

The FHWA Travel Model Improvement Program Travel Model Validation Manual Update

(or Why Your Model is
Wrong and What to Do
About it)

Part II

presented by
Thomas Rossi
David Kurth
Cambridge Systematics, Inc.

October 28, 2010

1

Manual Chapters

- 1: Introduction – yesterday
- 2: Model Validation Plan Specification – yesterday
- 3: Validating Model Inputs – yesterday
- 4: Socioeconomic Models – yesterday
- 5: Amount of Travel/Activity– yesterday

2

Manual Chapters (continued)

6: Trip Distribution/Destination Choice/
Location Choice – yesterday

7: Mode Choice – today

8: Time of Day – today

9: Assignment Procedures

- Highway – yesterday
- Transit – today

3

Manual Chapters (continued)

10: Temporal Validation and Sensitivity Testing
– today

11: Validation Documentation – yesterday

4

The New Manual Discusses, for Each Model Process...

- Sources of Data
- Aggregate Checks
- Disaggregate Checks
- Criteria Guidelines
- Reasonability and Sensitivity Testing
- Troubleshooting Strategies
- Forecasting Checks

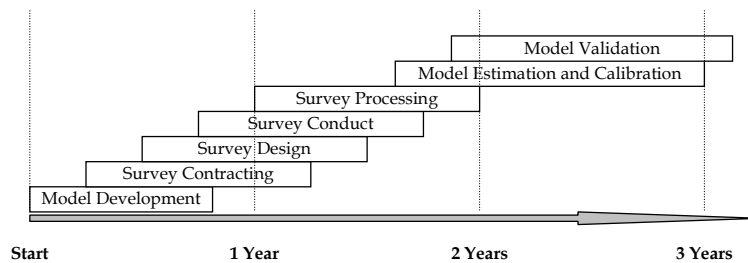
5

Temporal Validation and Sensitivity Testing (Ch. 10)

- Temporal validation
 - Forecasts / backcasts
 - Compare to observed data
- Sensitivity testing
 - Elasticities
 - Model response to changes in inputs
 - Coefficient sensitivity

6

Calibration / Validation Timeline



7

Sources of Temporal Validation Data

- Backcasts with new model
 - Archived travel survey data
 - Previous travel forecasts
 - Census data
 - Written reports

8

Sources of Temporal Validation Data

- “Forecasts” with existing model
 - Current traffic counts / boarding counts
 - American Community Survey data
 - New travel survey data

9

Sensitivity Testing

- Response to model inputs
- Coefficient confidence intervals
- **RISK ANALYSIS**

10

Mode Choice/ Vehicle Occupancy (Ch. 7)

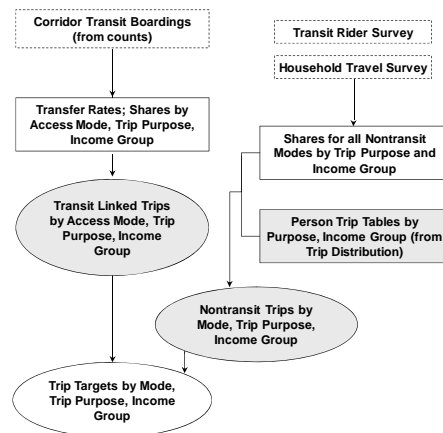
11

Data Sources

- Transit ridership counts
- Transit rider survey
- Household travel/activity survey
- Census data
- National sources
- Highway usage data

12

Example of Transit Mode Choice Validation Target Development



13

Other Considerations

- Regional comparison of mode shares not sufficient for validation
- Make sure total demand is correct
- Mode choice validation tied to transit assignment validation
- Transit trip lengths
 - For in-vehicle portion of transit trips (stop to stop)
 - For entire trips (origin to destination).

