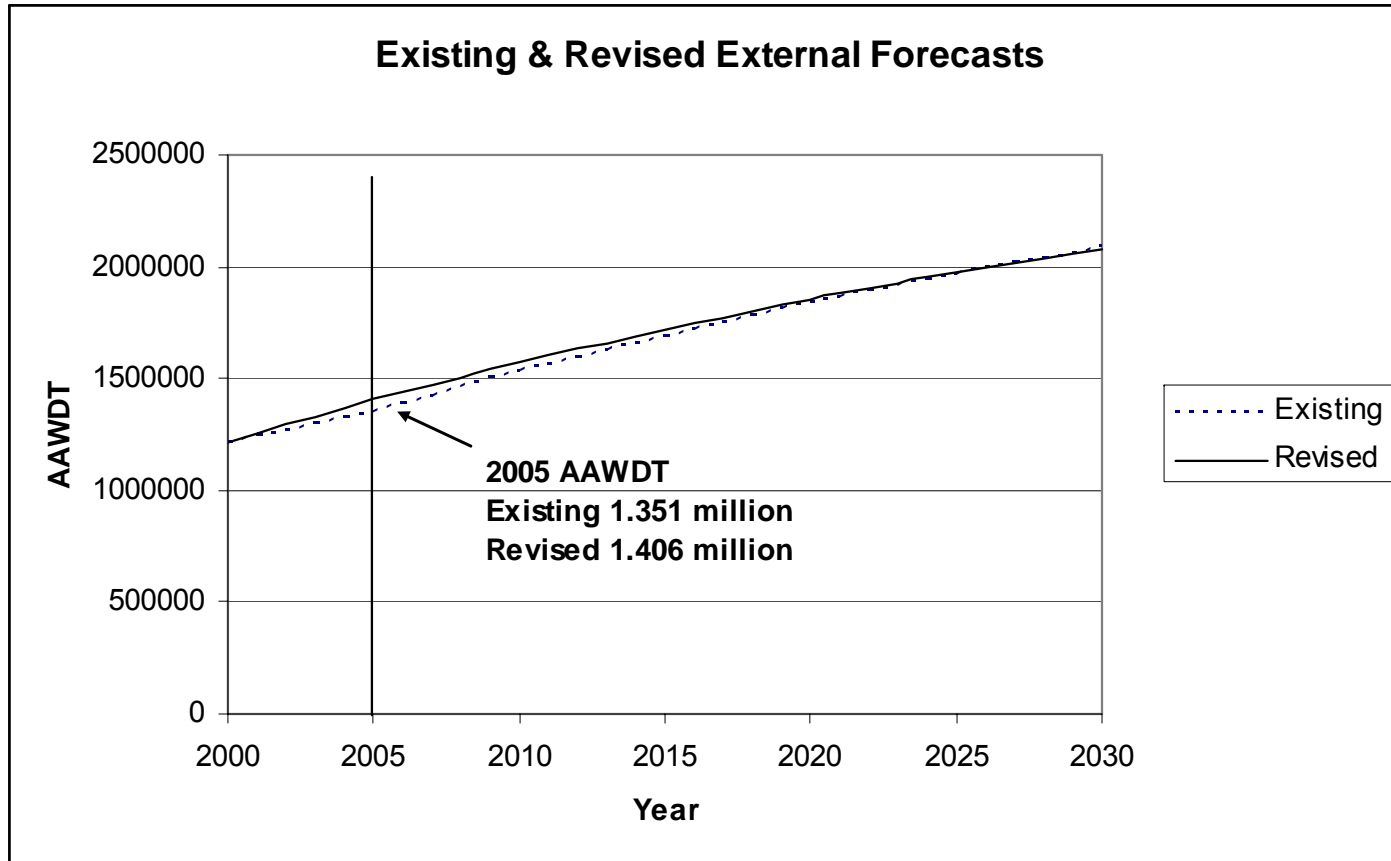
2005 External Truck Control Counts Also Adjusted

Existing			Revised			Difference (Revised - Existing)		
AAWDT	Trucks	Auto Driver	AAWDT	Trucks	Auto Driver	AAWDT	Trucks	Auto Driver
1,351,466	127,719	1,223,747	1,405,951	110,080	1,295,871	54,485	-17,639	72,124

V2.3 Truck Trip Gen. Model

Vehicle Type	Area Type	Land Use Category				
		Office	Retail	Industrial	Other	HH
Medium Truck	1 (CBD)	0.004	0.088	0.088	0.014	0.070
(Single Unit 6+ Tires)	2 - 4	0.005	0.125	0.125	0.020	0.100
	5	0.006	0.150	0.150	0.024	0.120
	6	0.006	0.150	0.150	0.024	0.120
	7 (rural)	0.006	0.150	0.150	0.024	0.120
Heavy Truck	1 (CBD)	0.001	0.027	0.055	0.002	0.011
(All Combination Vehicles	2 - 4	0.002	0.039	0.078	0.003	0.015
	5	0.002	0.043	0.086	0.003	0.017
	6	0.002	0.043	0.086	0.003	0.017
	7 (rural)	0.002	0.043	0.086	0.003	0.017

Truck Generator Locations Considered

- 35 zones were identified as special truck generator locations

- What is a truck generator zone?
  - zone that contains one or more land uses that are obviously expected to generate more truck trips per employee than the average zone: truck stops, major intermodal terminals, airports, etc.

Delta Matrix Statistics

		% of Non-Zero Cells	Avg. Non-Zero Value	Avg. Value < 0	Avg. Value > 0	Min. Value	Max. Value
Medium Truck	**Internal**	19.6%	0.002	-0.064	0.285	-546.337	6832.352
	External	11.9%	0.002	-0.074	0.127	-98.789	119.475
	Through	39.4%	-0.123	-1.353	1.694	-41.344	36.251
Heavy Truck	**Internal**	11.4%	0.007	-0.013	0.049	-101.469	1938.343
	External	11.4%	0.001	-0.092	0.155	-74.342	170.776
	Through	40.1%	-0.057	-3.941	5.326	-99.883	154.096

Note: Pct. of non-zero cells shown excludes 'inactive' TAZs

<u>What does this table mean?</u>
- The delta values are small in magnitude (~15% of the trip values on avg.)
- The average value is nearly zero
- Medium-Internal truck delta has a very few sizeable outliers

Comparison of 2005 Trips
V2.2 vs. V2.3

		Trips (Internal & External)	Avg. Trip Length (min)	Pct. Intrazonal
Medium Truck	**V2.2 (Iter. 6)**	327,698	33.47	6.75%
	V2.3 (iter. 6)	474,446	22.36	10.76%
	change (2.3-2.2)	146,748	-11.11	4.01%
Heavy Truck	**V2.2 (Iter. 6)**	169,148	45.73	5.76%
	V2.3 (Iter. 6)	159,762	49.67	6.41%
	change (2.3-2.2)	-9,386	3.94	0.65%

Nested Logit Mode Choice Model

Overview

- Description of the nested-logit mode choice (NL MC) model

- Region-level model results
  - Assumptions & network coding
  - 2002 (calibration year; transit validation year)
  - 2005 (highway validation year)

Description of the NL MC model

- The TPB NL MC model consists of

  – A set of available modes/choices (15) and a nesting structure

  – Utility equations, which include time & cost coefficients, and income constants

