The Travel Demand Model for the Macon Area

Prepared for
Georgia Department of Transportation
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1.0 Introduction

Transportation system studies are done periodically by the Georgia Department of Transportation, MATS and the MBTA to determine what types of transportation improvements or investments would best serve the public. Georgia DOT and MATS are primarily responsible for technical studies pertaining to the roadway system while the MBTA conducts studies of transit service.

The travel demand model is used to evaluate the performance of the roadway system in and around Macon by the Georgia Department of Transportation and MATS. The MATS model is a traditional urban area analysis tool that is used to identify where major improvements should be made to its principal thoroughfare system. Since there is usually more than one strategy proposed to address future congestion and safety concerns, the model is frequently used to study which combination of improvements provides the most end-user benefits. The output from the travel demand model is used to estimate mobile source emissions and perform the conformity analysis.

There are two key inputs to the travel demand modeling process, socio-economic data and the transportation system. Socio-economic data such as population, household and employment by type represents land use. Future year projections of socioeconomic data were based on a 2006 inventory of existing land uses including vacant land, as well as region wide forecasts of population, households and employment. Future year forecasts also considered planned major transportation improvements. Allocation of expected growth is then done using known development patterns and proposals as the basis, taking into consideration planned infrastructure improvements (new highways, sewer extensions, etc.). It is in this area of travel model development that land use and community planning are connected to the transportation planning process. Figure 1.1-1 shows the interaction between travel demand models and transportation system characteristics and population and employment characteristics

The other key element of the travel model is referred to as the highway network. The highway network is a computer file containing links and nodes that represent roadway segments and intersections. Each link record in the file contains information describing these items: free-flow travel speed, distance, number of lanes, area type (density of population and employment); facility type (similar to functional classification) and capacity. Node records simply contain positional, two dimensional x and y coordinates to enable the network file to be displayed pictorially.

Figure 1.1-1
Travel Demand Models

Source: Introduction to Travel Demand Forecasting
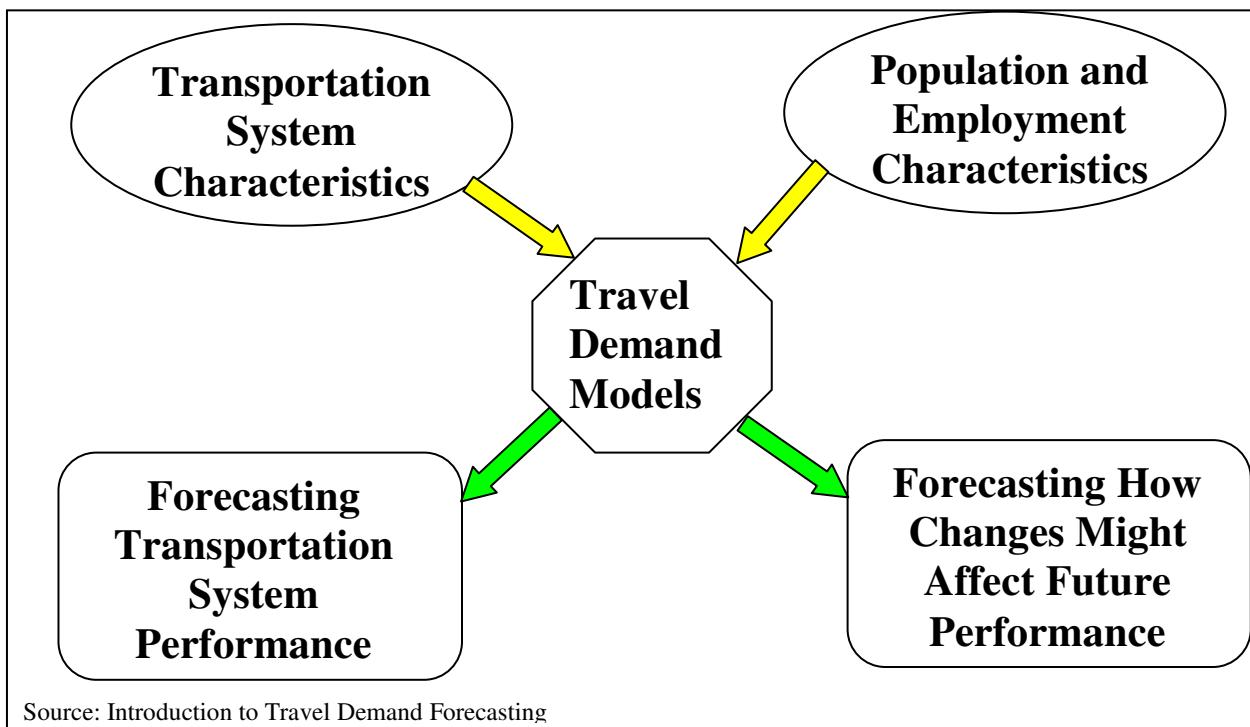
Georgia DOT is responsible for the development, maintenance and application of the MATS travel model. GDOT has updated various components of the MATS travel model to ensure that the model is state-of-the-practice and includes technical procedures that would be needed in developing the 2035 LRTP. A detailed description of the MATS' travel model is presented in Section 2. It includes explanations for how trips are estimated, how person trips are converted to vehicle trips, what attributes comprise the highway network and how trips are assigned onto the highway network. Each of the modeling steps involved in developing an urban travel model is described. These steps are as follows: Trip Generation; Trip Distribution; Mode Split; and Traffic Assignment.

