

APPENDIX B. TRANSPORT MODEL OUTPUTS AND VALIDATION

This appendix reports the aggregate forecasts and validation results for the year 2010 and 1990 in Boston metropolitan area. The models are estimated for 1990 and 2010 respectively (see Appendix A GREATER BOSTON TRANSPORT MODEL SPECIFICATION AND ESTIMATION). The population data come from 1990 and 2010, mostly from CTPP (Census Journey-to-Work) data.

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1 2010 model

1.1 Vehicle ownership (VO)

Table 1–1 Predicted and Observed Vehicle Ownership Shares (Year 2010)

	Model predicted		Observed (NCDB)		Observed (CTPP)	
	HH	%	HH	%	HH	%
0-veh	201,957	12.0	227,120	13.4	201,916	13.4
1-veh	555,660	33.0	597,566	35.4	555,619	35.4
2-veh	629,302	37.4	621,787	36.8	629,108	36.8
3-veh	295,663	17.6	243,061	14.4	295,396	14.4
Total HH	1,682,584	100.0	1,689,534	100.0	1,682,038	100.0

Note that TAZ accessibility input is updated after each iteration loop.

NCDB: Census Neighborhood Change Database 2010.

1.2 Trip generation (TG)

HBW trips

Table 1–2 Workers and Jobs by Earnings in 2010

Worker's earning	Workers	%	Jobs	%
Earn1 (<25K)	590,978	27.9	669,849	28.2
Earn2 (25-50K)	613,708	28.9	678,366	28.5
Earn3 (50-75K)	445,771	21.0	473,170	19.9
Earn4 (75-100K)	231,151	10.9	236,260	9.9
Earn5 (MT100K)	239,805	11.3	320,328	13.5
Total	2,121,416	100.0	2,377,973	100.0
(CTPP Total)	(2,208,318)		(2,378,383)	

Note: Computed from HH224 input table using a dictionary that translates HH-income to worker-earning. Dictionary is generated based on PUMS data.

HBW Output Summary

- Total HBW Trips 2,684,725
- Total HBW Captive Trips: 129,895 (workers from 0-veh HH)
- Total HBW Choice Trips: 2,554,829
- HBW Trips/Worker: 1.27 (this includes workers who work at home)

Table 1–3 HBW Trip Production and Attraction by Income Category in 2010

Worker's earning levels	P_HBW TOTAL	P_HBW_CHO	P_HBW_CAP
Earn1 (<25K)	740,456	679,033	61,423
Earn2 (25-50K)	785,026	746,677	38,349
Earn3(50-75K)	569,975	552,362	17,613
Earn4 (75-100K)	291,841	285,020	6,821
Earn5 (MT100K)	297,428	291,738	5,689
Total	2,684,725	2,554,829	129,895

Other trip purposes

Table 1–4 Trip Production and Attraction for Other Trip Purposes in 2010

Purpose	Production==Attraction
HBSC	938,961
HBPUDO	1,352,788
HBSH	1,475,053
HBBPB	1,485,402
HBSO	765,194
HBEAT	583,788
HBREC	1,155,633
HBO	72,793
NHBW	1,422,591
NHBO	2,526,583

1.3 Trip distribution (TD)

Table 1–5 Predicted vs. Observed HBW flows (Town level including Boston)

	b	b0	R_sq	p-value	std_err
Earn1	1.230	0.765	0.993	0	0.00092
Earn2	1.225	2.091	0.991	0	0.00102
Earn3	1.322	1.261	0.985	0	0.00143
Earn4	1.468	-0.075	0.977	0	0.00197
Earn5	1.006	0.519	0.976	0	0.00136

Table 1–6 Predicted vs. Observed HBW flows (Town level without Boston)

	b	b0	R_sq	p-value	std_err
Earn1	1.152	2.252	0.928	0.000	0.00282
Earn2	1.089	4.752	0.926	0.000	0.00270
Earn3	1.145	3.665	0.894	0.000	0.00349
Earn4	1.228	1.546	0.859	0.000	0.00445
Earn5	0.927	1.269	0.883	0.000	0.00301

Table 1–7 Predicted vs. Observed HBW flows (TAZ level)

	b	b0	R_sq	p-value	std_err
Earn1	0.677	0.354	0.520	0.000	0.001127
Earn2	0.497	0.503	0.561	0.000	0.000743
Earn3	0.404	0.418	0.551	0.000	0.000620
Earn4	0.329	0.233	0.483	0.000	0.000605
Earn5	0.227	0.240	0.443	0.000	0.000467

Earning groups: ['LT25K', '25-50K', '50to75K', '75to100K', 'MT100K']

1.4 Mode choice

Table 1–8 Observed Mode Shares for HBW in 2010

	Total	inc1	inc2	inc3	inc4
SOV	71.9%	56.0%	65.1%	70.5%	75.4%
APAX	8.3%	10.3%	9.8%	9.0%	7.7%
PT	13.5%	20.4%	16.4%	13.5%	12.1%
BIKWALK	5.5%	11.6%	7.6%	6.0%	4.2%
TAXIOTH	0.8%	1.7%	1.1%	0.9%	0.6%

Table 1–9 Predicted HBW Mode Shares in 2010

	Total	inc1	inc2	inc3	inc4
SOV	74.6%	59.9%	74.9%	76.9%	77.1%
APAX	4.4%	4.8%	4.4%	4.2%	4.5%
PT	11.7%	12.7%	10.8%	11.6%	12.2%
WAT	7.4%	10.4%	7.3%	7.1%	7.0%
DAT	4.2%	2.3%	3.6%	4.5%	5.2%
WALK	9.3%	22.6%	9.9%	7.2%	6.2%

