InSITE

Initiative to Simulate Individual Travel Events

January 6, 2021

Aggregate Versus Disaggregate Modeling

Trip Based Model - Aggregate	Activity Based Model - Disaggregate
Model 44 c	InSITE
1) Model Design 2004/MTA New Start 2) Estimated using 2001 HH Travel Survey 3) Calibrated using 2008 HH Travel Survey	1) Model Design 2014 2) Estimated using 2008 HH Travel Survey
4 - Step Model Households - Unit of Analysis	Micro Simulation – Activities Beyond the Household that Require Travel Person – Unit of Analysis
Cooperative Forecast 1) TAZ Household Stratification	Cooperative Forecast 1) TAZ Synthetic Household/Population
Trip Tables - Household Person Trips by Purpose	Person Trip Roster
Time of Day – 4 Periods	Time of Day – ½ hour
	Explicitly Capture 1. School/Day Care Escorting 2. Full Joint Non-Mandatory Travel
	Parcels – MD Property View

BMC

InSITE – Modeling Components

- ## Three Models

  - ### PopGen2.0 – Synthetic Household and Person Roster

    - Synthesized record for each household and persons roster containing characteristics – income group, household size (persons (child/adult) & pt/ft workers), person type (eight), gender, race (non-Hispanic white alone & other), and poverty. Jurisdiction/TAZ margins developed from Round9A, demographic sub models, and pOPTICS.

  - ### Freight Modeling System – Long distance commodity flows, and local freight and commercial truck/vehicle goods, deliveries, and service tours

    - Micro simulation of establishment fleet's tour/trip roster simulating origin start time, destination, dwell time, purpose, and pick-up and/or deliveries. Estimated from FAF and truck/commercial vehicle survey data (Texas & Ohio) and calibrated to regional truck counts.

  - ### Activity Based Model – Daily Activity Pattern/Person Trip Roster

    - Micro simulation of household/person long term choices (auto ownership, usual place of work) and average weekday tours/trips – destination, mode, time of day, and purpose for all synthesized persons.

BMC

Validation – Long Term Choice

Vehicle Availability						
		Expanded household survey data		Model Results		Percentage Point Difference
Vehicles		count	percentage	count	percentage		Percentage Difference
0		231,695	11.2%	236,984	11.4%	0.2%	2.1%
1		690,202	33.3%	692,946	33.4%	0.1%	0.2%
2		753,072	36.3%	752,555	36.2%	-0.1%	-0.2%
3+		398,131	19.2%	393,860	19.0%	-0.2%	-1.2%
Total		2,073,100		2,076,345			

Shares by county Percentage Point Difference

HH County	Total	Veh Available 0	1	2	3+
Total	0%	0%	0%	0%	0%
BaCy	0%	-4%	3%	-3%	
BaCo	0%		-1%	-2%	-2%
AACo	0%		-1%	3%	-3%
HwCo	0%		2%	1%	-6%
CarCo	0%			10%	-9%
HarCo	0%		1%	1%	-2%
MO/PG/FR	0%	2%	-1%	-1%	1%
DC	0%	-8%	-1%	4%	

Shares by county Percent Difference

HH County	Total	Veh Available 0	1	2	3+
Total	0%	2%	0%	0%	-1%
BaCy	0%	-17%	7%	-11%	
BaCo	0%		-3%	-6%	-8%
AACo	0%		-4%	6%	-11%
HwCo	0%		7%	3%	-19%
CarCo	0%			28%	-21%
HarCo	0%		5%	2%	-5%
MO/PG/FR	0%	31%	-4%	-3%	3%
DC	0%	-23%	-2%	21%	