2.0 Model Update

Several significant changes were made to the Macon area travel model. These changes are based on the original 2002 model and listed below.

- Updated the 1990 HPMS functional classification code to 2000 HPMS code in the network

- Updated base year highway network and trip generation for 2006 to 2035

- Updated the trip distribution model

- Updated the traffic assignment procedure

- Updated external trip data sets to 2006 and 2035 levels

- Split five existing TAZs (240, 253, 254, 269, 402) into 11 new zones

- Added the new zones in the network (zone 404-409)

- Renamed the external stations (from 404-430 to 414-440) to accommodate new zones

- Updated external trip data sets to 2006 and 2035 levels

- Updated network coordinate system from "NAD 1983 StatePlane Georgia West" (Unit as Mile) to "NAD_1983_Georgia_Statewide_Lambert" (Unit as Feet)

- Added the delta matrix post-process procedure to refine the final traffic assignment

The general structure of the Macon model is standard, in comparison with other travel demand models used in urban areas that are similar in size to Macon. Descriptions of each principal model element are presented in the subsequent parts of this section.

2.1 Highway Network Coding

The model network was updated to reflect 2006 conditions. The 2006 highway network was closely examined and revised to reflect base year conditions. The purpose of the highway network is to provide accurate routing paths based on the minimum time to travel from one traffic analysis zone to another. In effect, the highway network file is a simulation tool replicating the thoroughfare system in Macon, Bibb County and part of Jones County. A graphical representation of the model highway network by facility type is presented in Figure 2.1-1.