Table 1–10 Observed and Predicted Mode Shares for HBSHOP Trips

HBSHOP	Population	Sample	Population Share	Sample Share	Predicted Share
SOV	288,229	1,827	67.2%	71.1%	49.3%
Auto-pax	80,928	436	18.9%	17.0%	15.4%
Transit	24,271	116	5.7%	4.5%	2.9%
PNR	581	5	0.1%	0.2%	0.4%
Walk	35,183	184	8.2%	7.2%	31.9%

Table 1–11 Observed and Predicted Mode Shares for HBO Trips

HBO	Population	Sample	Population Share	Sample Share	Predicted
SOV	1,280,186	8,020	64.2%	67.9%	47.6%
Auto-pax	458,572	2,577	23.0%	21.8%	17.6%
Transit	116,382	490	5.8%	4.1%	2.4%
PNR	6,312	38	0.3%	0.3%	0.7%
Walk	131,844	691	6.6%	5.8%	31.6%

Table 1–12 Observed and Predicted Mode Shares for NHBW Trips

NHBW	Population	Sample	Population Share	Sample Share	Predicted
SOV	813,479	5,311	75.0%	77.9%	62.7%
Auto-pax	45,122	211	4.2%	3.1%	3.1%
Transit	72,775	361	6.7%	5.3%	1.9%

PNR	7,262	47	0.7%	0.7%	0.7%
Walk	146,222	889	13.5%	13.0%	31.6%

Table 1–13 Observed and Predicted Mode Shares for NHBO Trips

NHBO	Population	Sample	Share	Share	Predicted
SOV	1,066,215	6,634	60.2%	64.0%	47.1%
Auto-pax	462,746	2,581	26.1%	24.9%	19.3%
Transit	79,371	329	4.5%	3.2%	1.9%
PNR	1,845	10	0.1%	0.1%	0.2%
Walk	162,227	816	9.2%	7.9%	31.4%

1.5 Traffic Assignment

Table 1–14 Road Traffic Assignment Summary (2010)

24 HOURS	VMT	VHT	VHT_FF	SPEED	SPEED_FF
Expressways (1-6)	47,882,984	880,387	795,434	54.4	60.2
Main Arterials (11-14)	4,577,370	125,849	116,483	36.4	39.3
Minor Arterials (15-18)	15,364,175	563,375	543,282	27.3	28.3
Main Distributors (20-21)	11,405,104	466,016	456,215	24.5	25
Minor Distributors (25-26)	1,531,444	66,578	61,383	23	24.9
Local streets (31)	4,035,996	204,303	201,639	19.8	20
AM	VMT	VHT	VHT_FF	SPEED	SPEED_FF
Expressways (1-6)	3,586,599	66,954	59,410	53.6	60.4
Main Arterials (11-14)	334,082	9,091	8,332	36.7	40.1
Minor Arterials (15-18)	1,028,784	37,800	36,256	27.2	28.4
Main Distributors (20-21)	720,105	29,735	28,805	24.2	25
Minor Distributors (25-26)	108,526	4,787	4,350	22.7	24.9
Local streets (31)	237,296	12,032	11,846	19.7	20
MD	VMT	VHT	VHT_FF	SPEED	SPEED_FF
Expressways (1-6)	2,594,536	45,133	43,198	57.5	60.1
Main Arterials (11-14)	255,422	6,784	6,541	37.7	39
Minor Arterials (15-18)	877,159	31,674	31,058	27.7	28.2
Main Distributors (20-21)	663,029	26,810	26,522	24.7	25
Minor Distributors (25-26)	85,982	3,680	3,446	23.4	24.9
Local streets (31)	244,196	12,301	12,203	19.9	20

PM	VMT	VHT	VHT_FF	SPEED	SPEED_FF
Expressways (1-6)	4,752,689	92,845	78,874	51.2	60.3
Main Arterials (11-14)	451,373	13,140	11,568	34.4	39
Minor Arterials (15-18)	1,526,028	57,296	53,956	26.6	28.3
Main Distributors (20-21)	1,149,317	47,478	45,974	24.2	25
Minor Distributors (25-26)	150,449	6,805	6,030	22.1	24.9
Local streets (31)	402,222	20,539	20,097	19.6	20
RD	VMT	VHT	VHT_FF	SPEED	SPEED_FF
Expressways (1-6)	1,291,103	21,593	21,514	59.8	60.0
Main Arterials (11-14)	125,421	3,208	3,199	39.1	39.2
Minor Arterials (15-18)	442,780	15,721	15,690	28.2	28.2
Main Distributors (20-21)	332,305	13,309	13,292	25.0	25.0
Minor Distributors (25-26)	43,266	1,745	1,734	24.8	24.9
Local streets (31)	122,829	6,143	6,138	20.0	20.0

Volume (V) and Volume/Capacity (V/C)