  – Nesting coefficients (a.k.a. logsum parameters, or Φ) and nesting constants (NC)

Choices and nesting structure of the TPB NL MC model

Highway

Transit

Drive Alone

Shared Ride

Walk Access

Drive Access

K&R Access

SR 2

SR 3+

Comm. Rail

All Bus

Bus/ Metrorail

All Metrorail

Comm. Rail

All Bus

Bus/ Metrorail

All Metrorail

Comm. Rail

All Bus

Bus/ Metrorail

All Metrorail
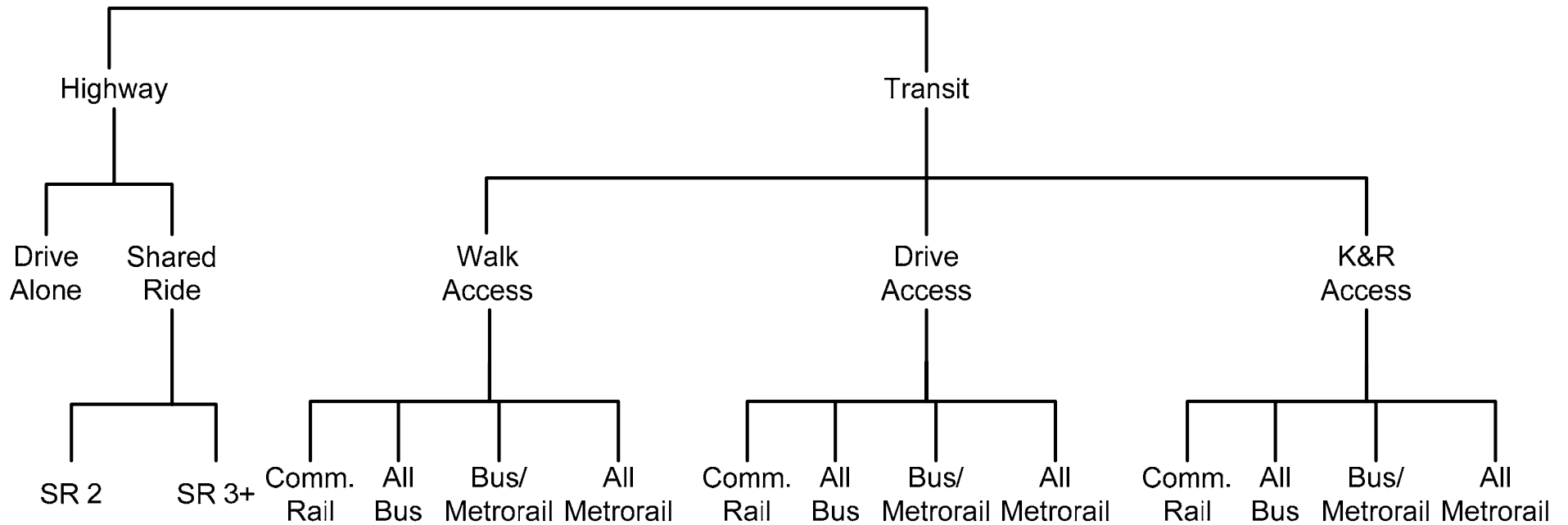
Calibration of the NL MC model

- Utility equations, which include time & cost coefficients, and income constants
  - Disaggregate statistical estimation used for some parameters (Alogit)
  - Rules of thumb and professional judgment used for others (See next slide)
- Nesting coefficients (a.k.a. logsum parameters, or Φ)
  - Set using professional judgment
- Nesting constants (NC)
  - Estimated in calibration process

Time & cost coefficients

Variable		Trip Purpose (4)				
		HBW	HBS	HBO	NHB	Rule
In-vehicle time	ivt	-0.02128	-0.02168	-0.02322	-0.02860	Stat Est
Auto access time	ovtaa	-0.03192	-0.03252	-0.03483	-0.04290	1.5*ivt
Walk access time	ovtwa	-0.04256	-0.04336	-0.04644	-0.05720	2.0*ivt
Other out-of-vehicle time*	ovtot	-0.05320	-0.05420	-0.05805	-0.07150	2.5*ivt
Cost - Income group 1	costinc1	-0.00185	-0.00202	-0.00202	-0.00994	Stat Est
Cost - Income group 2	costinc2	-0.00093	-0.00101	-0.00101	-0.00994	(base)/2
Cost - Income group 3	costinc3	-0.00062	-0.00067	-0.00067	-0.00994	(base)/3
Cost - Income group 4	costinc4	-0.00046	-0.00051	-0.00051	-0.00994	(base)/4

* Includes boarding penalty

In-vehicle time coefficient and cost coefficient for income group 1 statistically estimated from a previous regional model

Income constants

- Additional market stratification
  - Low income (income group 1)
  - Middle income (income groups 2 and 3)
  - High income (income group 4)

- Income constants apply to all purposes

| | Income stratification | | |
Mode	Low	Middle	High
All auto modes	0.0	0.0	0.0
Walk to commuter rail	2.0	0.0	-2.0
Walk to all bus	2.0	0.0	-2.0
Walk to bus/Metrorail	2.0	0.0	-2.0
Walk to all Metrorail	2.0	0.0	-2.0
PNR and KNR to transit	0.0	0.0	0.0

Calibration approach

- Seven superdistricts were combined to make 20 production/attraction "market segments"
- There is one nesting constant (NC) for each market segment and each travel mode
- Calibration consists of estimating these nesting constants
- Automated calibration routine: CALIBMS

	Production Area	Attraction Area
1	DC	DC core
2	DC	VA core
3	DC	Urban DC, MD, VA
4	DC	Suburban MD, VA
5	MD urban	DC core
6	MD urban	VA core
7	MD urban	Urban DC, MD, VA
8	MD urban	Suburban MD, VA
9	VA core/urban	DC core
10	VA core/urban	VA core
11	VA core/urban	Urban DC, MD, VA
12	VA core/urban	Suburban MD, VA
13	MD suburban	DC core
14	MD suburban	VA core
15	MD suburban	Urban DC, MD, VA
16	MD suburban	Suburban MD, VA
17	VA suburban	DC core
18	VA suburban	VA core
19	VA suburban	Urban DC, MD, VA
20	VA suburban	Suburban MD, VA

2002 calibration: Targets vs. observed data

- To calibrate the NL MC model, you need a series of calibration "targets," which are simply daily person trips stratified by
  - Trip purpose (HBW, HBS, HBO, NHB),
  - Market segment (1-20), and
  - Travel mode (1-15)

2002 calibration: Targets vs. observed data

- 15 modes: 3 auto person and 12 transit
- Sources for transit targets (observed data)
  - Metrorail: 2002 WMATA rail survey
  - Bus: 2000 bus survey
  - Commuter rail and express bus: boarding counts
- Source for auto person targets
  - Simulated 2002 auto person trips, squeezed to 20 market segments, from a recent run of the Ver. 2.2 travel model.
- Thus, transit data differs from that used to develop the Ver. 2.2 mode choice model (i.e., 1994 HTS & 2000 CTPP)

Example: HBW targets for market segment 1 (DC to DC core)