Figure 2.1-1
MATS 2006 Highway Network
Color Coded by 2000 HPMS Functional Classification
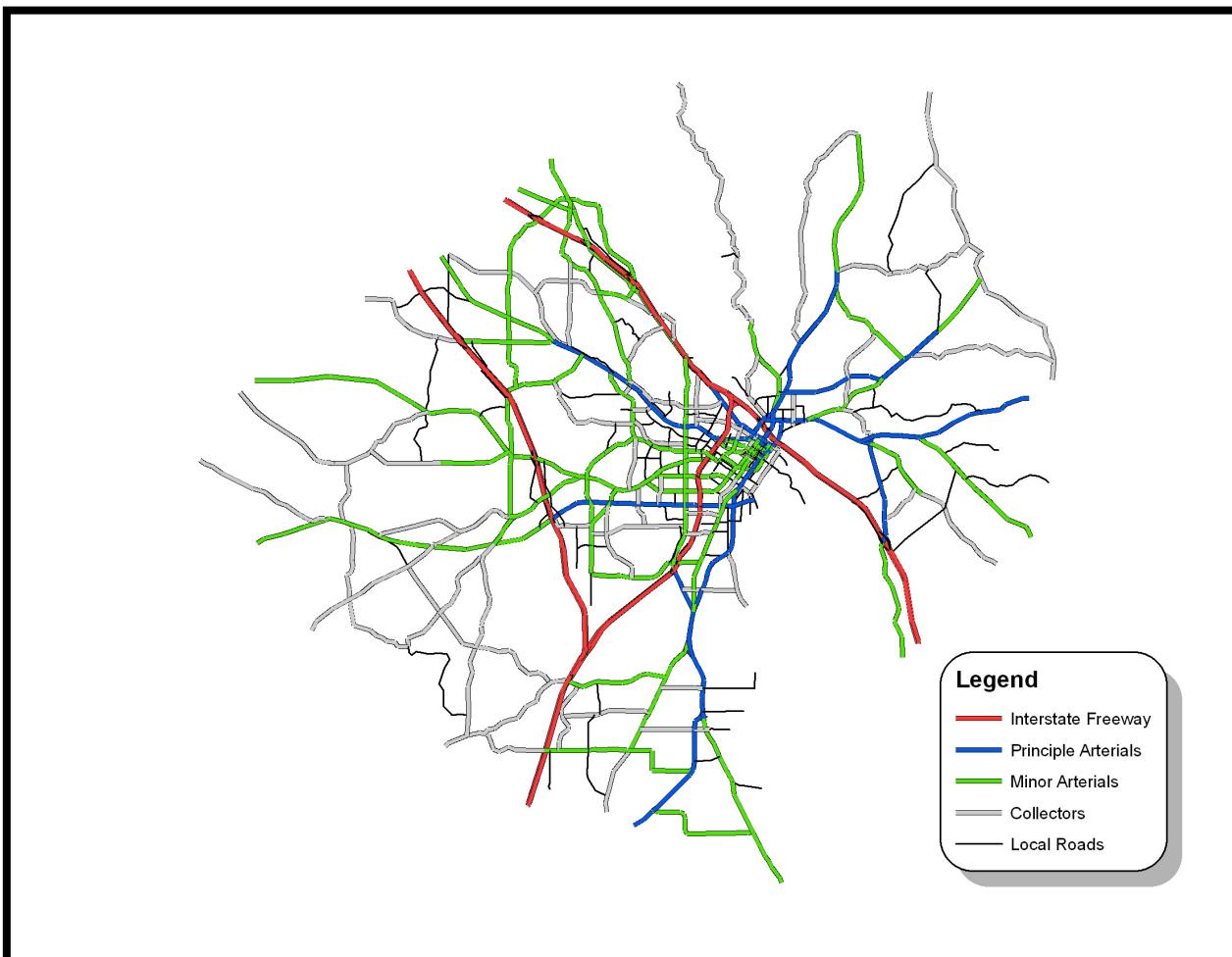
Facility Type and Area Type. Individually and in combination these two link attributes provide the framework for organizing the network into sub-groups so that free-flow speeds and capacities can be assigned. In combination with the distance and number of lanes, these attributes constitute the base layer of highway network data needed to update and apply the travel model. The facility type and area type definitions used in the MATS highway network and modeling process are shown in the table below.

Table 2.1-1

MATS Travel Demand Model – Facility and Area Types			
Code	**Facility Type**	**Code**	**Area Type**
1	Interstate	1	High Density Urban
2	Freeway	2	High Density Urban Commercial
3	Expressway	3	Urban Residential
4	Parkway	4	Suburban Commercial
6	Freeway to Freeway Ramp	5	Suburban Residential
7	Freeway Entrance Ramp	6	Exurban
8	Freeway Exit Ramp	7	Rural
11	Principal Arterial – Class I		
12	Principal Arterial – Class II		
13	Minor Arterial – Class I		
14	Minor Arterial – Class II		
15	One Way Arterial		
21	Major Collector		
22	Minor Collector		
23	One Way Collector		
30	Local Road		
32	Centroid Connector		

Capacity. Link capacities for the model network are obtained from a lookup table of per-lane hourly capacities based on facility type and area type. The final link capacity is calculated by multiplying the hourly capacity per lane by the number of lanes. The following table displays the hourly capacities per lane:

Table 2.1-2

MATS Travel Demand Model – Hourly Capacities Per Lane							
	Area Type						
Facility Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Interstate	1900	1950	2000	2050	2100	2060	2020
Freeway	1600	1660	1730	1790	1850	1820	1780
Expressway	1300	1380	1450	1530	1600	1570	1540
Parkway	1170	1240	1310	1370	1440	1410	1380
Freeway to Freeway Ramp	1400	1530	1650	1780	1900	1860	1820
Freeway Entrance Ramp	900	1030	1150	1280	1400	1370	1340
Freeway Exit Ramp	800	810	810	820	820	810	790
Principal Arterial – Class I	1000	1030	1050	1080	1100	1080	1060
Principal Arterial – Class II	900	900	900	900	900	880	860
Minor Arterial – Class I	800	810	810	820	820	810	790