BMC

Validation – DAP FT Worker

Daily Activity Pattern - FT Worker						
DAP Type	Expanded household survey data		Model Results		Percentage Point Difference (Model% - Obs%)	Percentage of Percentage Point Difference (Model% - Obs%)/Obs%
	Count	Percentage	Count	Percentage		
None	0	0.0%	0	0.0%		
OneWorkTourNoStops	986,563	42.6%	1,048,943	42.5%	0.0%	-0.1%
OneWorkTourWithStops	729,477	31.5%	813,322	33.0%	1.5%	4.8%
TwoWorkToursNoStops	47,491	2.0%	38,028	1.5%	-0.5%	-24.8%
TwoWorkToursStopsOnOne	36,882	1.6%	30,436	1.2%	-0.4%	-22.5%
TwoWorkToursStopsOnBoth	10,098	0.4%	8,684	0.4%	-0.1%	-19.2%
OneUniOneWorkTourNoStops	5,966	0.3%	4,953	0.2%		
OneUniOneWorkTourStopsOnWorkTour	3,892	0.2%	3,122	0.1%		
OneSchOneWorkTourNoStops	0	0.0%	0	0.0%		
OneSchOneWorkTourStopsOnWorkTour	0	0.0%	0	0.0%		
OneUniTour	10,445	0.5%	11,333	0.5%	0.0%	1.9%
TwoUniTours	0	0.0%	0	0.0%		
OneSchoolTour	0	0.0%	0	0.0%		
TwoSchoolTours	0	0.0%	0	0.0%		
NonMandatoryTravel	244,707	10.6%	277,791	11.3%	0.7%	6.7%
StayAtHome	241,912	10.4%	229,893	9.3%	-1.1%	-10.7%
OutOfArea	0	0.0%	0	0.0%		
ExternalTravelOnly	0	0.0%	0	0.0%		
	2,317,432		2,466,505			

Validation − Trip Mode Choice (Work)

Tour Mode	Expanded household survey data		Model Results		Percentage Difference (Model - Obs)/Obs
purpose Work					
Regional					
	Count	Percentage	Count	Percentage	
DriveAlone	1,366,896	59.0%	1,315,205	58.6%	-0.8%
SharedRide2	333,051	14.4%	369,511	16.5%	14.4%
SharedRide3	178,882	7.7%	174,559	7.8%	0.7%
WalkToTransit	210,363	9.1%	185,466	8.3%	-9.1%
DriveToTransit	153,713	6.6%	127,333	5.7%	-14.6%
Walk	53,318	2.3%	53,817	2.4%	4.1%
Bike	19,140	0.8%	18,917	0.8%	1.9%
SchoolBus	0	0.0%	0	0.0%	
	2,315,364		2,244,808		