Market Seg.	Mode	HBW Targets
(1) DC to DC CORE	DR ALONE	23,083
	SR2	5,483
	SR3+	2,192
	WK-CR	0
	WK-BUS	57,803
	WK-BU/MR	13,458
	WK-MR	39,020
	PNR-CR	0
	KNR-CR	0
	PNR-BUS	750
	KNR-BUS	263
	PNR-BU/MR	280
	KNR-BU/MR	107
	PNR-MR	7,476
	KNR-MR	2,769

Nesting constants, 1 of 2

HBW - Top level equivalents of nest constants

	1 DC CORE / URBAN-DC CORE	2 DC CORE / URBAN-VA CORE	3 DC CORE / URBAN-URBAN	4 DC CORE / URBAN-OTHER	5 MD URBAN-DC CORE	6 MD URBAN-VA CORE	7 MD URBAN-URBAN	8 MD URBAN-OTHER	9 VA CORE / URBAN-DC CORE	10 VA CORE / URBAN-VA CORE	11 VA CORE / URBAN-URBAN	12 VA CORE / URBAN-OTHER	13 MD OTHER-DC CORE	14 MD OTHER-VA CORE	15 MD OTHER-URBAN	16 MD OTHER-OTHER	17 VA OTHER-DC CORE	18 VA OTHER-VA CORE	19 VA OTHER-URBAN	20 VA OTHER-OTHER
1 LOV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2 HOV2	-0.6899	-0.6785	-0.9054	-1.0628	-0.6845	-0.6843	-0.8558	-0.9245	-0.7319	-0.7299	-0.8566	-0.9010	-0.6852	-0.6756	-0.8261	-0.9402	-0.7747	-0.7113	-0.7939	-0.9021
3 HOV3+	-0.9251	-0.9094	-1.0781	-1.1820	-0.9079	-0.8784	-1.1285	-1.1067	-0.8847	-1.0084	-1.0834	-1.1176	-0.9225	-0.9151	-1.0936	-1.4238	-0.9326	-0.9888	-1.0539	-1.3002
4 WLK CR	3.1101	1.2776	3.1487	0.8990	5.9174	1.6689	0.1335	-0.4656	3.6747	0.7442	0.5154	-0.2531	1.4942	0.7116	-1.2180	-1.8422	0.5043	0.7488	-1.5950	-2.6648
5 WLK BUS	3.0859	0.9097	3.3346	1.1475	5.3129	1.3573	0.1233	0.8423	2.8369	0.6522	0.1946	-0.5336	1.2149	1.3359	0.3359	-0.1630	0.9515	1.2333	-0.1802	-1.1855
6 WLK BU/MR	2.9487	1.2158	2.5976	0.3356	4.7331	0.9418	-0.1674	0.1812	3.6170	0.7235	-0.3782	-0.9045	1.0695	0.6590	-0.3390	-0.7848	1.0535	0.9788	-0.5619	-1.5814
7 WLK METRO	3.2068	1.4011	2.9464	2.1109	6.7719	2.2960	0.4457	0.6572	7.7124	0.8103	0.7368	1.5200	2.3034	1.0466	0.4125	-0.2929	3.4269	1.9115	0.7200	0.8894
8 PNR CR	1.1904	-0.5206	-0.1687	-0.2813	3.7691	-1.0919	-1.4329	-0.6254	3.6282	-0.0966	-1.6797	3.9024	0.8692	-0.2186	-1.6771	-3.3243	0.1229	0.0466	-1.8710	-5.0802
9 KNR CR	-0.5152	-1.5460	-0.7185	-1.3771	2.5956	-1.1429	-2.4338	-1.4328	0.1975	-2.2087	-3.0361	-2.5919	-0.5950	-1.1357	-3.0098	-4.8359	-1.3926	-1.4875	-3.2317	-6.4412
10 PNR BUS	0.1290	-0.5206	-0.7537	0.5248	2.6058	-1.0919	-2.1093	-1.5941	1.6643	-0.0966	-1.6797	-1.9682	0.1998	0.0083	-1.5092	-3.0263	-0.2837	-0.4844	-1.0935	-4.6334
11 KNR BUS	-0.3024	-1.5460	0.0401	0.0097	2.5822	-1.1429	-2.5260	0.6256	0.1975	-2.2087	-3.0361	-2.6205	-1.1527	-1.5432	-1.8673	-3.1496	-1.5524	-1.9850	-2.0104	-4.3911
12 PNR BU/MR	0.6301	-0.8858	-0.6916	-0.8140	2.9696	-1.0919	-2.3188	-2.0160	1.2419	-1.6118	-3.1919	-3.1964	0.3288	-0.2990	-2.0138	-3.1693	-0.2160	-0.5063	-2.2171	-5.1978
13 KNR BU/MR	-0.6875	-1.3343	-0.7861	-1.6961	2.1477	-0.6181	-2.3914	-1.5744	0.1975	-2.6926	-3.4996	-3.5434	-0.7075	-1.3736	-2.1369	-3.1645	-1.2515	-1.7994	-2.5995	-5.4041
14 PNR METRO	1.4218	0.0578	0.1352	-0.7044	3.3205	-0.6241	-1.6477	-1.9626	2.0422	-1.1681	-1.6804	-1.8407	0.6449	0.0430	-1.3953	-2.5234	0.2321	-0.1759	-1.6292	-1.8158
15 KNR METRO	-0.5132	-1.5448	-1.1153	-1.4893	2.4005	-1.0708	-2.3423	-1.3926	0.4854	-2.9578	-2.9401	-2.1229	-0.1903	-0.6322	-1.8437	-2.5056	-0.2687	-0.9101	-1.6949	-1.7975