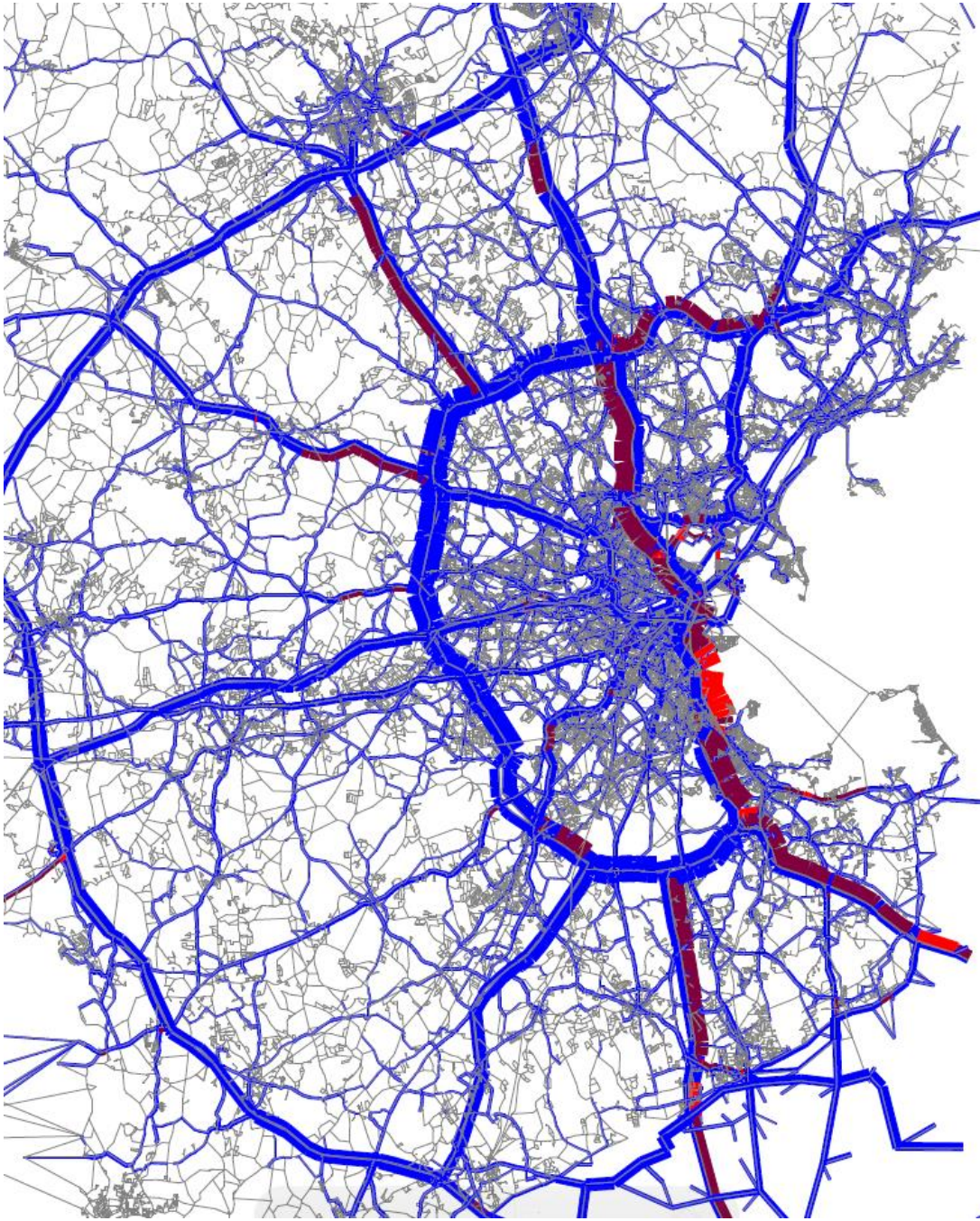


Figure 1-1 AM Volume (V) and Volume/Capacity (V/C)

(Dark red: $1 < V/C < 1.5$; bright red: $V/C > 1.5$)