MATS Travel Demand Model – Hourly Capacities Per Lane							
	Area Type						
Facility Type	1	2	3	4	5	6	7
Minor Arterial – Class II	630	630	640	640	640	630	610
One Way Arterial	760	760	770	770	770	760	740
Major Collector	520	530	540	550	560	550	540
Minor Collector	380	390	390	400	400	390	380
One Way Collector	460	470	470	480	480	470	460
Local Road	340	350	360	370	380	370	360
Centroid Connector	0	0	0	0	0	0	0

Speeds.   Link speeds in the model network are derived from a speed lookup table based on facility type and area type. Assumed free-flow speed are approximately 5 mph faster than typical speed limits for the various roadway classes and area types, taking into consideration control for delay (i.e. traffic signals) if applicable. Peak and off-peak free-flow speeds were evaluated using observed speeds obtained from a travel time study conducted in the Augusta area. Based on the initial study of the speeds, a revised speed table was developed. An analysis of the Augusta data determined that Augusta's characteristics and data results are appropriate for use in the Macon model since the travel dynamics for these urban areas are very similar. Final free-flow calibrated speeds are shown in the matrix below.

Table 2.1-3

MATS Travel Demand Model – Speed Matrix							
	Area Type						
Facility Type	1	2	3	4	5	6	7
Interstate	55	60	60	60	60	70	70
Freeway	50	55	55	55	55	60	60
Expressway	50	50	50	50	55	55	55
Parkway	45	50	50	50	50	55	55
Freeway to Freeway Ramp	55	55	55	55	55	55	55
Freeway Entrance Ramp	45	50	50	50	50	55	55
Freeway Exit Ramp	22	23	30	31	34	40	48
Principal Arterial – Class I	22	28	33	34	37	47	52
Principal Arterial – Class II	23	26	31	32	35	45	49
Minor Arterial – Class I	22	23	30	31	34	40	47
Minor Arterial – Class II	21	22	27	30	32	38	45
One Way Arterial	23	26	30	32	35	42	48
Major Collector	17	18	21	27	29	34	42
Minor Collector	14	15	18	24	26	30	40
One Way Collector	17	18	21	27	29	34	42
Local Road	14	14	17	18	22	28	35
Centroid Connector	14	14	17	18	22	28	35

Network Link Attributes.   All input network link attributes are included in the following table. While most of them are not directly involved in the model process, they provide assistances in

link attributes summary for post model result processing and for model calibration and validation.

Table 2.1-4

MATS Travel Demand Model – Input Network Link Attributes	
Attribute Name	**Description**
Area	Area Type (automatically added)
Lanes	Number of Lanes
Distance	Roadway Link Length in miles
County	County FIPS Code
Cstation	Traffic Count Station Number
Count02	2002 AADT - One Way
Screenline	Screenline ID
UAB	Urbanized Area Code
HPMS1990	HPMS Functional Classification Code, 1990
Roadname	Roadway Name
Ftype	Facility Type
Tcount02	2002 AADT - Two Way
Tcount06	2006 AADT - Two Way (from GDOT QA/QC Database)
Trkpct06	Truck Percent 2006
HPMS2000	HPMS Functional Classification Code, 2000
Count06	2006 AADT - One Way
GDOT_PI	GDOT Project Identification Number
Local_PI	Local Project Identification Number
Open_date	Model Year Open to Construction

Network Nodes Attributes. The network node contains three attributes designated to identify the accessibility of a node. Only the centroid nodes of the network are attached with these attributes which use "1" to indicate the availability of transit. The level of the accessibility is shown in the following table.