HBS - Top level equivalents of nest constants

	1 DC CORE / URBAN-DC CORE	2 DC CORE / URBAN-VA CORE	3 DC CORE / URBAN-URBAN	4 DC CORE / URBAN-OTHER	5 MD URBAN-DC CORE	6 MD URBAN-VA CORE	7 MD URBAN-URBAN	8 MD URBAN-OTHER	9 VA CORE / URBAN-DC CORE	10 VA CORE / URBAN-VA CORE	11 VA CORE / URBAN-URBAN	12 VA CORE / URBAN-OTHER	13 MD OTHER-DC CORE	14 MD OTHER-VA CORE	15 MD OTHER-URBAN	16 MD OTHER-OTHER	17 VA OTHER-DC CORE	18 VA OTHER-VA CORE	19 VA OTHER-URBAN	20 VA OTHER-OTHER
1 LOV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2 HOV2	-0.5719	-0.4508	-0.5412	-0.4356	-0.8274	-0.7941	-0.7455	-0.3256	-0.9511	-0.8070	-0.6650	-0.4010	-1.0757	-0.6565	-0.4834	-0.5444	-1.2964	-0.4895	-0.3710	-0.4969
3 HOV3+	-0.7020	-0.6236	-0.6863	-0.5493	-0.8975	-0.8387	-0.9133	-0.4718	-1.0570	-1.0242	-0.8497	-0.5520	-1.1823	-0.7873	-0.6397	-0.6892	-1.4333	-0.6514	-0.5230	-0.6419
4 WLK CR	-1.5542	-0.3137	-0.7856	-2.1488	-1.3560	0.9156	-2.0818	-1.6656	-1.5213	-1.4474	-2.4686	-2.6885	-2.7574	-0.2701	-1.5244	-2.7101	-4.3226	0.6156	-1.7139	-19.0447
5 WLK BUS	-1.6580	-0.0362	-0.5450	-2.2236	-3.3694	0.9156	-2.1227	-1.5517	-3.3457	-3.9915	-2.6399	-2.8308	-2.7894	-0.3834	-1.8332	-1.7089	-4.3226	-0.6604	-2.0373	-2.3903
6 WLK BU/MR	-1.2690	-0.3350	-1.2981	-2.2354	-2.0112	0.0450	-2.0212	-2.0259	-1.9472	-1.6394	-2.2241	-2.3606	-2.8529	-0.5907	-1.7298	-1.9940	-2.4028	-0.7605	-1.9401	-4.8823
7 WLK METRO	-1.4532	-0.3592	-1.2284	-1.8249	-0.8050	1.6784	-1.9664	-2.0094	-1.1986	-0.8920	-2.1074	-1.4992	-2.5163	0.3170	-1.7076	-2.5693	-1.6908	0.7335	-1.5185	-0.7203
8 PNR CR	-1.7640	-1.7597	-3.2750	-3.3130	-2.8305	-0.7988	-2.7524	-3.1862	-3.0002	-2.6448	-6.1108	-6.1894	-1.7197	-1.2757	-2.8798	-4.2127	-0.9679	-0.5941	-2.6849	-5.6913
9 KNR CR	-3.7549	-3.9597	-3.9630	-4.0948	-3.9755	-1.1773	-4.8568	-3.4417	-5.0482	-5.4475	-7.1978	-6.6314	-3.4840	-1.6683	-3.8912	-5.3087	-5.5875	-2.0700	-3.9911	-6.8554
10 PNR BUS	-2.9152	-1.7597	-3.2410	-2.5243	-2.8305	-0.7988	-4.5106	-4.7239	-3.0002	-2.5492	-6.1108	-6.1894	-1.3392	-1.2757	-2.3288	-4.7701	-2.9986	-2.4648	-5.5024	-7.6491
11 KNR BUS	-3.7549	-3.9597	-2.8537	-3.4229	-3.9755	-1.1773	-4.3165	-1.8666	-5.0482	-5.4475	-7.1978	-6.6314	-3.4840	-1.6683	-3.2956	-4.6716	-5.5875	-3.2267	-5.2068	-6.7583
12 PNR BU/MR	-2.9879	-1.7597	-3.4863	-4.1475	-2.8305	-0.7988	-4.1882	-4.9533	-3.0002	-2.6448	-5.3045	-6.1894	-3.3260	-1.1456	-3.7515	-5.3876	-4.9997	-2.4790	-4.5935	-8.3011
13 KNR BU/MR	-3.8686	-3.9597	-4.5563	-3.9164	-3.9755	-1.1773	-4.7848	-3.5795	-5.0482	-5.4475	-7.1978	-6.3377	-3.7591	-1.2060	-3.6429	-4.5330	-5.5875	-3.2267	-4.4766	-8.0325
14 PNR METRO	-1.6059	-1.1680	-3.2120	-3.9271	-2.4037	-0.4776	-4.1923	-5.0734	-1.9845	-3.1280	-5.1781	-3.3316	-2.2596	-1.0632	-3.4416	-5.0873	-2.6451	-1.9328	-3.4131	-5.3881
15 KNR METRO	-3.5876	-3.7927	-4.4024	-4.8238	-3.2512	-0.9737	-4.9403	-4.6288	-4.1389	-5.3012	-6.0385	-4.4912	-3.2962	-1.4771	-4.0732	-5.1152	-3.7307	-2.6279	-4.3308	-5.5657

Nesting constants, 2 of 2

HBO - Top level equivalents of nest constants

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		DC CORE / URBAN-DC CORE	DC CORE / URBAN-VA CORE	DC CORE / URBAN-URBAN	DC CORE / URBAN-OTHER	MD URBAN-DC CORE	MD URBAN-VA CORE	MD URBAN-URBAN	MD URBAN-OTHER	VA CORE / URBAN-DC CORE	VA CORE / URBAN-VA CORE	VA CORE / URBAN-URBAN	VA CORE / URBAN-OTHER	MD OTHER-DC CORE	MD OTHER-VA CORE	MD OTHER-URBAN	MD OTHER-OTHER	VA OTHER-DC CORE	VA OTHER-VA CORE	VA OTHER-URBAN	VA OTHER-OTHER
1	LOV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	HOV2	-0.1861	-0.1937	-0.2818	-0.2489	-0.1971	-0.3671	-0.3732	-0.1048	-0.1801	-0.4287	-0.4207	-0.1234	-0.2541	-0.3402	-0.1255	-0.4270	-0.3490	-0.1827	-0.1650	-0.3518
3	HOV3+	-0.2808	-0.2793	-0.3522	-0.3135	-0.2728	-0.4139	-0.4470	-0.1773	-0.2731	-0.5379	-0.5030	-0.2019	-0.3334	-0.4229	-0.2004	-0.4942	-0.4277	-0.2836	-0.2448	-0.4189
4	WLK CR	0.2778	0.7622	-0.5472	-1.2765	0.7632	3.9105	-1.7688	-0.8803	0.5211	-0.6943	-1.7731	-1.5671	1.8647	0.5914	-1.7537	-9.6957	1.3458	0.8142	-1.9285	-26.9673
5	WLK BUS	0.2937	0.9604	-0.4479	-1.4403	-0.8856	3.9105	-1.7180	-0.8418	-1.0554	-3.3766	-1.6922	-1.6226	-0.0494	0.6118	-0.8792	-1.2303	-0.7986	-0.7764	-1.5997	-8.5436
6	WLK BU/MR	0.2965	0.6711	-0.8148	-1.5076	-0.3168	2.5204	-2.0235	-1.1788	-0.7746	-0.7610	-2.1544	-1.6648	-0.4780	0.2563	-1.3445	-2.7540	-0.4653	-0.9050	-2.2068	-14.1603
7	WLK METRO	0.2473	0.7724	-0.7729	-0.4988	1.3355	5.4413	-1.7608	-0.7419	0.9594	-0.2322	-1.7685	-0.7981	-0.0099	1.1385	-1.2696	-1.9359	0.6196	0.5182	-1.6170	-2.7547
8	PNR CR	-0.9386	-1.2446	-3.1461	-2.7647	1.4254	1.8016	-2.2310	-2.2482	-0.5813	-1.8935	-5.3482	-5.1803	0.1884	-0.4764	-2.4930	-29.1201	0.8541	0.1284	-2.4706	-49.4692
9	KNR CR	-3.0119	-3.1029	-3.7107	-4.1022	0.2439	1.0377	-4.3202	-2.9812	-2.6902	-4.2781	-6.2972	-5.4955	-1.1863	-0.7078	-3.8374	-29.9786	-0.6217	-1.3283	-3.9111	-50.2395
10	PNR BUS	-2.2783	-1.2446	-3.2422	-2.0667	-1.3779	1.8016	-4.1655	-4.1252	-0.5813	-1.8792	-5.3482	-5.1803	0.4789	-0.4764	-1.8269	-8.2595	-0.1623	-1.7881	-5.2513	-42.6998
11	KNR BUS	-3.0119	-3.1029	-2.8484	-2.9355	-2.2993	1.0377	-4.0191	-1.3538	-2.6902	-4.2781	-6.2972	-5.4955	-0.9766	-0.7078	-2.7803	-7.5790	-1.9301	-2.5883	-6.0565	-33.4658
12	PNR BU/MR	-2.1001	-1.2446	-3.3191	-4.1786	-1.3740	0.7769	-3.8894	-4.7755	-1.6140	-1.8935	-4.8100	-5.1803	-0.8080	-0.4079	-3.3469	-29.9572	-0.5820	-1.6852	-4.9225	-42.4174
13	KNR BU/MR	-2.7865	-3.1029	-4.3647	-4.2344	-2.2993	1.0377	-4.4498	-3.5688	-2.4135	-4.2781	-6.2972	-5.4554	-1.2389	-0.3369	-2.8811	-17.6720	-1.2359	-2.5883	-4.7721	-35.1290
14	PNR METRO	-0.7810	-0.5093	-2.9944	-3.0614	-1.0426	1.9109	-3.7032	-4.2141	-0.9881	-2.4903	-4.5418	-2.5634	-0.6344	-0.4205	-2.8820	-10.8140	-0.4555	-1.4468	-3.3025	-26.7281
15	KNR METRO	-2.9119	-2.9182	-4.0765	-4.1642	-1.9690	1.3739	-4.3192	-3.8560	-2.8355	-4.1909	-5.1632	-3.7422	-1.4196	-0.6190	-3.1748	-6.2896	-1.2209	-2.1163	-4.1600	-23.1630

