

# **Release of the Version 2.3 travel model on the 3,722-TAZ area system**

Special meeting of the  
Travel Forecasting Subcommittee

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National Capital Region Transportation Planning Board (TPB)

# Today's agenda

- Review of Version 2.3 history
- Overview of Version 2.3 documentation
- Travel modeling process details
- Application of the Version 2.3 model
- Performance of Version 2.3
- Comparison of Version 2.2 and Version 2.3 models
- Next steps

# Up-front disclosure

- What will not be presented today:
  - Transit assignment
  - 2040 execution
- Results and evaluation of these items are anticipated by the March TFS

# Version 2.3 History

- Version 2.3 was released in draft over two years ago (June 2008) developed with:
  - the existing 2,191-TAZ system
  - 1994 Household Travel Survey/2000 CTPP data
  - NL mode choice model, new truck models
- Version 2.3 release was subsequently deferred to incorporate:
  - New data: 2007/2008 Household Travel Survey
  - New, more detailed 3,722-TAZ system

# Since June 2008...

- ✓ 3,722 TAZ system reviewed, finalized
- ✓ 2007 land activity on 3,722 TAZ system developed
- ✓ Highway and transit networks completed & conflated to NAVTEQ base map
- ✓ 2007/08 HTS geocoded, cleaned, checked
- ✓ Substantial demographic and travel-related data compiled (traffic counts, VMT, transit on-board surveys, ACS, INRIX, etc.)
- ✓ Model calibration work undertaken during past 6 months (July 2010 to January 2011)

# Version 2.3 “add-on” features

- NHB divided by NHW and NHO markets
- Non-work, non-motorized travel developed
- Time periods modeled are increased from 3 to 4:
  - Off-peak period divided among midday and nighttime/early morning periods
- Traffic assignment user classes increased from 5 to 6 (commercial vehicles now a separate market)
- Traffic assignment convergence criteria is more stringent than before

# Version 2.3 Documentation

- Draft documentation released today includes:

## Calibration report:

- Calibration data (land use, survey, etc.)
- Demographic models
- Trip generation
- Trip distribution
- Mode choice
- Time-of-day model
- Traffic assignment/feedback
- Validation

## User's Guide:

- Description of application process
- Flowcharts and descriptions of model steps (incomplete)
- Scripts, control files, and batch listings

# Modeling Process

- Trip Generation
  - Trip production using cross-classification
  - Trip attraction using linear regression equations
  - Non-motorized travel developed for all purposes
- Trip Distribution
  - Gravity model, 30 markets modeled
- Mode Choice
  - Nested Logit model with 15 modes
- Traffic assignment
  - Conical Volume Delay Function with no Queuing Delay
  - Bi-conjugate Frank-Wolfe user equilibrium assignment until a relative gap of  $10^{-3}$  is achieved or max of 200 iterations is reached
- Speed Feedback
  - Four speed feedback loops (instead of 6 used in Version 2.2)