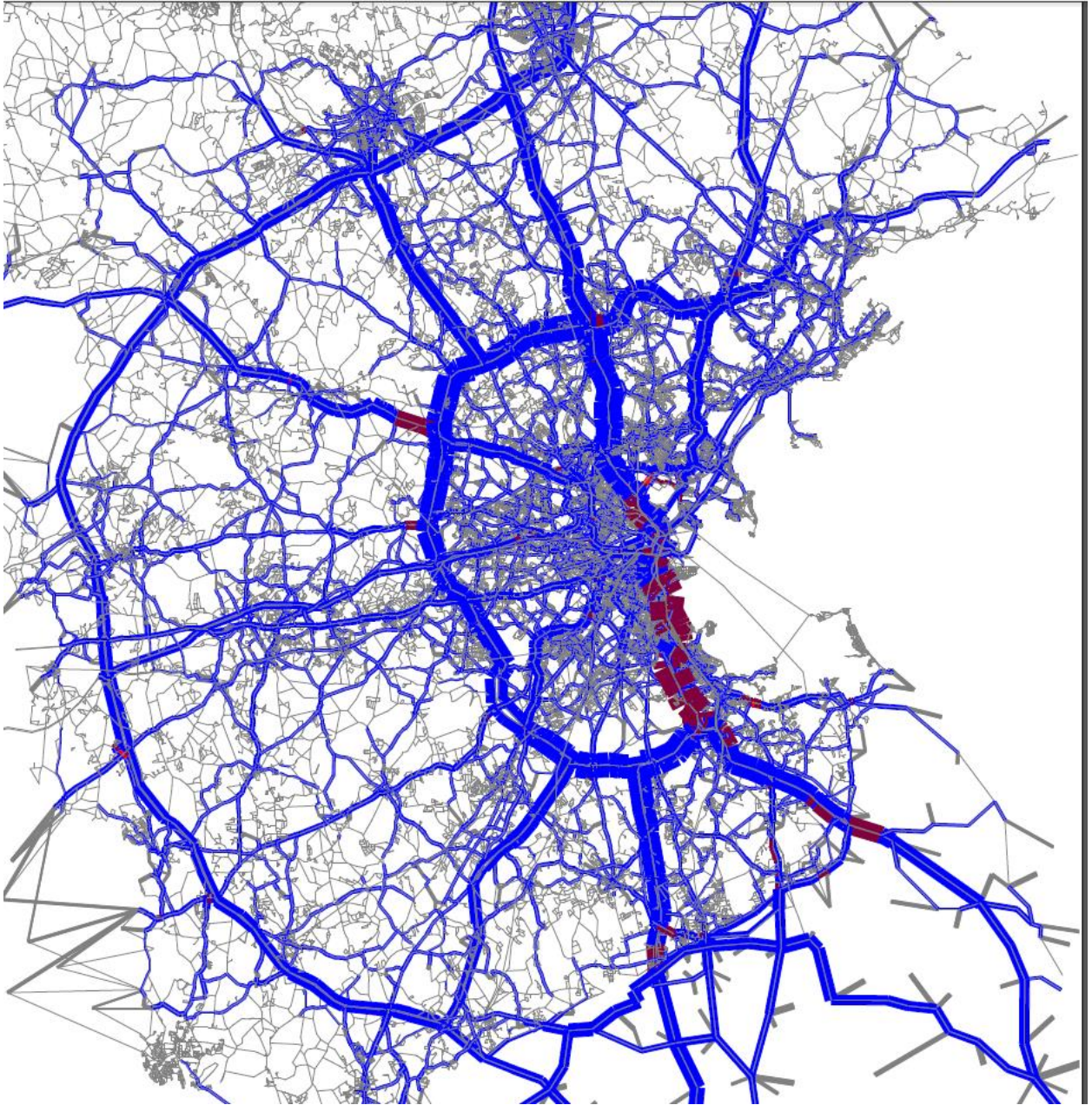


Figure 1-2 Mid-day Volume (V) and Volume/Capacity (V/C)

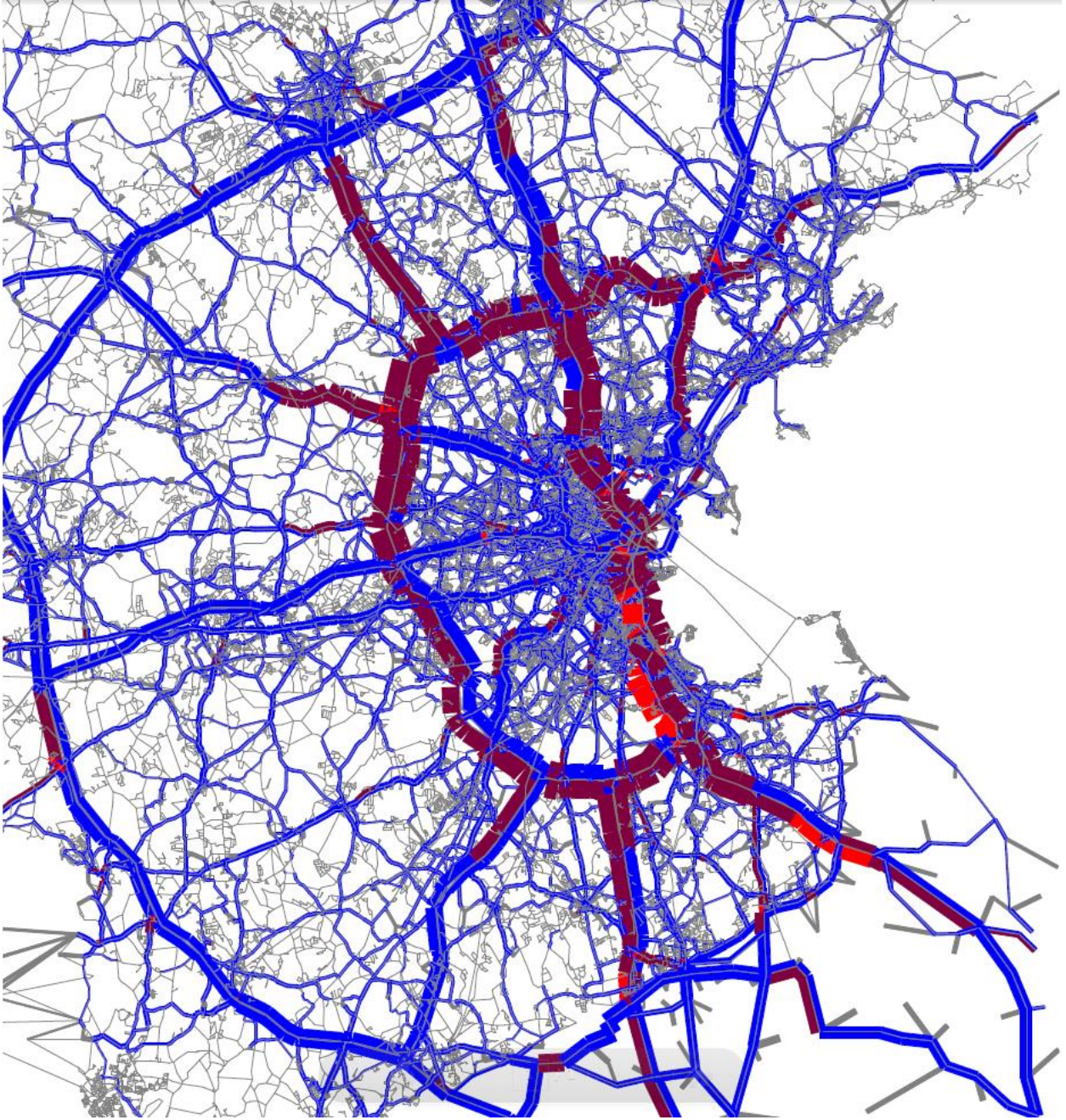


Figure 1-3 PM Volume (V) and Volume/Capacity (V/C)