NHB - Top level equivalents of nest constants

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		DC CORE / URBAN-DC CORE	DC CORE / URBAN-VA CORE	DC CORE / URBAN-URBAN	DC CORE / URBAN-OTHER	MD URBAN-DC CORE	MD URBAN-VA CORE	MD URBAN-URBAN	MD URBAN-OTHER	VA CORE / URBAN-DC CORE	VA CORE / URBAN-VA CORE	VA CORE / URBAN-URBAN	VA CORE / URBAN-OTHER	MD OTHER-DC CORE	MD OTHER-VA CORE	MD OTHER-URBAN	MD OTHER-OTHER	VA OTHER-DC CORE	VA OTHER-VA CORE	VA OTHER-URBAN	VA OTHER-OTHER
1	LOV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	HOV2	-1.3760	-0.7130	-0.6163	-1.2053	-1.2244	-1.1264	-0.7046	-0.8586	-1.3952	-0.9240	-0.6645	-0.9087	-2.1214	-1.6902	-1.0425	-0.8596	-2.1830	-1.1546	-0.9734	-0.7934
3	HOV3+	-2.0483	-1.0638	-0.8012	-1.5856	-1.8046	-1.5344	-0.9019	-1.2339	-2.1049	-1.3500	-0.9018	-1.2983	-3.0032	-2.3377	-1.4265	-1.2248	-3.0912	-1.7376	-1.3762	-1.1239
4	WLK CR	-1.2475	-0.5241	-1.7805	-2.3760	1.1460	1.2487	-1.9957	-1.6709	-2.3334	-0.7410	-3.2014	-2.9042	-0.8060	0.1672	-1.8938	-6.7969	-1.5401	-0.0364	-1.9722	-16.7091
5	WLK BUS	-1.7312	-0.8122	-1.3787	-1.8974	1.1633	1.2487	-1.8621	-1.3737	-2.6673	-1.9188	-2.8676	-3.0616	-1.6224	-0.2719	-0.8662	-1.0313	-2.5685	-1.7529	-2.0028	-3.9918
6	WLK BU/MR	-0.8812	-0.4364	-2.2340	-2.8109	0.5627	1.4578	-1.8143	-2.0024	-2.3670	-0.4093	-3.1759	-3.7309	-1.7050	-0.4755	-1.5996	-2.6817	-3.0485	-1.3706	-2.3740	-8.7111
7	WLK METRO	-1.0593	-0.5257	-2.8131	-2.7961	1.2982	1.3773	-2.2180	-2.3176	-2.3163	-0.6229	-3.4640	-2.1008	1.4746	0.6839	-2.3276	-2.5391	2.5207	2.4206	-2.6821	-3.1673
8	PNR CR	-2.2478	-1.3474	-4.0588	-2.4327	-0.6537	-1.1306	-1.5250	-2.3608	-2.7519	-1.6615	-4.4514	-4.3133	-1.6074	-2.0902	-2.2347	-10.0801	-1.9321	-0.6415	-2.2763	-21.0245
9	KNR CR	-3.1294	-1.9243	-3.9498	-2.3963	-1.6057	-1.9661	-3.9020	-4.6718	-4.3448	-3.8629	-6.0562	-6.1598	-3.1561	-2.7375	-3.7516	-11.6061	-3.3108	-1.9846	-3.7914	-21.7363
10	PNR BUS	-2.6233	-1.3474	-4.0588	-1.6114	-0.6537	-1.1306	-2.4209	-1.6152	-2.7519	-1.6615	-3.4762	-3.8181	-0.5906	0.6992	-2.3822	-2.6900	-2.7283	-1.7548	-4.6124	-6.5230
11	KNR BUS	-1.9779	-1.9243	-3.0493	-0.9185	-1.1536	-1.9661	-2.4289	-1.6477	-4.3448	-3.8629	-6.0562	-6.1598	-2.8158	-2.7375	-2.6818	-2.8756	-3.7124	-3.5252	-5.3866	-4.9613
12	PNR BU/MR	-2.3819	-1.1589	-3.2833	-3.2683	-1.0932	-0.4741	-4.3584	-4.2633	-2.7519	-1.5748	-4.4514	-4.3133	-2.5712	-2.0902	-3.1996	-14.3200	-3.3365	-2.3789	-4.4474	-18.2711
13	KNR BU/MR	-3.0792	-1.9243	-3.7077	-2.4082	-1.5470	-1.9661	-4.4689	-4.6718	-4.6994	-3.8629	-5.8259	-6.1598	-2.7303	-2.0907	-3.0471	-9.3385	-3.4209	-2.3038	-5.0988	-16.6252
14	PNR METRO	-2.2050	-1.3222	-3.4791	-2.5693	-1.0245	-1.1989	-4.4037	-4.1772	-2.7161	-1.5164	-5.2797	-3.7824	-3.1646	-2.3314	-3.5347	-5.4684	-4.0273	-2.8036	-4.2809	-9.2302
15	KNR METRO	-3.5045	-2.3806	-4.2856	-3.5744	-1.7132	-1.8892	-5.3474	-4.5616	-4.3627	-3.8089	-6.0707	-4.4635	-3.9652	-2.6850	-3.8684	-5.3687	-4.7573	-3.4775	-5.0748	-8.3844

Region-level model results

2002 and 2005

Modeling assumptions

- ## Network coding

  - The 2002 network has enhanced network coding, added by AECOM for NL MC model

  - Due to resource limitations, the 2005 network has only a subset of the enhanced network coding for the NL MC model (see next slide)

Network enhancements:
Optimal vs. necessary - Manual vs. automatic

Network enhancement for using with NL MC model	Manual or automatic	Optimal or necessary	Used in "shortcut coding"
Revisions to the highway and transit networks			
1. Detailed coding around Metrorail stations that have park-and-ride lots (37 stations in 2002)	Manual	Optimal	No
2. Re-routing of transit routes around these Metrorail stations to take advantage of the detailed coding	Manual	Optimal	No
3. Highway network clean-ups	Manual	Optimal	No
4. Application of board-only, alight-only stops for express bus service in CBD	Manual	Optimal	No
Transit access coding			
5. Enhancements to the consolidated station database	Manual	Necessary	Yes
6. New method for coding auto-access links	Automatic	Necessary	Yes
7. Station transfer links	Automatic	Necessary	Yes
8. Sidewalk links and zonal walk links	Automatic	Necessary	Yes

Due to time constraints, the 2005 network made use of only the "necessary" network enhancements (#'s 5-8). The 2002 network had all eight enhancements.