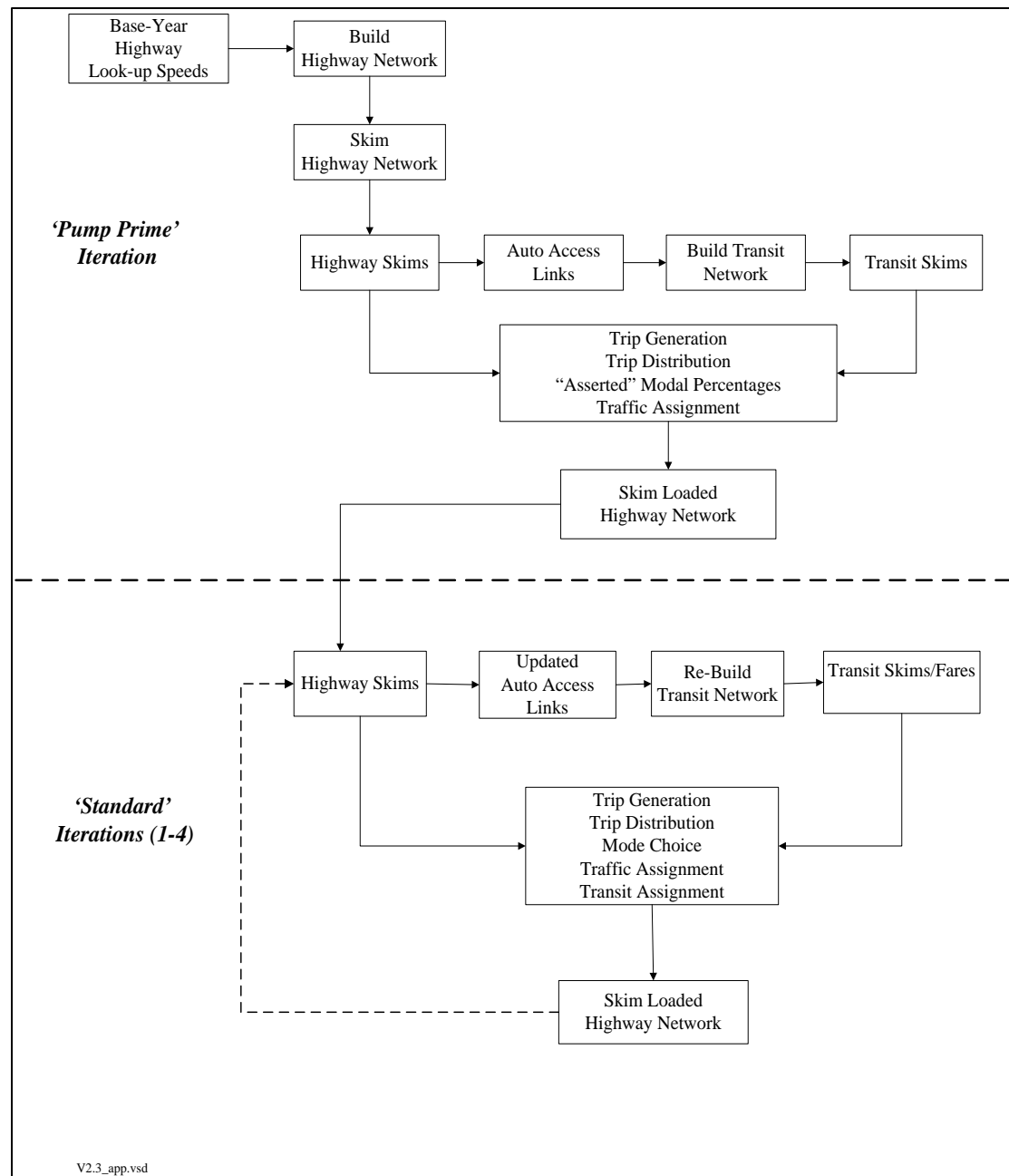


# Application Notes

- Very similar to Version 2.2 application
- Cube Voyager Version 5.1.2 required
- Batch file driven
- Structured subdirectory system used
- Model running time: 52 hours
  - 18 hours required for Version 2.2
  - Reasons for long running time:
    - Larger matrix size
    - Traffic assignment refinements (more user classes, higher convergence threshold)
    - Additional time period modeled