Traffic Volume by Household Income

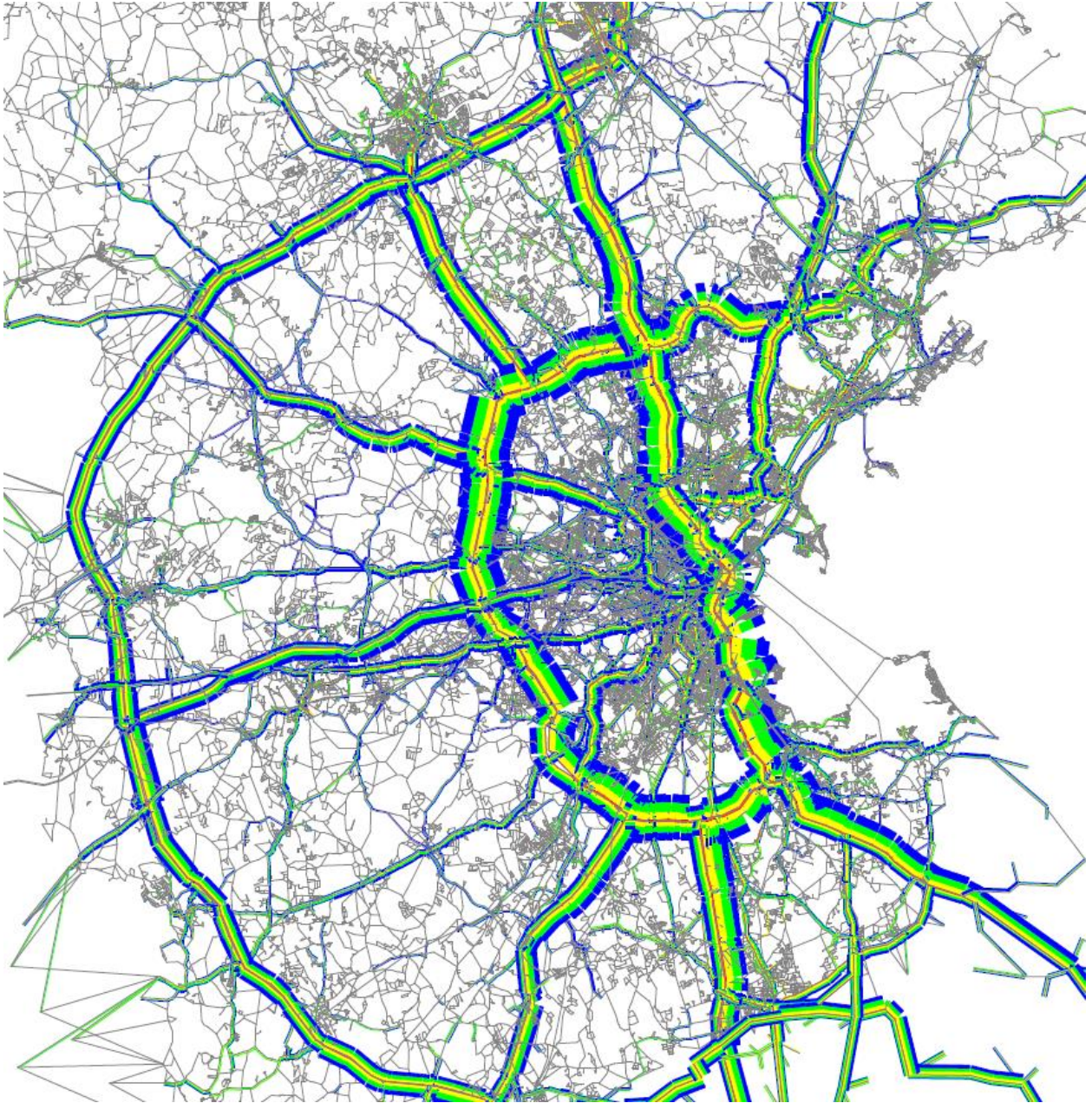


Figure 1-4 AM Volume by Household Income

(Red: INC1; yellow: INC2; green: INC3; blue: INC4)