2002 results

Calibration year, Transit validation

2002 mode choice output vs. targets: Trips by purpose and mode

Seg	Mode	HBW Target	HBW Model	HBS Target	HBS Model	HBO Target	HBO Model	NHB Target	NHB Model	ALL Target	ALL Model
All 20 Segments	DR ALONE	2,472,132	2,478,881	2,084,762	2,085,746	5,562,444	5,563,075	3,319,069	3,322,505	13,438,407	13,450,207
	SR2	418,866	419,746	611,033	611,275	2,098,121	2,099,097	1,089,374	1,090,551	4,217,394	4,220,670
	SR3+	145,598	145,497	358,317	358,341	1,658,327	1,659,230	772,070	772,089	2,934,312	2,935,157
	WK-CR	1,685	1,771	8	52	178	264	84	199	1,955	2,286
	WK-BUS	229,215	230,538	23,216	23,075	89,160	87,250	49,100	48,237	390,691	389,101
	WK-BU/MR	102,250	106,153	3,674	3,755	20,635	20,886	15,880	16,291	142,439	147,085
	WK-MR	127,994	115,908	5,011	5,036	36,305	36,138	75,458	72,398	244,768	229,480
	PNR-CR	20,901	19,503	91	85	1,628	2,483	1,725	1,846	24,345	23,916
	KNR-CR	1,492	1,459	7	9	117	379	121	176	1,737	2,023
	PNR-BUS	17,176	18,365	274	288	1,246	1,095	3,727	3,757	22,423	23,505
	KNR-BUS	5,393	5,518	419	430	1,114	1,112	2,456	2,301	9,382	9,361
	PNR-BU/MR	9,765	10,141	122	131	1,045	1,534	603	797	11,535	12,603
	KNR-BU/MR	5,012	5,399	257	260	1,383	1,926	1,465	1,675	8,117	9,259
	PNR-MR	141,501	143,226	1,088	1,086	17,294	17,235	9,134	9,299	169,017	170,846
	KNR-MR	39,193	39,904	551	539	5,624	5,463	4,955	5,036	50,323	50,940
	Total Person	3,738,173	3,742,008	3,088,830	3,090,108	9,494,621	9,497,168	5,345,221	5,347,156	21,666,845	21,676,440
	Total Transit	701,577	697,884	34,718	34,746	175,729	175,766	164,708	162,012	1,076,732	1,070,407
	Transit Pct	18.8%	18.6%	1.1%	1.1%	1.9%	1.9%	3.1%	3.0%	5.0%	4.9%

Sources of data for target trips:

1)   Transit: 2002 WMATA rail survey; 2000 bus survey, adjusted; boarding counts for express bus & commuter rail.

2)   Auto: Most recent run of the NL MC model within the speed feedback loop of the Vers. 2.2 travel model

2002 mode choice output vs. targets: Trips by purpose and market segment

Market Seg.			HBW		HBS		HBO		NHB		ALL	
			Target	Model	Target	Model	Target	Model	Target	Model	Target	Model
1	DC	DC core	152,906	152,383	17,595	17,475	142,688	140,898	131,188	129,215	444,377	439,971
2	DC	VA core	15,388	15,403	9,311	9,426	9,467	9,775	14,872	15,075	49,038	49,679
3	DC	Urban DC, MD, VA	97,018	97,332	138,146	138,311	478,481	478,063	222,864	222,578	936,509	936,283
4	DC	Suburban MD, VA	50,233	51,249	48,062	48,341	130,083	132,808	174,713	177,270	403,091	409,669
5	MD urban	DC core	29,660	29,537	773	798	12,682	12,597	11,152	11,114	54,267	54,045
6	MD urban	VA core	3,008	2,967	276	287	868	891	1,185	1,204	5,337	5,349
7	MD urban	Urban DC, MD, VA	37,279	37,282	57,639	57,403	158,350	157,423	77,048	76,562	330,316	328,670
8	MD urban	Suburban MD, VA	25,557	25,852	41,525	41,669	68,537	69,384	80,102	80,704	215,721	217,608
9	VA core/urban	DC core	49,745	49,830	404	486	28,724	29,672	33,410	34,252	112,283	114,240
10	VA core/urban	VA core	21,292	21,408	13,159	13,104	27,706	27,289	23,103	22,773	85,260	84,573
11	VA core/urban	Urban DC, MD, VA	45,858	45,970	93,067	92,912	226,591	226,218	129,300	129,031	494,816	494,130
12	VA core/urban	Suburban MD, VA	45,365	45,293	22,447	22,696	117,508	117,763	128,731	128,606	314,051	314,358
13	MD suburban	DC core	228,606	227,430	1,553	1,615	61,784	61,624	41,113	41,360	333,056	332,028
14	MD suburban	VA core	29,463	29,066	1,700	1,775	6,266	6,551	5,417	5,622	42,846	43,015
15	MD suburban	Urban DC, MD, VA	253,342	253,764	43,932	44,689	309,346	311,437	176,889	177,934	783,509	787,825
16	MD suburban	Suburban MD, VA	1,308,097	1,310,833	1,430,028	1,429,663	4,381,986	4,380,673	2,300,855	2,300,147	9,420,966	9,421,317
17	VA suburban	DC core	135,621	137,319	375	434	32,558	33,945	28,303	29,480	196,857	201,177
18	VA suburban	VA core	48,922	49,210	6,715	6,653	18,224	18,102	15,776	15,716	89,637	89,681
19	VA suburban	Urban DC, MD, VA	122,864	123,173	66,354	66,394	160,591	161,973	120,736	121,370	470,545	472,910
20	VA suburban	Suburban MD, VA	1,037,949	1,036,707	1,095,769	1,095,978	3,122,181	3,120,082	1,628,464	1,627,145	6,884,363	6,879,912
			3,738,173	3,742,008	3,088,830	3,090,108	9,494,621	9,497,168	5,345,221	5,347,156	21,666,845	21,676,440
			701,577	697,884	34,718	34,746	175,729	175,766	164,708	162,012	1,076,732	1,070,407
			18.8%	18.6%	1.1%	1.1%	1.9%	1.9%	3.1%	3.0%	5.0%	4.9%

Sources of data for target trips:

1)   Transit: 2002 WMATA rail survey; 2000 bus survey, adjusted; boarding counts for express bus & commuter rail.