14

Disaggregate Validation

Mode Alternative	0 Vehicle	1 Vehicle	2 Vehicles	3+ Vehicles	All
Nonmotorized					
Number chosen	94	210	540	318	1,162
Standard deviation	15.0	28.0	53.0	38.0	72.6
Number predicted	66	156	530	302	1,054
Drive alone					
Number chosen	0	2532	8450	6466	1,7448
Standard deviation	0.0	50.8	89.6	71.6	135.4
Number predicted	0	2534	8408	6509	17,451
Shared ride					
Number chosen	200	98	372	284	954
Standard deviation	26.0	24.0	43.0	35.0	57.8
Number predicted	212	136	392	246	986
Transit-walk access					
Number chosen	58	56	26	12	152
Standard deviation	15.6	14.6	16.2	8.8	24.2
Number predicted	72	68	54	19	213
Transit-auto access					
Number chosen	6	18	18	4	46
Standard deviation	4.8	7.2	7.6	4.8	12.0
Number predicted	8	20	22	8	58
Total					
Number chosen	358	2,914	9,406	7,084	19,862
Number predicted	358	2,914	9,406	7,084	19,862

15

Examples of Home Based Work Mode Choice Model Parameters

Model	Year	Auto IVT (Min)	Auto OVT (Min)	Auto Operating Cost (\$)	Parking Cost (\$)	Transit IVT (Min)	Transit Walk Time (Min)	Transit Wait Time (Min)	Transit Transfer Time (Min)	Transit Cost (\$)
Composite ^a		-0.025	-0.050	-0.400	-1.200	-0.025	-0.050	-0.050	-0.050	-0.500
Dallas	1984	-0.030	-0.055	-0.460	-1.160	-0.030	-0.055	-0.055	-0.055	-0.460
Denver	1985	-0.018	-0.093	-0.350	-0.950	-0.018	-0.054	-0.028	-0.059	-0.440
Detroit	1965	-0.046	-0.260	-0.650	-0.650	-0.046	-0.064	-0.117	-0.038	-0.650
Los Angeles	1991	-0.021		-0.296	-0.296	-0.021	-0.053	-0.053	-0.053	-0.296
Milwaukee	1991	-0.016	-0.041	-0.450	-0.450	-0.016	-0.041	-0.041	-0.041	-0.450
Philadelphia	1986	-0.042		-0.260	-0.260	-0.011	-0.032	-0.051	-0.051	-0.115
Pittsburgh	1978	-0.047	-0.069	-2.100	-2.100	-0.047	-0.069	-0.069	-0.069	-2.100
Portland	1985	-0.039	-0.065	-1.353	-1.353	-0.039	-0.065	-0.040	-0.090	-1.353
Sacramento	1991	-0.025	-0.038	-0.279	-0.279	-0.025	-0.038	-0.038	-0.038	-0.279
St. Louis	1965	-0.023	-0.057	-1.170	-1.170	-0.023	-0.057	-0.057	-0.057	-1.170
Tucson	1993	-0.018		-0.184	-0.184	-0.018	-0.040	-0.040	-0.040	-0.184
Average		-0.029	-0.085	-0.687	-0.805	-0.027	-0.052	-0.053	-0.054	-0.682

16

Mode Choice Model

Sensitivity Tests: Changes to...

- Highway or transit times
- CBD parking costs
- Headways on selected transit routes/submodes
- Fares on selected transit submodes
- Development patterns for forecast years
- Number of households by income level for a forecast year

17

Vehicle Occupancy

- Occupancy level shares by purpose
- Average vehicle occupancy by purpose

18

Time of Day (Ch. 8)

- Aggregate methods/fixed factors
- Time of day choice models

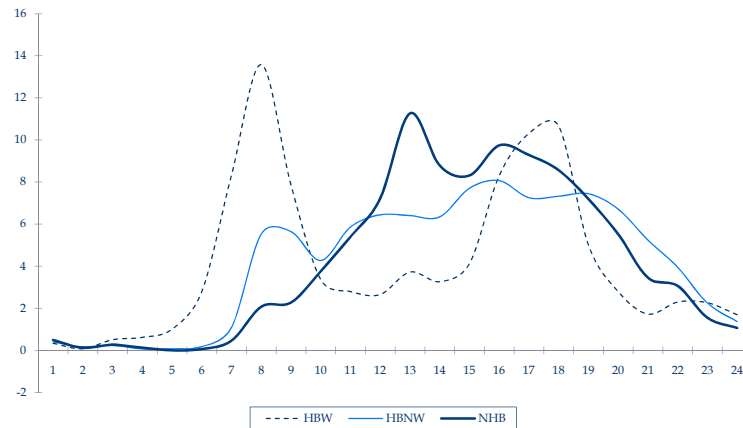
19

Data Sources

- Household travel/activity survey
- National sources
- Traffic counts
- Transit ridership counts
- Census journey-to-work data