Validation − Transit Boardings

MTA Bus Boardings

y = 1.1347x + 783.63
R² = 0.7702

Model (y-axis)
2014 Weekday (x-axis)
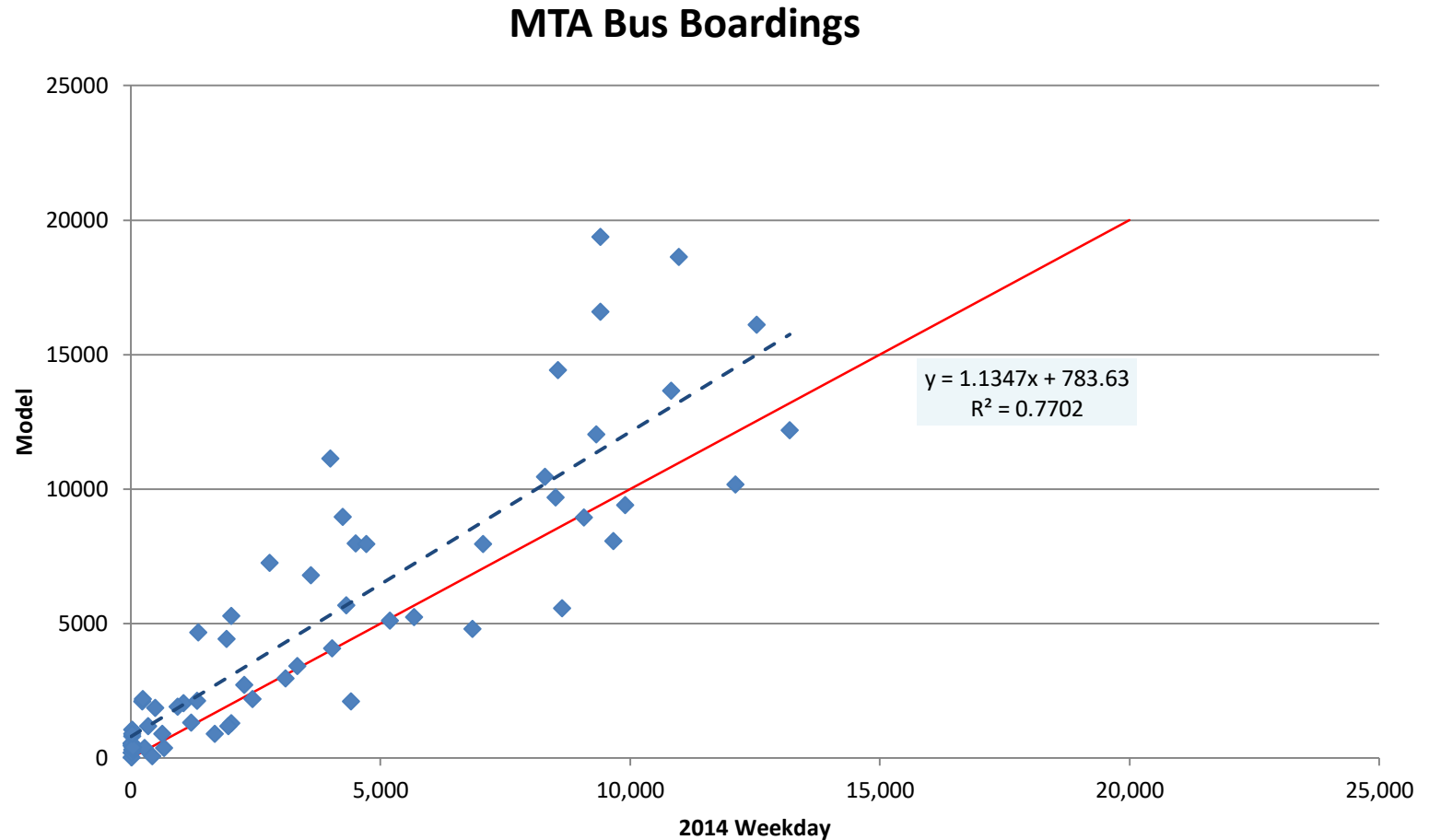
Validation – Highway Assignment

SINGLE Unit - Medium Truck ONLY

With feedback loop

VMT by functional class

Functional class	Observed VOL	Modeled VOL	% Diff
Interstate/freeway	1,021,220	1,159,837	14%
Toll road			
Primary arterial	282,950	167,434	-41%
Minor arterial	144,690	62,513	-57%
Collector	56,357	21,912	-61%
Other (incl. ramp)	29,747	28,843	-3%
Total	1,534,964	1,440,540	-6%

VMT by county

County	Observed VOL	Modeled VOL	% Diff
Baltimore City	46,326	44,633	-4%
Baltimore County	272,471	265,112	-3%
Anne Arundel	194,363	157,645	-19%
Howard	131,397	185,466	41%
Carroll	45,230	38,991	-14%
Harford	77,510	50,722	-35%
Mont/PG/Frederick	767,666	697,970	-9%
D.C.			
Total	1,534,964	1,440,540	-6%
BMC region	767,298	742,569	-3%
MWCOG region	767,666	697,970	-9%