2)   Auto: Most recent run of the NL MC model within the speed feedback loop of the Vers. 2.2 travel model

Calibration results: Transit assignment: 2002 HBW Metrorail

Metrorail Segment	Observed 2002 Prods	Observed 2002 Attrs	Estimated 2002 Prods	Estimated 2002 Attrs
1 Red Line - "A" route MD outside Beltway	37,926	7,377	26,914	7,272
2 Red Line - "A" route MD inside Beltway	14,627	13,768	17,578	14,111
3 Red Line - "A" route DC non-core	18,047	7,429	23,610	5,058
4 Red Line - DC core	31,486	142,468	18,080	115,879
5 Red Line - "B" route DC non-core	22,810	6,003	26,360	3,776
6 Red Line - "B" route MD	30,632	6,134	41,550	6,055
7 Green Line - "E" route MD	21,582	3,646	13,902	2,725
8 Green Line - "E" route DC non-core	9,084	3,797	10,542	4,293
9 Green Line - DC core	7,632	41,771	8,042	43,313
10 Green Line - "F" route DC non-core	11,496	7,101	9,649	6,621
11 Green Line - "F" route MD	29,659	2,084	30,139	755
12 Blue/Yellow Line - VA Fairfax	28,329	1,826	35,938	1,507
13 Blue/Yellow Line - VA Alexandria	9,705	4,671	9,615	6,177
14 Blue/Yellow Line - VA Core	27,384	26,950	27,477	27,633
15 Orange Line - VA Fairfax	35,669	4,339	29,100	5,364
16 Orange Line - VA Arlington non-core	31,004	12,062	35,725	15,334
17 Orange/Blue Line - VA/DC core	15,018	133,239	13,352	165,238
18 Orange/Blue Line - DC non-core	10,381	2,747	10,081	2,570
19 Orange Line - DC/MD	24,183	2,410	26,763	1,883
20 Blue Line - DC/MD	14,164	993	21,382	334
Total	430,817	430,817	435,799	435,898
DC/VA Core Total	81,520	344,428	66,951	352,063
Percent RMSE			64.7%	274.6%

Equivalency table for Metrorail segments (i.e., station groups)

Sta. No.	Station Name	Seg. No.	Segment Name
7301	Shady Grove	1	Red Line - "A" route MD outside Beltway
7302	Rockville	1	Red Line - "A" route MD outside Beltway
7303	Twinbrook	1	Red Line - "A" route MD outside Beltway
7304	White Flint	1	Red Line - "A" route MD outside Beltway
7305	Grosvenor	1	Red Line - "A" route MD outside Beltway
7306	Medical Center	2	Red Line - "A" route MD inside Beltway
7307	Bethesda	2	Red Line - "A" route MD inside Beltway
7308	Friendship Heights	2	Red Line - "A" route MD inside Beltway
7309	Tenleytown	3	Red Line - "A" route DC non-core
7310	Van Ness-UDC	3	Red Line - "A" route DC non-core
7311	Cleveland Park	3	Red Line - "A" route DC non-core
7312	Woodley Park-Zoo	3	Red Line - "A" route DC non-core
7313	Dupont Circle	4	Red Line - DC core
7314	Farragut North	4	Red Line - DC core
7315	Metro Center	4	Red Line - DC core
7316	Gallery Place	4	Red Line - DC core
7317	Judiciary Square	4	Red Line - DC core
7318	Union Station	4	Red Line - DC core
7319	Rhode Island Ave	5	Red Line - "B" route DC non-core
7320	Brookland-CUA	5	Red Line - "B" route DC non-core
7321	Fort Totten	5	Red Line - "B" route DC non-core
7322	Takoma	5	Red Line - "B" route DC non-core
7323	Silver Spring	6	Red Line - "B" route MD
7324	Forest Glen	6	Red Line - "B" route MD
7325	Wheaton	6	Red Line - "B" route MD
7326	Glenmont	6	Red Line - "B" route MD
7327	Greenbelt	7	Green Line - "E" route MD
7328	College Park	7	Green Line - "E" route MD
7329	PG Plaza	7	Green Line - "E" route MD
7330	West Hyattsville	7	Green Line - "E" route MD
7331	Georgia Ave	8	Green Line - "E" route DC non-core
7332	Columbia Heights	8	Green Line - "E" route DC non-core
7333	U-Street-Cardozo	8	Green Line - "E" route DC non-core
7334	Shaw-Howard Univ	9	Green Line - DC core
7335	Mt Vernon Square	9	Green Line - DC core
7336	Archives	9	Green Line - DC core
7337	L'Enfant Plaza	9	Green Line - DC core
7338	Waterfront	10	Green Line - "F" route DC non-core
7339	Navy Yard	10	Green Line - "F" route DC non-core
7340	Anacostia	10	Green Line - "F" route DC non-core
7341	Congress Heights	10	Green Line - "F" route DC non-core
7342	Southern Avenue	11	Green Line - "F" route MD
7343	Naylor Road	11	Green Line - "F" route MD
7344	Suitland	11	Green Line - "F" route MD
7345	Branch Avenue	11	Green Line - "F" route MD
7346	Van Dorn Street	12	Blue/Yellow Line - VA Fairfax
7347	Franconia-Springfield	12	Blue/Yellow Line - VA Fairfax
7348	Huntington	12	Blue/Yellow Line - VA Fairfax
7349	Eisenhower Avenue	13	Blue/Yellow Line - VA Alexandria
7350	King Street	13	Blue/Yellow Line - VA Alexandria
7351	Braddock Road	13	Blue/Yellow Line - VA Alexandria
7352	National Airport	14	Blue/Yellow Line - VA Core
7353	Crystal City	14	Blue/Yellow Line - VA Core
7354	Pentagon City	14	Blue/Yellow Line - VA Core
7355	Pentagon	14	Blue/Yellow Line - VA Core
7356	Arlington Cemetery	14	Blue/Yellow Line - VA Core
7357	Vienna	15	Orange Line - VA Fairfax
7358	Dunn Loring	15	Orange Line - VA Fairfax
7359	West Falls Church	15	Orange Line - VA Fairfax
7360	East Falls Church	16	Orange Line - VA Arlington non-core
7361	Ballston	16	Orange Line - VA Arlington non-core
7362	Virginia Square	16	Orange Line - VA Arlington non-core
7363	Clarendon	16	Orange Line - VA Arlington non-core
7364	Court House	16	Orange Line - VA Arlington non-core
7365	Rosslyn	17	Orange/Blue Line - VA/DC core
7366	Foggy Bottom-GWU	17	Orange/Blue Line - VA/DC core
7367	Farragut West	17	Orange/Blue Line - VA/DC core
7368	McPherson Square	17	Orange/Blue Line - VA/DC core
7369	Federal Triangle	17	Orange/Blue Line - VA/DC core
7370	Smithsonian	17	Orange/Blue Line - VA/DC core
7371	Federal Center SW	17	Orange/Blue Line - VA/DC core
7372	Capitol South	17	Orange/Blue Line - VA/DC core
7373	Eastern Market	18	Orange/Blue Line - DC non-core
7374	Potomac Avenue	18	Orange/Blue Line - DC non-core
7375	Stadium Armory	18	Orange/Blue Line - DC non-core
7376	Minnesota Avenue	19	Orange Line - DC/MD
7377	Deanwood	19	Orange Line - DC/MD
7378	Cheverly	19	Orange Line - DC/MD
7379	Landover	19	Orange Line - DC/MD
7380	New Carrollton	19	Orange Line - DC/MD
7381	Benning Road	20	Blue Line - DC/MD
7382	Capitol Heights	20	Blue Line - DC/MD
7383	Addison Road	20	Blue Line - DC/MD