# Version 2.3 Model Application Overview

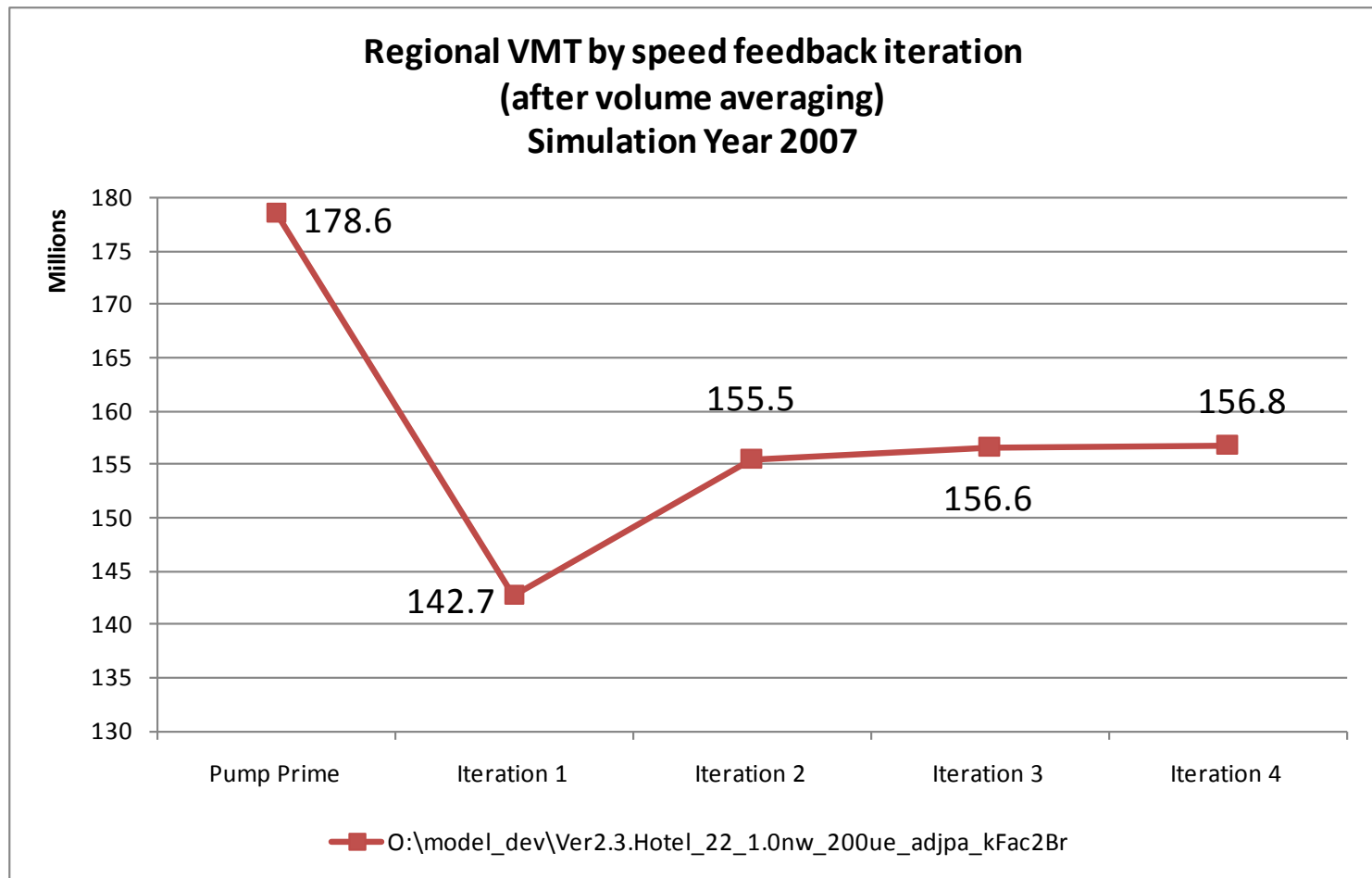
From page 4 of User's  
Guide



# Notes on model application

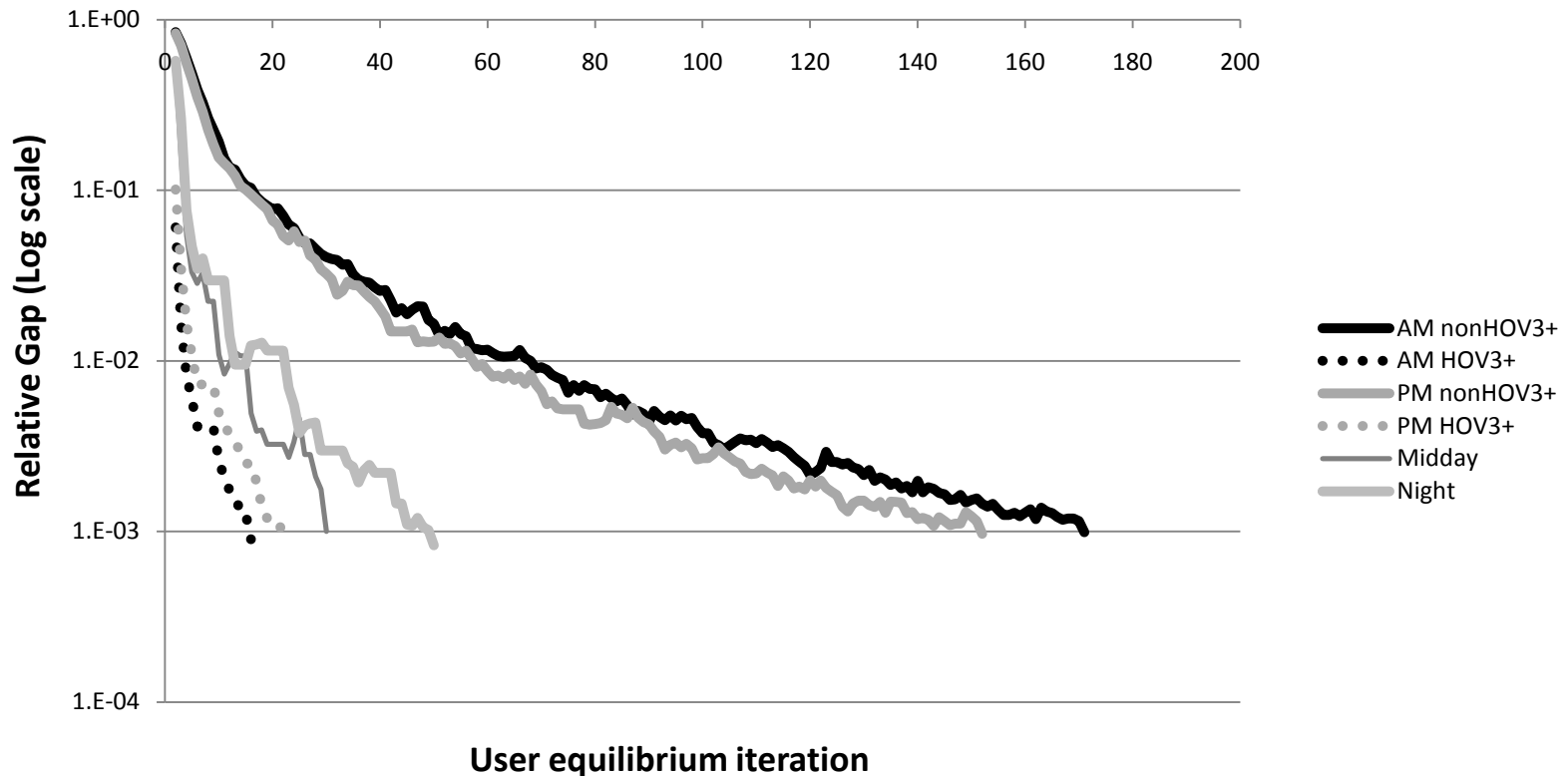
- Calibrated models have been put into application scripts
- 2007 “Pseudo Round 8.0” land use inputs used
- Added adjustments used in validation, to better match the HTS (see Appendix A in Calibration Report):
  - Jurisdictional “P-mods”/”A-mods” used
  - K-factors used in distribution:
