

# Highway Assignment

Note: Highway assignment also occurs as a feedback loop in the distribution phase. The pre mode choice assignment in distribution and the post mode choice assignment (final assignment) methods and parameters are consistent, with the exception of trip tables. In distribution, the mode choice split is assumed to be consistent with the 1993 Home Interview Survey, and final assignment accounts for any changes in mode share that are unique to the scenario.

## Path impedance function

In Version 2.1, path choice was based on minimizing the following function:

$$\text{COST} = (0.25 * \text{MINUTES} + 0.75 * \text{MILES}).$$

When time was the only consideration, freeways were loaded much heavier than they should have been. The heavy weighting on distance was to help bring volumes on both freeways and arterials closer to observed counts. Since the units on time and distance are inconsistent, it is difficult to relate these parameters in this way. In Version 3.0, both time and distance are converted to dollar values. Thus the time savings an alternative route offers is valued at \$4.00/hour, and the mileage savings the comparable route offers is valued at \$0.10/mile. The result is the following cost function:

$$\text{COST} = [(4 \text{ dollars/hour})(1\text{hour}/60 \text{ minutes})(\text{MINUTES}) + (0.10 \text{ dollars/mile}) * \text{MILES}].$$

This reduces to:

$$\text{COST} = (0.067 * \text{MINUTES} + 0.10 \text{ MILES}).$$

When factors are scaled up so as to sum to 1 (as in Version 2.1) the function is:

$$\text{COST} = (0.4 * \text{MINUTES} + 0.6 * \text{MILES}).$$

Thus Version 3.0 factors can be expressed in dollars, which can facilitate comprehension of the trade-offs between time and distance.

## Volume/Delay functions

Version 2.1 volume delay functions were of the standard BPR format:

$$\text{Congested Time (minutes)} = \text{Free flow time} * (1 + \text{Coefficient} * (V/C)^{\text{Exponent}})$$

The development of Version 3.0 experimented with Conical and Akcelic functions, but found little significant difference in either curve shapes or assignment results. Thus Version 3.0 continues with BPR format functions. The following compares Version 2.1 to 3.0. The graphic demonstrates the effect of the 3.0 functions. Note that the average speed of ramps drops to 10 mph by  $V/C = 1$ . This is to simulate not only the affect of ramp metering, but also the signal delay typically experienced when attempting to enter or leave a freeway ramp.

Table 1: Congested Speed Factors between Model Versions

Version 2.1	Coef	Exp	Version 3.0	Coef	Exp
Freeways/Ramps	0.88	6.5	Freeways	0.4	8
All else (traditional BPR)	0.15	4.0	Ramps	2	12
			Principals	0.5	4
			Minors	0.3	4
		Collectors	0.1	4	

The improvements to the volume-delay functions resulted in AM model speeds that compare well with observed data and modeled daily volumes that match observed traffic volumes reasonably well.