20

Example Diurnal Distributions



21

Time-of-Day Percentages for Urban Areas of Approximately 1 Million in Population

	HBW		HBNW		NHB		All Trips	
	7-9 a.m.	3-6 p.m.	7-9 a.m.	3-6 p.m.	7-9 a.m.	3-6 p.m.	7-9 a.m.	3-6 p.m.
Austin	32.3%	20.8%	12.5%	23.8%	6.9%	24.6%	13.6%	23.7%
Buffalo	23.7%	26.7%	9.3%	23.6%	5.9%	23.6%	9.7%	23.8%
Greensboro	30.3%	24.0%	12.2%	25.6%	8.1%	26.7%	12.7%	25.8%
Jacksonville	29.6%	24.7%	10.4%	24.4%	9.1%	27.1%	11.6%	25.3%
Hartford	26.0%	29.5%	9.2%	25.3%	7.2%	20.5%	10.4%	24.3%
Memphis	35.0%	18.2%	13.6%	25.6%	6.9%	27.2%	13.5%	25.4%
Nashville	32.7%	23.8%	10.1%	24.9%	7.5%	24.7%	10.4%	24.7%
Providence	28.9%	33.7%	11.8%	24.9%	7.9%	16.3%	11.8%	22.4%
Raleigh	32.4%	26.3%	12.0%	26.5%	8.0%	19.1%	12.2%	24.0%
Average	30.1%	25.3%	11.2%	25.0%	7.5%	23.3%	11.8%	24.4%

Source: 2001 National Household Travel Survey

22

Types of Time of Day Checks

- Person trip/activity percentages
- Traffic volume checks
- Transit boarding checks
- Activity duration checks (for ABMs)
- Disaggregate checks (for choice models)

23

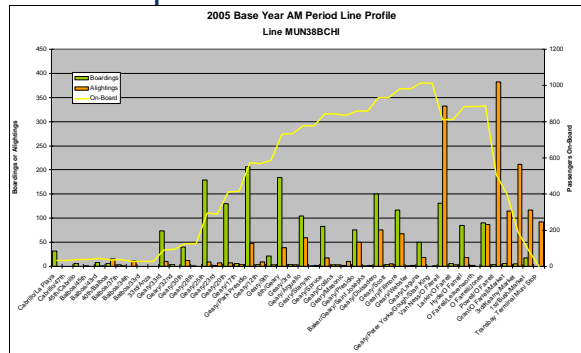
Assignment Procedures (Ch. 9) Transit Assignment

- Everything said about traffic count data...ditto
 - Boarding counts (often)
 - Boarding & alighting counts (sometimes)
 - Average number on board (rarely)
 - Park-and-ride lot utilization
- But, it's also better
 - On-board survey data

24

Transit Assignment Aggregate Checks

- Boardings by line
- Boardings per linked trip
- Route profiles
 - Logical?



25

Transit Assignment Disaggregate Checks

- Options with observed O-D data
 - Boardings by line
 - Comparison of individual boardings per linked trip

Assignment	Number of Linked Trips	Percent with Skipped Boardings:		
		Equal Reported Boardings	Greater Than Reported Boardings	Less Than Reported Boardings
Walk Access	854	67%	23%	9%
Drive Access	424	67%	25%	7%
All Trips	1,278	67%	24%	9%

26

Transit Assignment

FTA New Starts Guidance

- “Tell a coherent story.”
- Forecasting checks:

Demonstrating Reasonable Predictions of Change

- Models should provide reasonable predictions of change
 - ✓ Between today and a future no-build condition
 - ✓ Between a future no-build condition and a realistic alternative (i.e., a change in the transportation system)
- To be useful, tests of reaction to change must be done through applications of the model in full production mode
 - ✓ Findings can highlight problems not prevalent in base year conditions

Source: TMIP – *Shining a Light Inside the Black Box (2): Model Testing*