    - To address Potomac River as a perceived barrier
    - Most HBW K-factors used in Ver.2.2 were also needed in Version 2.3
    - Intra-jurisdiction K-factors also needed to keep non-work trips within production jurisdictions
- Model adjustments may still be revisited, removed

# VMT by Speed Feedback Iteration



# Traffic Assignment Convergence

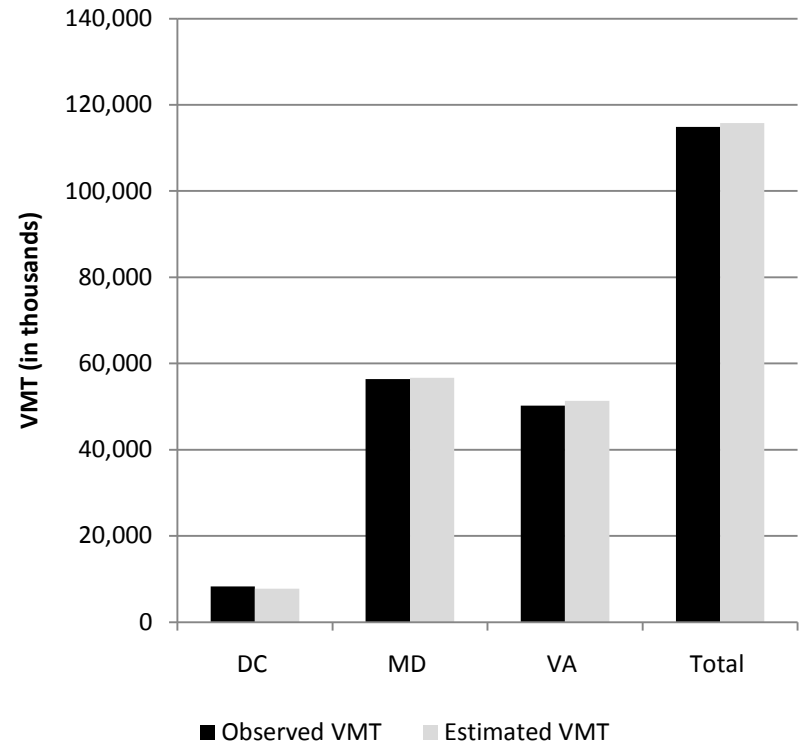
**Relative Gap: Traffic assignment in the Ver. 2.3 travel model  
Modeled year: 2007, speed feedback iteration 4**