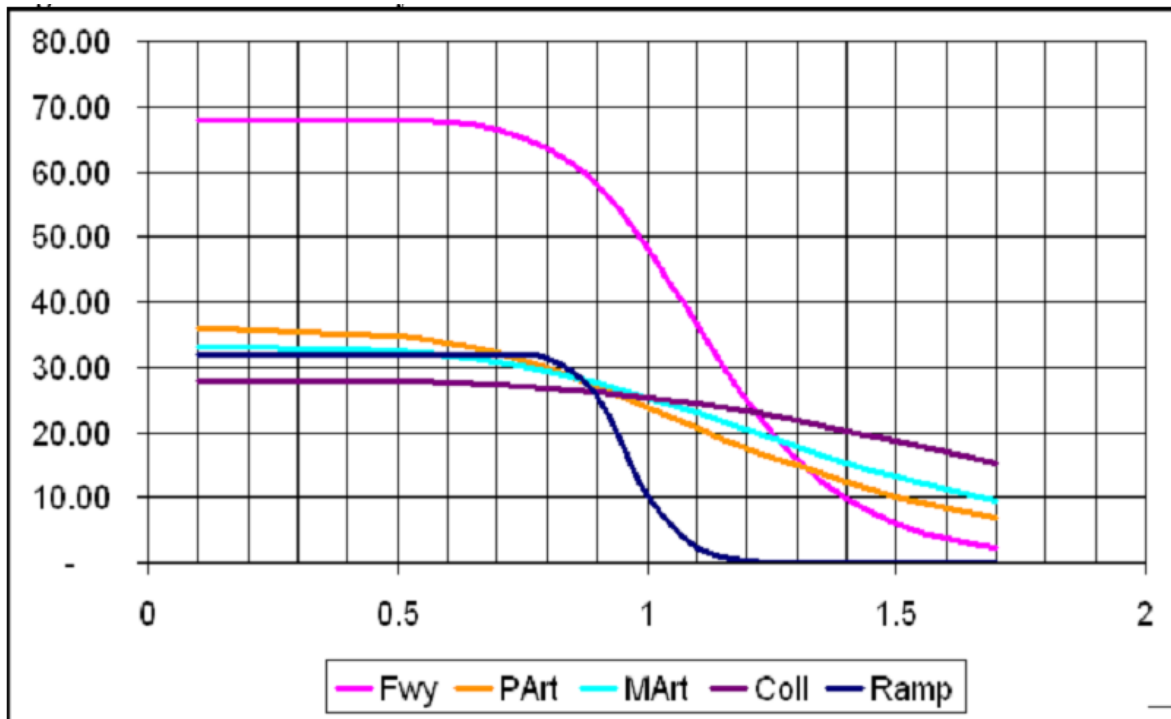


Figure 1: New Volume-Delay Function.

**CALIBRATION**  
**Average Speed Weighted By Number of Segments**

<b>Type</b>	<b>Area Type</b>	<b>Obs. Speed</b>	<b>Est. Speed</b>	<b>Segments</b>
<b>Freeways</b>	Rural	64.30	61.40	114
	Suburban	62.39	59.89	159
	Urban	56.26	58.06	114
<b>Pr. Arterials</b>	Rural	40.28	43.50	76
	Suburban	35.09	33.10	159
	Urban	29.09	26.09	69
	CBD	27.26	20.05	34
<b>M. Arterials</b>	Rural	39.01	38.60	113
	Suburban	32.73	32.25	301
	Urban	28.92	27.16	156
	CBD	28.11	21.57	85
<b>Collectors</b>	Rural	29.44	38.40	34
	Suburban	30.16	29.66	114
	Urban	27.72	24.82	109
	CBD	21.61	18.49	38

Figure 2: Highway Network AM Speed Comparison (2001 Model vs. Actual)

**Calibration Summary Link volume By Functional Type  
Four County Region**

<b>All Facility Types</b>		<b>ARTERIALS &amp; MULTILANE</b>	
Total UDOT Counts	70,421,980	Total UDOT Counts	40,434,877
Total Estimated Volume	68,187,203	Total Estimated Volume	40,476,888
Total Difference of Estimated and Observed links with counts	-2,234,777	Total Difference of Estimated and Observed links with counts	42,011
Total Number of Links in the Network (Links with UDOT Counts only)	5,775	Total Number of Links in the Network (Links with UDOT Counts only)	3,348
%Error (E-O/O)	-3.17	%Error (E-O/O)	0.10
FHWA recommended target % Error	5%	FHWA recommended target % Error	10-15%

<b>FREEWAYS</b>		<b>COLLECTORS &amp; RURAL ROADS</b>	
Total UDOT Counts	19,790,653	Total UDOT Counts	10,164,086
Total Estimated Volume	19,471,619	Total Estimated Volume	8,227,195
Total Difference of Estimated and Observed links with counts	-319,034	Total Difference of Estimated and Observed links with counts	-1,936,891
Total Number of Links in the Network (Links with UDOT Counts only)	445	Total Number of Links in the Network (Links with UDOT Counts only)	1,976
%Error (E-O/O)	-1.61	%Error (E-O/O)	-19.06
FHWA recommended target % Error	7%	FHWA recommended target % Error	25%

Figure 3: Daily Link Volume Comparison (2001 Model vs. Actual)

**By County and Facility Types**

<b>County</b>	<b>Freeways</b>			<b>Arterials</b>		
	Estimated	Observed	% Diff	Estimated	Observed	% Diff
Weber	956,310	1,119,015	-14.54	2,385,195	2,487,630	-4.12
Davis	3,017,477	3,122,301	-3.36	2,295,595	2,071,836	10.80
Salt Lake	8,481,973	8,971,734	-5.46	10,750,749	11,671,186	-7.89
Utah	3,226,456	3,380,258	-4.55	4,125,703	4,119,636	0.15
Total	15,682,216	16,593,308	-5.49	19,557,242	20,350,288	-3.90

<b>County</b>	<b>Locals</b>			<b>Total</b>		
	Estimated	Observed	% Diff	Estimated	Observed	% Diff
Weber	320,144	767,119	-58%	3,661,649	4,373,763	-16.28
Davis	394,842	1,146,586	-66%	5,707,914	6,340,723	-9.98
Salt Lake	1,586,030	3,395,762	-53%	20,818,752	24,038,682	-13.39
Utah	704,539	1,711,711	-59%	8,056,698	9,211,605	-12.54
Total	3,005,555	7,021,177	-57%	38,245,013	43,964,773	-13.01

Figure 4: Daily VMT Comparison (2001 Model vs. Actual)