VMT by area type

Area type	Observed VMT	Modeled VOL	% Diff
1	690,257	716,295	4%
2	395,572	358,263	-9%
3	342,189	281,383	-18%
4	86,840	70,738	-19%
5	12,518	8,712	-30%
6	1,344	820	-39%
7	4,775	3,516	-26%
8	162	78	-52%
9	1,307	735	-44%
Total	1,534,964	1,440,540	-6%

Combination Unit - Heavy Truck ONLY

With feedback loop

VMT by functional class

Functional class		Daily	
	Observed VOL	Modeled VOL	% Diff
Interstate/freeway	935,895	1,060,057	13%
Toll road			
Primary arterial	84,640	118,364	40%
Minor arterial	30,290	35,316	17%
Collector	8,648	11,885	37%
Other (incl. ramp)	14,288	20,129	41%
Total	1,073,761	1,245,752	16%

VMT by county

County		Daily	
	Observed VOL	Modeled VOL	% Diff
Baltimore City	21,891	32,933	50%
Baltimore County	242,776	251,954	4%
Anne Arundel	89,354	141,097	58%
Howard	113,320	140,295	24%
Carroll	21,701	30,607	41%
Harford	69,935	63,738	-9%
Mont/PG/Frederick	514,784	585,130	14%
D.C.			
Total	1,073,761	1,245,752	16%
BMC region	558,977	660,622	18%
MWCOG region	514,784	585,130	14%

VMT by area type

Area type		Daily	
	Observed VMT	Modeled VOL	% Diff
1	574,956	671,221	17%
2	262,055	288,739	10%
3	186,533	224,533	20%
4	43,972	51,684	18%
5	4,804	6,182	29%
6	167	519	210%
7	885	2,333	164%
8	30	50	67%
9	359	491	37%
Total	1,073,761	1,245,752	16%

BMC

Validation − Highway Assignment

		2 Axle Cnt - Commercial Veh & InSITE Household									
With feedback loop											
VMT by functional class					**VMT by county**					**VMT by area type**	

	Daily					Daily					Daily		
Functional class	**Observed VOL**	**Modeled VOL**	**% Diff**		**County**	**Observed VOL**	**Modeled VOL**	**% Diff**		**Area type**	**Observed VMT**	**Modeled VOL**	**% Diff**
Interstate/freeway	18,961,988	18,328,198	-3%		Baltimore City	1,036,499	1,021,277	-1%		1	11,851,401	11,732,279	-1%
Toll road					Baltimore County	5,370,323	4,944,654	-8%		2	7,828,240	7,209,784	-8%
Primary arterial	5,897,228	5,813,244	-1%		Anne Arundel	4,043,644	3,528,250	-13%		3	6,908,839	6,323,750	-8%
Minor arterial	2,625,701	2,246,938	-14%		Howard	2,409,888	2,182,371	-9%		4	1,872,432	1,813,228	-3%
Collector	956,487	780,977	-18%		Carroll	670,890	672,204	0%		5	330,397	367,120	11%
Other (incl. ramp)	566,135	515,825	-9%		Harford	1,283,001	1,100,703	-14%		6	48,055	47,850	0%
Total	29,007,539	27,685,183	-5%		Mont/PG/Frederick	14,193,294	14,235,724	0%		7	130,499	148,462	14%
					D.C.					8	6,189	6,572	6%
					Total	29,007,539	27,685,183	-5%		9	31,487	36,138	15%
					BMC region	14,814,245	13,449,458	-9%		**Total**	29,007,539	27,685,183	-5%
					MWCOG region	14,193,294	14,235,724	0%					