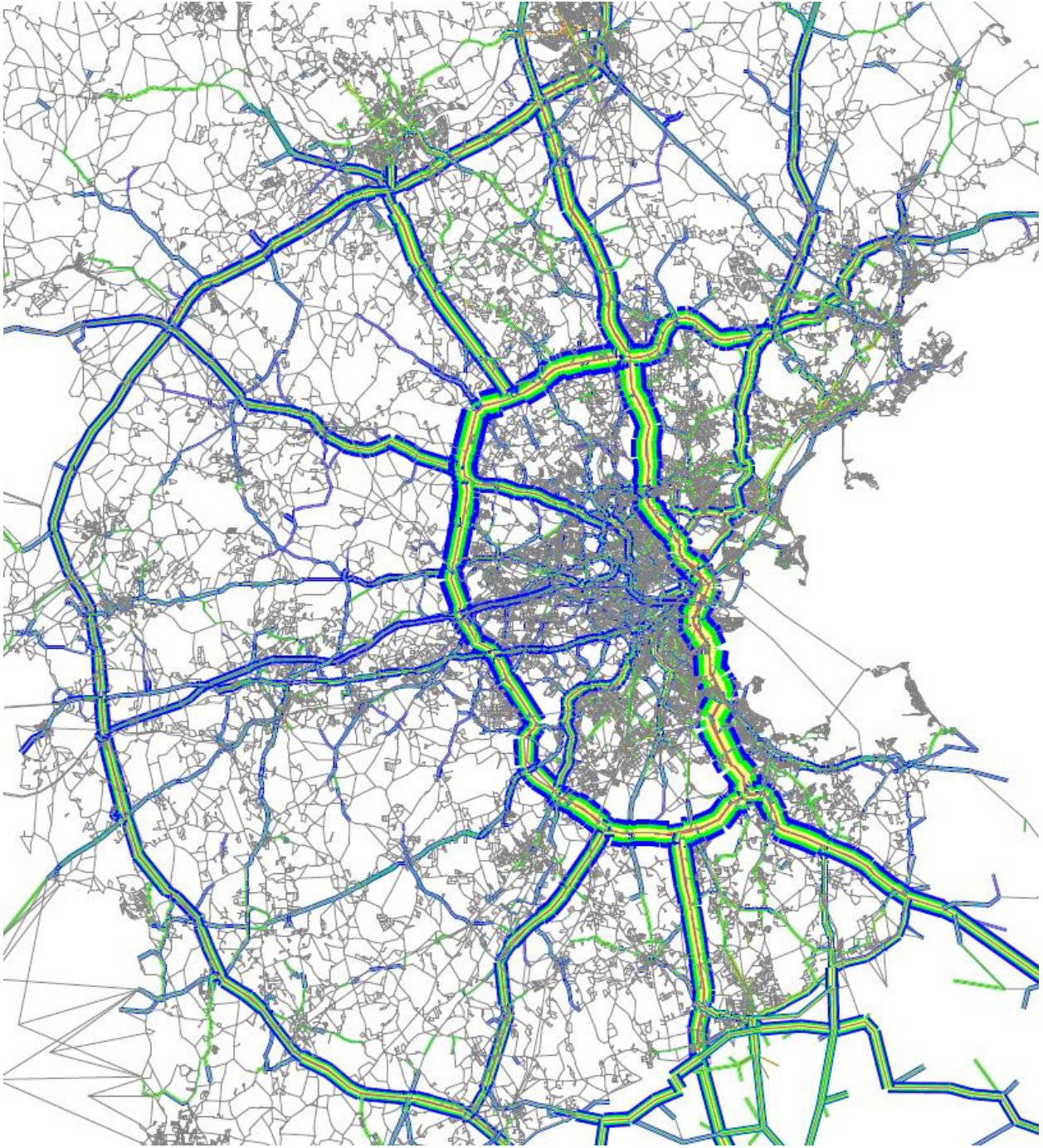


Figure 1-5 Mid-day Volume by Household Income

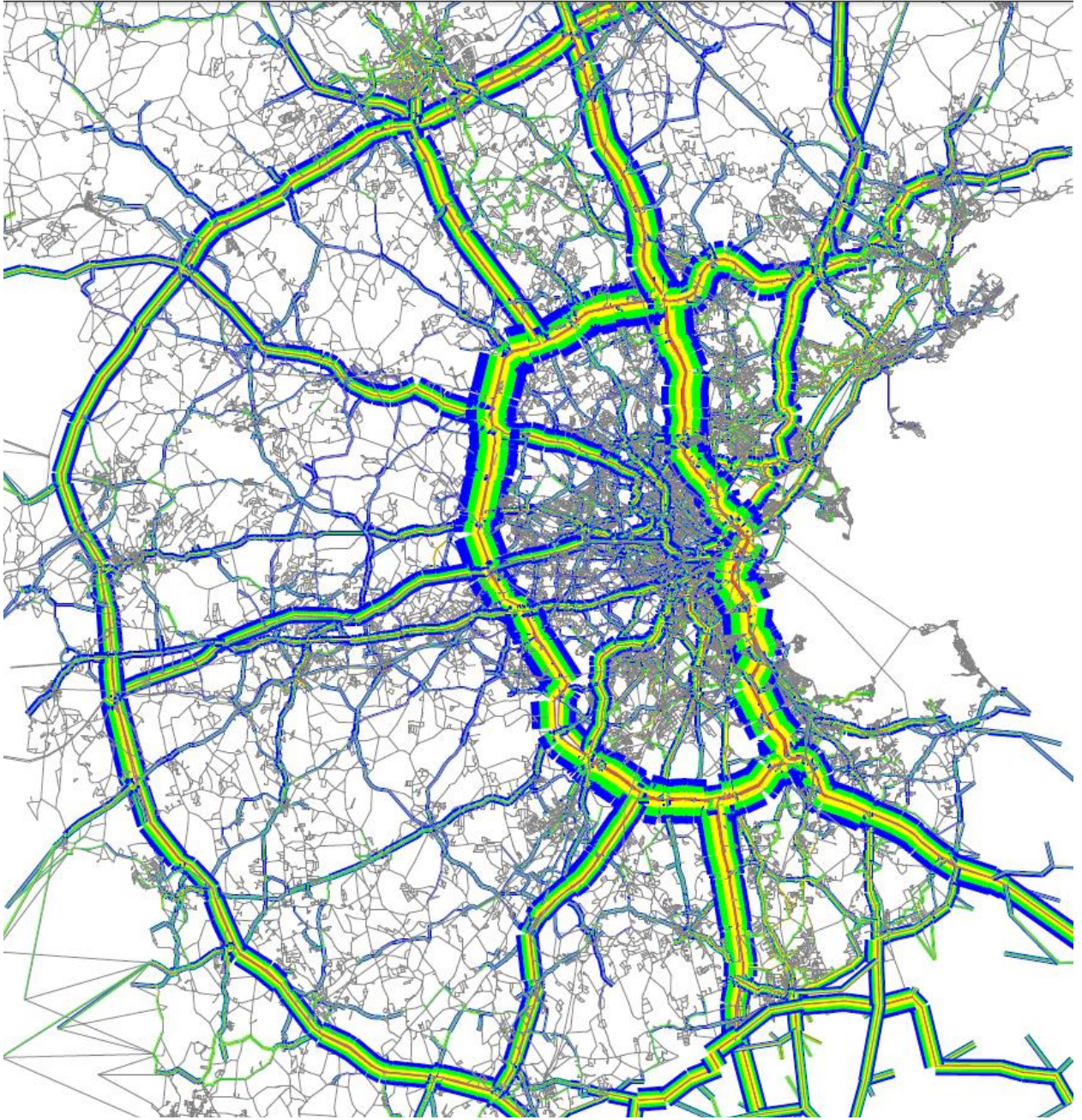


Figure 1-6 PM Volume by Household Income

1.6 Transit Ridership

Table 1–15 Observed and Predicted Transit Ridership in 2010

Transit lines	Blue Book 2010 Unlinked trips	Predicted	% diff