# 2007 VMT by State for MSA

VMT in thousands

State	Observed VMT	Estimated VMT	Difference	Pct. Difference
DC	8,272	7,739	-533	0.94
MD	56,366	56,677	310	1.01
VA	50,238	51,331	1,093	1.02
Total	114,876	115,746	870	1.02



From page 116 in calibration report

# 2007 VMT (in 000s) by Jurisdiction

Jurisdiction	Observed VMT	Estimated VMT	Difference (E-O)	Ratio (E/O)
District of Columbia	8,272	7,739	-533	0.94
Montgomery County	19,890	20,307	418	1.02
Prince George's County	23,316	22,335	-981	0.96
Arlington County	4,392	4,215	-176	0.96
City of Alexandria	1,958	1,980	23	1.01
Fairfax County	26,799	25,888	-911	0.97
Loudoun County	5,260	6,407	1,147	1.22
Prince William County	8,000	8,769	769	1.10
Frederick County	7,842	9,172	1,330	1.17
Howard County	10,094	10,600	506	1.05
Anne Arundel County	15,330	15,369	39	1.00
Charles County	3,348	3,038	-311	0.91
Carroll County	3,395	4,397	1,002	1.30
Calvert County	1,971	1,824	-146	0.93
St. Mary's County	2,195	2,129	-66	0.97
King George County	789	711	-78	0.90
City of Fredericksburg	948	822	-126	0.87
Stafford County	3,829	4,071	242	1.06
Spotsylvania County	3,300	2,122	-1,177	0.64
Fauquier County	3,149	3,137	-12	1.00
Clarke County	770	1,009	240	1.31
Jefferson County	1,082	1,445	363	1.34
<b>Total</b>	<b>155,927</b>	<b>157,488</b>	<b>1,561</b>	<b>1.01</b>

From page 116 in calibration report

# *Selected* Screenline Crossings

Screenline	Estimated	Observed	Est./Obs.	Screenline links	Screenline links with counts	Pct. links with counts
1	185,470	250,195	0.74	61	20	32.8%
2	283,722	308,354	0.92	80	19	23.8%
5	477,239	482,452	0.99	117	23	19.7%
6	565,309	651,694	0.87	189	34	18.0%
20	690,529	627,424	1.10	17	10	58.8%
<b>All Screenlines</b>	<b>9,470,586</b>	<b>9,783,655</b>	<b>0.97</b>	<b>2,199</b>	<b>509</b>	<b>23.1%</b>

From page 121 in calibration report



# RMSE Analysis

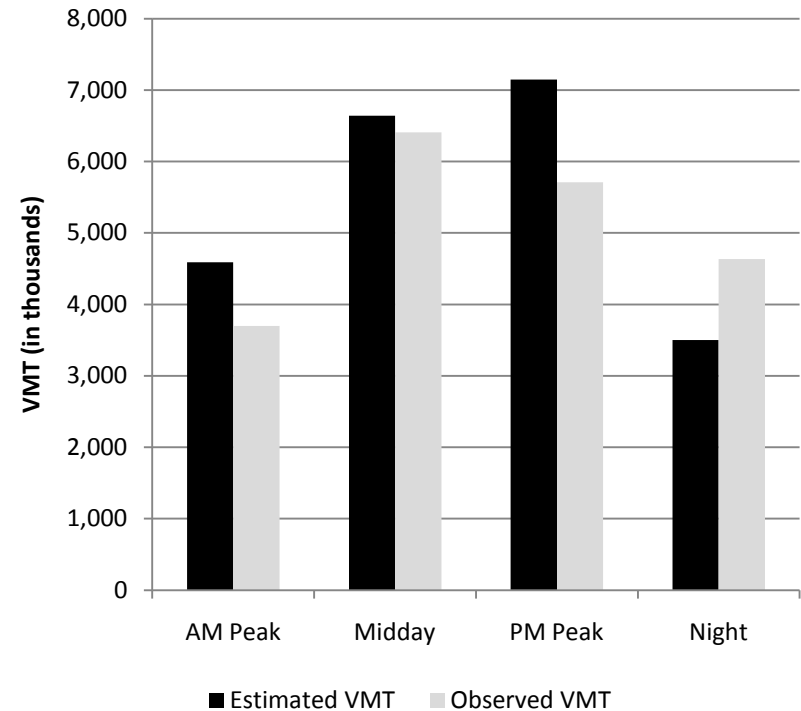
Daily link volume pct. RMSE by  
Facility Type