Validation - Screen Lines

Screenline Summary	2012 AAWDT	PopGen Fix (Final) DailyVolume	Ratio	Action	RMSE
Screenline 1 - North CBD	180,293	184,918	1.03	OK	0.22
Screenline 2 - East CBD	200,644	296,672	1.43	LOWER	0.68
Screenline 3 - South CBD	245,930	269,233	1.09	OK	0.24
Screenline 4 - West CBD	150,701	159,257	1.00	OK	0.51
Screenline 5 - Patterson Park/East Baltimore	190,052	256,987	1.23	LOWER	0.59
Screenline 6 - North Of Liberty Heights Avenue	76,072	90,012	1.18	OK	0.27
Screenline 7 - East Of Jones Falls Expressway	223,000	255,710	1.15	OK	0.47
Screenline 8 - Harford Road	90,209	121,439	1.35	LOWER	0.70
Screenline 9 - South Of Monument	64,198	72,432	1.13	OK	0.40
Screenline 10 - North Baltimore City Line	362,995	295,417	0.81	RAISE	0.39
Screenline 11 - East Baltimore City Line	396,831	403,488	1.02	OK	0.64
Screenline 12 - South Baltimore City Line	550,345	504,968	0.92	OK	0.30
Screenline 13 - West Baltimore City Line	229,345	199,026	0.87	OK	0.31
Screenline 14 - Beltway Screenline (South)	412,375	336,575	0.82	RAISE	0.33
Screenline 15 - Beltway Screenline (Southwest)	504,579	466,087	0.92	OK	0.34
Screenline 16 - Beltway Screenline (Northwest)	371,185	317,562	0.86	OK	0.24
Screenline 17 - Beltway Screenline (North)	430,826	401,889	0.93	OK	0.17
Screenline 18 - Beltway Screenline (East)	495,611	432,862	0.87	OK	0.24
Screenline 19 - South Outer Cordon Line	280,024	247,266	1.10	OK	0.67
Screenline 20 - Southwest Outer Cordon Line	535,113	488,519	0.91	OK	0.23
Screenline 21 - West Outer Cordon Line	153,784	134,373	0.87	OK	0.27
Screenline 22 - Northwest Cordon Line	110,720	127,883	1.14	OK	0.29
Screenline 23 - North Outer Cordon Line	77,794	86,022	1.11	OK	0.29
Screenline 24 - Northeast Outer Cordon Line	261,884	235,066	0.90	OK	0.26
Screenline 25 - Towson Cordon	424,840	358,354	0.84	OK	0.49
Screenline 26 - Westminster Cordon	166,072	156,929	0.94	OK	0.36
Screenline 27 - Bel Air Cordon	239,378	195,407	0.82	RAISE	0.34
Screenline 28 - Columbia Cordon	531,896	445,143	0.82	RAISE	0.34
Screenline 29 - Mid-Howard County Screenline	544,507	438,941	0.81	RAISE	0.40
Screenline 30 - Annapolis Cordon	451,154	412,291	0.95	OK	0.22
Screenline 31 - MD 543-Harford County	188,426	163,588	0.87	OK	0.20
Screenline 32 - Anne Arundel Region Boundary	228,486	247,761	1.08	OK	0.33
Screenline 33 - Anne Arundel/Howard County Region Boundary	489,564	443,290	0.91	OK	0.20
Screenline 34 - Western Howard Region Boundary	32,295	52,015	1.10	OK	0.30
Screenline 35 - West Carroll Region Boundary	107,568	117,446	1.09	OK	0.25