Red	241,603	263,779	9.2%
Orange	184,961	237,141	28.2%
Blue	57,273	63,789	11.4%
Green	236,096	235,495	-0.3%
Silver Line	30,026	29,433	-2.0%
Bus (including Trackless Trolley)	344,014	504,585	46.7%

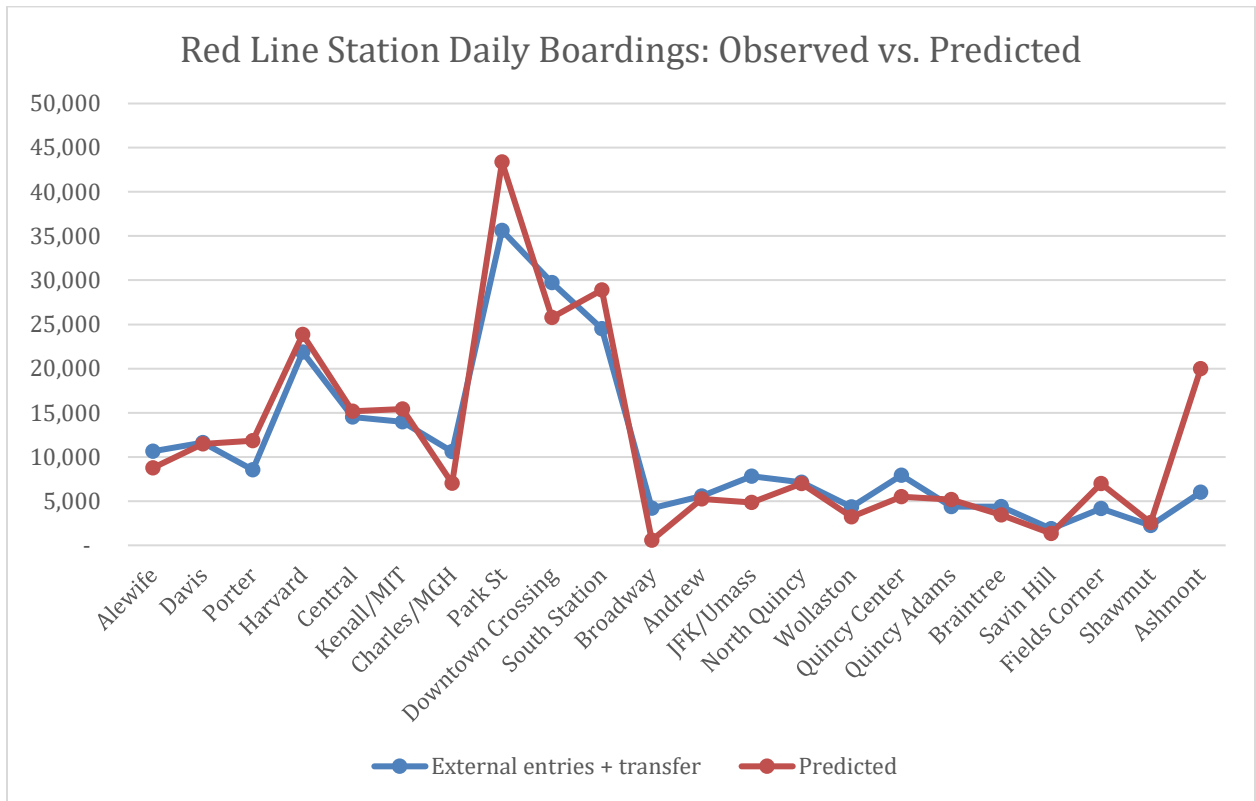


Figure 1-7 Observed and Predicted Daily Boarding for Red Line Subway Stations.