Facility Type		% RMSE
FTYPE1	Freeway	23%
FTYPE2	Major Arterial	41%
FTYPE3	Minor Arterial	59%
FTYPE4	Collector	80%
FTYPE5	Expressway	33%
All FTYPEs		43%

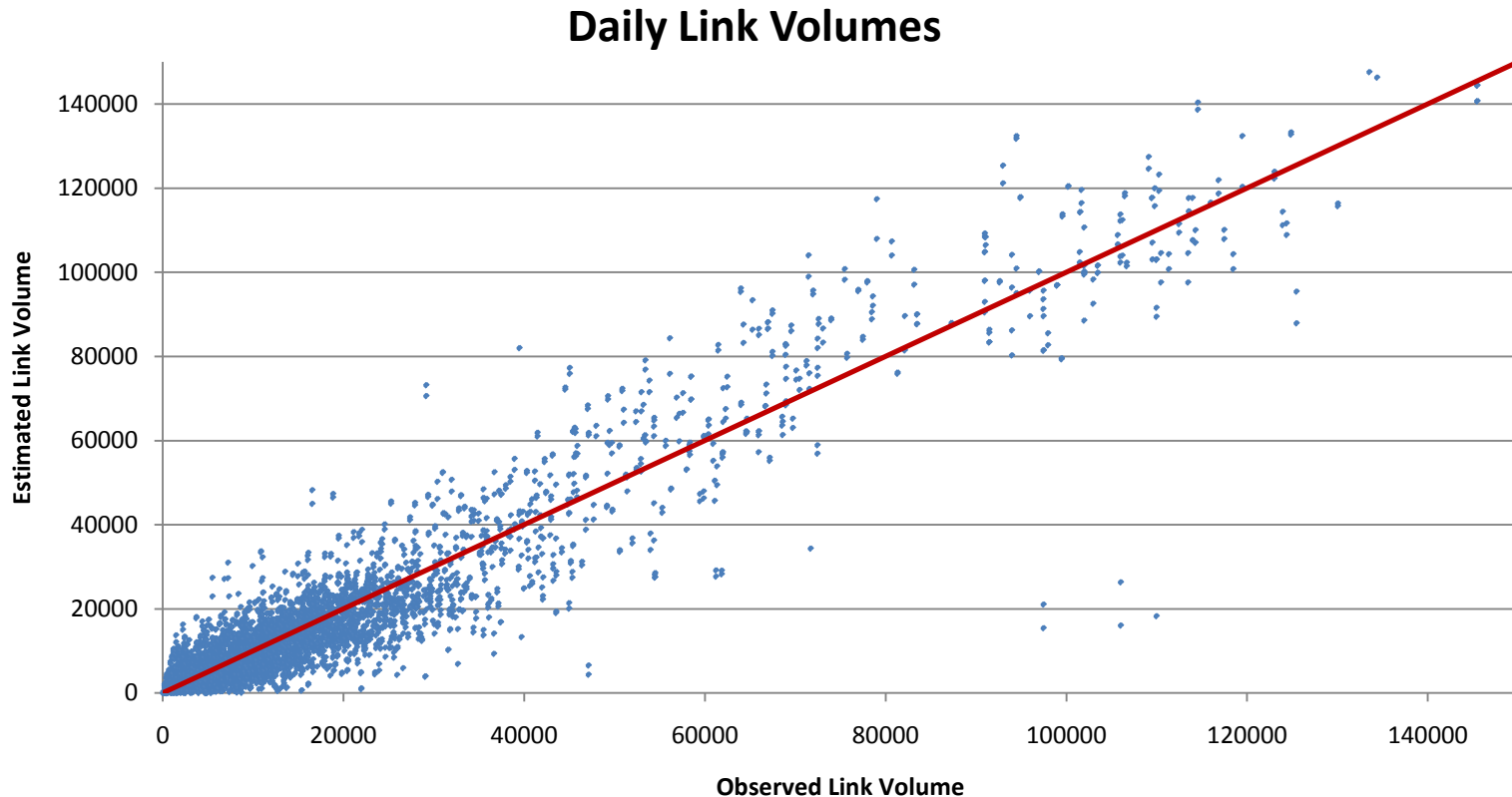
# 2007 VMT by Time of Day

VMT (in thousands) based on 1,717 links with counts

Time of Day	Estimated	Observed	Difference (E.-O.)	Ratio (E./O.)
AM Peak	4,589	3,699	889	1.24
Midday	6,642	6,409	233	1.04
PM Peak	7,148	5,711	1,437	1.25
Night	3,499	4,634	-1,134	0.76



# 2007 Estimated vs. Observed Directional Volumes



Based on 6,246 links with daily counts

# Simulated Transit 2007 Trips and Targets

		Simulated	Observed - On-Board Surveys			Observed - 2007/08 HTS		
		Trips	Trips	Diff. (E- O)	Ratio (E/O)	Trips	Diff. (E-O)	Ratio (E/O)
HBW	Transit	723,490	756,439	-32,949	0.96	571,886	151,604	1.27
	Pct. Transit	20.70%	21.60%	-0.90%	0.96	16.20%	4.50%	1.28
HBS	Transit	25,567	26,906	-1,339	0.95	70,250	-44,683	0.36
	Pct. Transit	0.90%	0.94%	-0.04%	0.95	2.40%	-1.50%	0.38
HBO	Transit	184,390	188,675	-4,285	0.98	215,477	-31,087	0.86
	Pct. Transit	2.90%	2.94%	-0.04%	0.99	3.40%	-0.50%	0.85
NHW	Transit	106,783	108,896	-2,113	0.98	139,584	-32,801	0.77
	Pct. Transit	6.90%	7.07%	-0.17%	0.98	8.70%	-1.80%	0.79
NHO	Transit	42,073	44,854	-2,781	0.94	65,365	-23,292	0.64
	Pct. Transit	1.50%	1.56%	-0.06%	0.96	2.20%	-0.70%	0.68
TOTAL	Transit	1,082,302	1,125,770	-43,468	0.96	1,062,563	19,739	1.02
	Pct. Transit	6.30%	6.55%	-0.25%	0.96	6.10%	0.20%	1.03

# Comparison of Selected Version 2.2 and Version 2.3 Travel Model Results

	Version 2.2 - 2011 CLRP 2005	Version 2.3 2007	Version 2.2 - 2011 CLRP 2011	Diff. (V2.3- V2.2) 2005