Screenline Summary	2012 AAWDT	PopGen Fix (Final) DailyVolume	Ratio	Action	RMSE
Screenline 37 - North Frederick/Carroll Region Boundary	66,200	68,703	1.04	OK	0.06
Screenline 38 - North Baltimore County Region Boundary	61,423	65,228	1.06	OK	0.11
Screenline 39 - North Harford Region Boundary	24,679	18,609	1.01	OK	0.03
Screenline 40 - Northeast Region Boundary	118,638	123,322	0.99	OK	0.08
Screenline 41 - Annapolis Bay Bridge	74,531	76,616	1.04	OK	0.06
Screenline 42 - W of MD 3/I-97	298,605	253,715	0.85	OK	0.27
Screenline 43 - Howard/Anne Arundel County Line	402,047	377,581	0.94	OK	0.14
Screenline 44 - Howard/Carroll County Line	80,724	70,683	0.88	OK	0.24
Screenline 45 - Gwynns Falls West	321,436	324,512	1.01	OK	0.11
Screenline 46 - East of I-83/Baltimore County	414,344	300,164	0.73	RAISE	0.50
Screenline 47 - East of I-95/Baltimore County	269,959	199,942	0.74	RAISE	0.43
Screenline 48 - West of US 1/Harford County	126,626	98,717	0.78	RAISE	0.40
Screenline 49 - West of I-95/Harford County	182,989	151,291	0.83	OK	0.37
Screenline 50 - Harbor Crossings	234,776	128,631	0.55	RAISE	0.50
Screenline 51 - Expanded Region Boundary North Of I-495	137,566	143,679	1.04	OK	0.10
Screenline 52 - Potomac River Between Capital Beltway Crossings	828,900	817,649	0.99	OK	0.27
Screenline 53 - Expanded Region Boundary South of I-95	180,824	181,281	1.00	OK	0.00
Screenline 54 - East of MD 140/Baltimore County	300,258	257,950	0.86	OK	0.25
Screenline 55 - US 40 West Baltimore City	76,701	119,024	1.55	LOWER	1.04
Screenline 56 - Cold Spring Lane / Moravia Road	460,707	465,646	1.01	OK	0.29
Screenline 64 - Inner Washington	783,577	1,276,119	1.62	LOWER	1.19
Screenline 66 - Washington Beltway	1,666,401	1,720,416	1.03	OK	0.36
Screenline 68 - Outer Washington Region	1,633,668	1,514,987	0.92	OK	0.39
Screenline 72 - Rock Creek	541,200	562,321	1.04	OK	0.32
Screenline 75 - South of US 50	376,408	311,787	0.83	OK	0.24
Screenline 84	562,552	485,575	0.86	OK	0.44
Screenline 85	233,998	123,883	0.87	OK	0.33
	20,458,433	19,652,859	0.96	OK	0.34
Baltimore CBD	777,568	910,080	1.17	OK	1.66
Baltimore City Line	1,539,516	1,402,899	0.91	OK	1.64
Baltimore Beltway	2,214,576	1,954,975	0.88	OK	1.31
Outer Cordon Line	1,419,319	1,319,129	0.93	OK	2.01
			RAISE	9	
			OK	49	
			LOWER	5	

Application − Mobile Source Emissions

	TIP21_24	InSITE		TIP21_24	InSITE		TIP21_24	InSITE
InSITE>TIP21_24	2021	2020/2021		2021	2020/2021		2021	2020/2021
InSITE<TIP21_24								
	Vehicle Miles of Travel			VOC			NOx	
Baltimore Region								
MC	289,078	291,357		0.789	0.802		0.181	0.180
LDV	72,446,741	74,009,953		17.187	17.342		17.118	17.376
BUS	1,017,708	812,183		0.193	0.153		2.621	2.079
HDV	6,845,942	5,791,774		2.017	1.862		20.827	18.403
Total	80,599,468	80,905,266		20.186	20.158		40.746	38.038

	TIP21_24	InSITE		TIP21_24	InSITE		TIP21_24	InSITE
InSITE>TIP21_24	2045	2045		2045	2045		2045	2045
InSITE<TIP21_24								
	Vehicle Miles of Travel			VOC			NOx	
Baltimore Region								
MC	336,229	321,962		0.821	0.813		0.204	0.194
LDV	83,853,610	81,855,649		7.460	7.458		3.568	3.524
BUS	1,010,889	826,640		0.053	0.042		0.960	0.785
HDV	8,337,552	7,084,147		1.180	1.130		11.774	10.754
Total	93,538,281	90,088,398		9.514	9.443		16.506	15.257

For more information

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