37

Calibration results: Transit assignment: 2002 Total Metrorail

Metrorail Segment	Observed 2002 Prods	Observed 2002 Attrs	Estimated 2002 Prods	Estimated 2002 Attrs
1 Red Line - "A" route MD outside Beltway	47,317	13,546	34,184	9,979
2 Red Line - "A" route MD inside Beltway	24,066	22,227	28,647	20,818
3 Red Line - "A" route DC non-core	28,912	18,748	34,964	8,990
4 Red Line - DC core	69,137	200,671	35,751	165,373
5 Red Line - "B" route DC non-core	32,637	12,768	39,254	6,239
6 Red Line - "B" route MD	39,335	11,116	49,594	8,605
7 Green Line - "E" route MD	27,853	8,419	19,118	4,273
8 Green Line - "E" route DC non-core	15,124	7,588	16,197	7,358
9 Green Line - DC core	17,580	53,480	17,374	64,008
10 Green Line - "F" route DC non-core	18,895	10,702	20,160	8,444
11 Green Line - "F" route MD	34,470	5,682	36,723	1,395
12 Blue/Yellow Line - VA Fairfax	34,832	4,944	42,807	1,901
13 Blue/Yellow Line - VA Alexandria	13,984	8,024	15,782	7,856
14 Blue/Yellow Line - VA Core	45,940	44,890	37,503	46,251
15 Orange Line - VA Fairfax	42,405	8,622	34,935	11,050
16 Orange Line - VA Arlington non-core	41,379	19,686	54,773	24,105
17 Orange/Blue Line - VA/DC core	49,483	181,024	40,071	232,500
18 Orange/Blue Line - DC non-core	16,142	5,927	18,522	3,746
19 Orange Line - DC/MD	29,547	6,059	33,107	3,293
20 Blue Line - DC/MD	18,395	3,308	27,427	959
Total	647,431	647,431	636,893	637,143
DC/VA Core Total	182,139	480,065	130,699	508,132
Percent RMSE			56.2%	253.7%

2005 results

Highway validation

2005 VMT and Vehicle Trips

Total VMT, Ver. 2.2 vs. Ver. 2.3, 2005

153,084,810   159,124,106

- Ver. 2.2 2005
- Ver. 2.3 2005

Total VMT

Total Vehicle Trips, Ver. 2.2 vs. Ver. 2.3, 2005

20,756,928   21,048,715

- Ver. 2.2 2005
- Ver. 2.3 2005

Total VMT
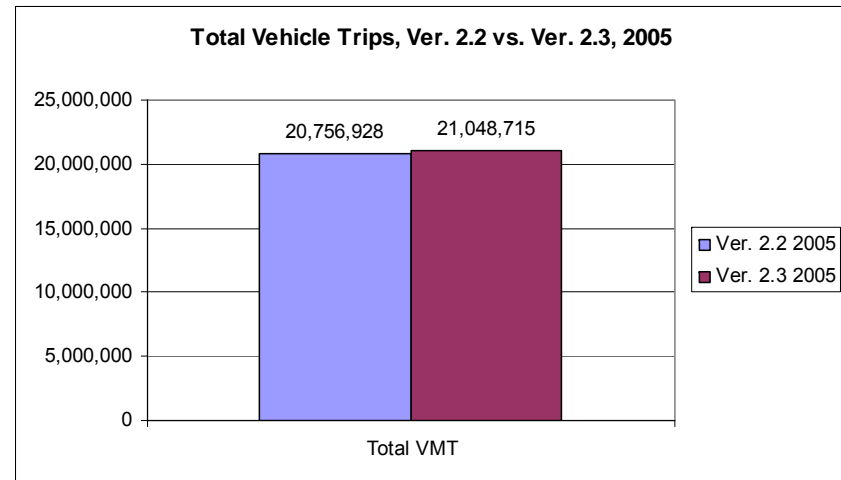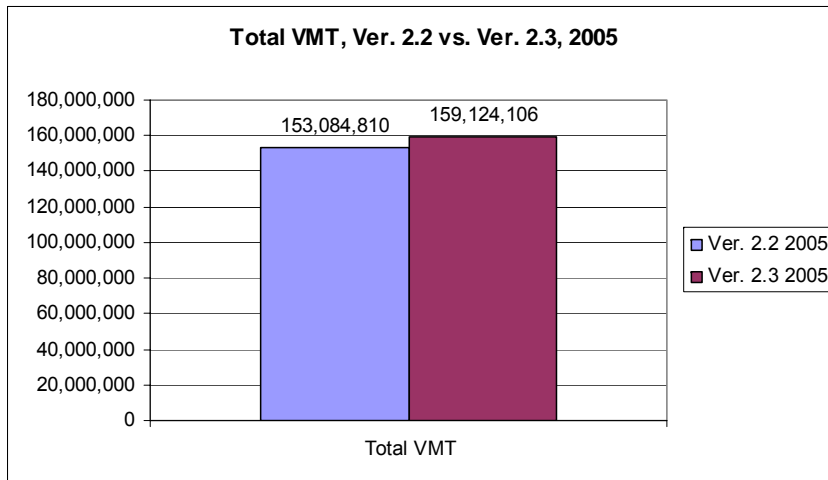
Comparison with HPMS data: Ver. 2.2 w/ MNL MC vs. Ver. 2.3 w/ NL MC

Estimated and Obseved VMT by state (HPMS), 2005
Ver. 2.2 travel model with 5-mode MNL MC model

MSA	Est(000s)	Obs(000s)	E-O Ratio
DC	8,999	8,619	1.04
MD	56,002	56,806	0.99
VA	51,031	50,733	1.01
MSA Total	116,032	116,158	1.00
Modeled area Tot	153,085	N/A	N/A

Estimated and Obseved VMT by state (HPMS), 2005
Ver. 2.3 travel model with 15-mode NL MC model

MSA	Est(000s)	Obs(000s)	E-O Ratio
DC	8,875	8,619	1.03
MD	57,814	56,806	1.02
VA	53,064	50,733	1.05
MSA Total	119,753	116,158	1.03
Modeled area Tot	159,124	N/A	N/A

Regional traffic assignment: %RMSE by facility type, 2005

Facility Type	Ver. 2.2 MNL MC		Ver. 2.3 NL MC	
	Percent RMSE	Link Count	Percent RMSE	Link Count
Freeway	21.05	539	20.84	539
Major Arterial	42.21	2,376	42.71	2,376
Minor Arterial	60.56	1,338	61.85	1,338
Collector	77.56	973	76.54	971
Expressway	34.48	136	34.20	136
Total	41.12	5,362	41.20	5,360

Conclusions

- Development on Version 2.3 is underway
- Version 2.3 vehicle trips in 2005 is higher than that of V2.2 by 292,000 (1.5%)
  - External Auto/Truck volumes have been refreshed with observed 2005 data
  - NL model calibration produced more auto driver trips
  - Truck model produces more truck trips
- 2005 VMT is higher by 6 million (3.9%)
- More detailed analysis is needed

Next Steps and Beyond

- Version 2.3 will be refined as necessary
- The draft Version 2.3 model will be rolled out in July, with documentation
- Sensitivity testing will follow through the fall; TFS will be regularly apprised of results
- It is expected that V2.3 will be used in application in 2009, pending reasonable performance
- New data and new zone system will be considered after January 2009
  - Used to re-calibrate trip-based model
  - May be used to inform a more advanced model set