1 Households	2,344,561	2,339,832	2,524,150	-4,729
2 Employment	3,700,075	3,801,935	3,982,448	101,860
41 Motorized Person Trips/HH	10.28	7.35	10.24	-2.93
42 Motorized Person Trips/capita	3.85	2.87	3.85	-0.98
83 Total VMT	152,063,583	157,488,051	160,327,029	5,424,468
84 VMT per Capita	24.28	26.33	23.91	2.05
85 VMT per HH	64.86	67.31	63.52	2.45
86 VMT per Vehicle Trip	7.36	11.19	7.21	3.83

Pages 124-126 in calibration report

# Conclusions

- Version 2.3 model calibration/validation is completed, documented
- Relative to the Version 2.2 model:
  - Trip rates are lower (too low?)
  - Trip lengths are longer
  - Overall 2007 VMT tracks well with Version 2.2 simulation
  - VMT matches at Jurisdiction level are reasonable
- Version 2.3 is available for testing

# Next Steps

- Prepare a transmittal package of draft Version 2.3 model
- Consider refinements
  - To eliminate K-factors
  - Modify capacities/speeds to improve VMT by fac. type & Area type
  - To modify time-of-day model
- Run transit assignment
- Prepare, run future year analysis (2040)
- Check “outlier” ground counts, enhance count coverage
- Revisit the application process
  - To reduce model adjustments
  - To optimize run times with distributed process
  - To streamline code, application steps
- Complete User’s Guide
- April- December:
  - Model Testing (TFS oversight)

# Acknowledgements

- Models development unit:
  - Mark Moran
  - Hamid Humeida
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