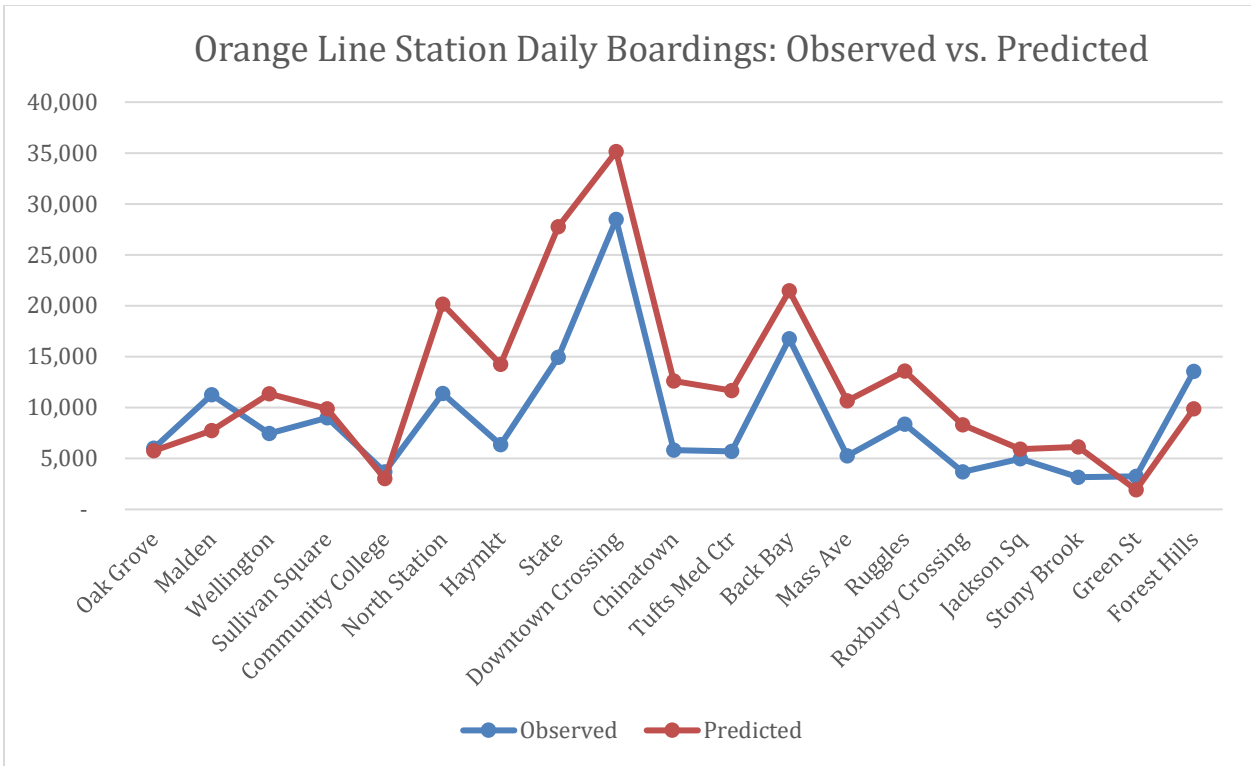


Figure 1-8 Observed and Predicted Daily Boarding for Orange Line Subway Stations.

2 1990 model

2.1 Vehicle ownership

Table 2-1 Predicted and Observed Vehicle Ownership Shares (Year 1990)

HH	Predicted		Observed	
0-veh	179,272	12.1%	225,788	15.2%
1-veh	597,538	40.5%	533,275	35.9%
2-veh	515,482	34.9%	524,363	35.3%
3-veh	184,751	12.5%	202,021	13.6%
Total	1,477,045	100.0%	1,485,447	100.0%

2.2 Trip generation

HBW trips

Table 2-2 Workers and Jobs by Earnings in 1990

Inputs	Workers	%	Jobs	%
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Earn1	605,202	30.8	647,419	29.9
Earn2	633,767	32.3	735,685	34
Earn3	417,364	21.2	413,207	19.1
Earn4	175,765	8.9	176,766	8.2
Earn5	132,078	6.7	190,716	8.8
Totals by earning	1,964,178	100	2,163,794	100
TAZ table totals	2,001,671		2,193,132	

Output Summary

• Total HBW Trips	2,916,824
• Total HBW Captive Trips	162,559
• Total HBW Choice Trips	2,754,264
• HBW Trips/worker	1.49

Table 2–3 HBW Production and Attraction in 1990

P_HBW (=A_HBW)	Total	Choice	Captives
Earn1	881,272	806,498	74,774
Earn2	949,647	895,756	53,891
Earn3	626,782	602,494	24,287
Earn4	263,183	257,048	6,136
Earn5	195,941	192,469	3,471

Other trip purposes

Table 2–4 Trip Production for Other Trip Purposes (1990)

Trips by Other Purposes	Trips
HBSC	863,123
HBPUDO	1,168,082
HBSH	1,581,868
HBBPB	1,435,712
HBSO	883,436
HBEAT	552,373
HBREC	796,426
HBO	90,061
HBOA	3,758,008
NHBW	2,172,225
NHBO	2,376,092

2.3 Mode choice

Table 2–5 Predicted Mode Shares for 1990

	HBW	%	HBSHOP	%	HBO	%	NHBW	%	NHBO	%
SOV	2049435	70.3	624692	39.5	1818828	36.9	1472931	67.8	809981	34.1
APAX	299466	10.3	750778	47.5	2417355	49.1	392318	18.1	1149774	48.4
WAT	135328	4.6	19684	1.2	67598	1.4	23377	1.1	49242	2.1
DAT	99925	3.4	3776	0.2	19093	0.4	7336	0.3	19340	0.8
WALK	332668	11.4	182936	11.6	603213	12.2	276260	12.7	347753	14.6
Total	2916822	100	1581866	100	4926087	100	2172222	100	2376090	100

2.4 Traffic Assignment

Table 2–6 Summary of Traffic Assignment for 1990 Model

VMT	76,304,886
VHT	2,114,992
VHT_FF	2,001,395
VMT_AM	5,511,617
VHT_AM	151,988
VMT_MD	4,981,127
VHT_MD	135,515
VMT_PM	7,423,812
VHT_PM	213,731
VMT_RD	1,891,426
VHT_RD	49,696

2.5 Transit Assignment

Table 2–7 Observed and Predicted Transit Ridership for 1990

	Pass	PassDist	PassHr	Observed Ridership	Error
Bus & Trolley	238,403	325,687	25,964	381,659	-38%
Subway	605,616	1,406,620	8,587	561,441	8%
Red line	203,791	690,165	2,921	185,671	10%
Blue line			631	45,798	20%

	54,837	112,855			
Orange line	152,417	341,636	1,565	120,486	27%
Green line	194,570	261,965	3,469	209,486	-7%
Commuter rail	130,793	1,699,821	14,359		