Table 2.1-5

MATS Travel Demand Model – Input Network Node Attributes	
Attribute Name	**Description**
Transit1	Centroid within 0.25 miles of transit access
Transit2	Centroid within 0.50 miles of transit access
Transit3	Centroid within 1.00 miles of transit access

2.2   Trip Generation

Trip generation is the first step in the traditional four-step modeling process.   It estimates the number of trips that will begin and end in each individual traffic analysis zone (TAZ).   These are referred to as "trip ends".   Trip ends generated by households are referred to as productions. Trip ends calculated from employment or school enrollment figures are referred to as attractions. This process is accomplished by establishing relationships between trips and socioeconomic variables. The process estimates the number of trip ends, or productions and attractions, for each traffic zone by various trip purposes.   Trip generation does not determine the origin and destination of each trip, only the total trips generated by each TAZ's socioeconomic characteristics.

In 1997, GDOT contracted with a consulting firm to assist in developing a new standardized trip generation process for the state's urbanized areas outside of Atlanta.   The Trip Generation Update Project included a household travel survey and external travel survey in the Augusta metropolitan area.   Household travel behavior by household size and income group is homogeneous from one urban area to another if transportation choices and land-use patterns are similar.   The Augusta survey information was used to formulate and recommend a trip generation process that is considered transferable to the State's other urbanized areas.

The new trip generation process includes trip production and trip attraction sub-models. For all trips that have origins and destinations inside the MATS region, excluding trucks, the trip production sub-model applies trip rates through a cross-classification of household size (1,2,3,4+) and automobiles available (0,1,2,3+).   Aggregate household data for each traffic analysis zone is disaggregated into sixteen cross-classified cells using a household stratification model.   The household stratification model is also a product of the Trip Generation Update Project.   This model breaks out the total number of MATS households into cross-classification cells using zonal income, Macon area specific data from the Census Transportation Planning Package (CTPP), and data from the Augusta household survey.   The trip production sub-model applies regression equations for other trip purposes.   The trip attraction sub-model applies regression equations for all trip purposes.

Typically, there are three types of trips that travel demand models include: (1) Internal-Internal (I-I) trips whose origin and destination are inside the study area boundary; (2) Internal-External (I-E) trips that have exactly one trip end inside the study area; and (3) External-External (E-E) trips that have both trip ends outside of the study area. I-I trips follow the production and attraction logic of trip formulation. They are commonly grouped into trip purposes so their characteristics can be reproduced by the chain of sub-models in the four-step process. I-E and E-E trips are developed separately using a different methodology that is heavily dependent on traffic counts observed on the principal roads leading into and out of the region.

2.2.1 Trip Purposes

Seven trip purposes were included in the trip generation process.   These purposes are summarized below:

1. **Home Based Work (HBW)**: All travel made for the purpose of work and which begins or ends at the traveler's home.
2. **Home Based Other (HBO):** Any trip made with one end at the home except those for the purpose of work or shopping.
3. **Home Based Shopping (HBS)**: Trips made for the purpose of shopping and which begins or ends at the traveler's home.
4. **Non Home Based (NHB)**: Any trip that neither begins nor ends at home.
5. **Internal-Internal Truck (IIT)**: Internal trips made by commercial vehicles.
6. **Internal-External Passenger Car (IEPC)**: Internal trips beginning or ending outside the modeled area, excluding trucks.
7. **Internal-External Truck (IET)**: Internal truck trips beginning or ending outside the modeled area.

2.2.2 Socioeconomic Data

The MATS provided 2006 Base Year socioeconomic data for the model. For each of the 409 traffic analysis zones (TAZ's) the following socioeconomic variables were collected for use in the trip generation model:

Population: The total number of individuals that are residing in each traffic zone.

Retail Employment: Number of employees working for retail businesses in a given traffic analysis zone where the business is located.

Industrial Employment: Number of employees working for industrial based businesses in a given traffic analysis zone where the business is located

Service Employment: Number of employees working for service based businesses in a given traffic analysis zone where the business is located.

Total Employment: The total number of employed persons in those traffic zones with employment.

Income: Average household income in TAZ in 2000 dollars (per 2000 Census).

Total Households: Total number of occupied households in a given traffic analysis zone.

School Enrollment: The total number of enrolled students in zones with educational facilities.

Acres: Area of TAZ in acres.

Appendix A contains the zonal level socioeconomic data used in the travel demand model for 2006. An illustrative picture of the zone boundary map is presented in Figure 2.2.2-1. There are

409 internal zones in the MATS model with 27 additional zones called external stations. The external station zones represent the key facilities where travel in and out of the MATS region occurs such as I-75, I-475 and I-16.

Figure 2.2.2-1
Map of Traffic Analysis Zones
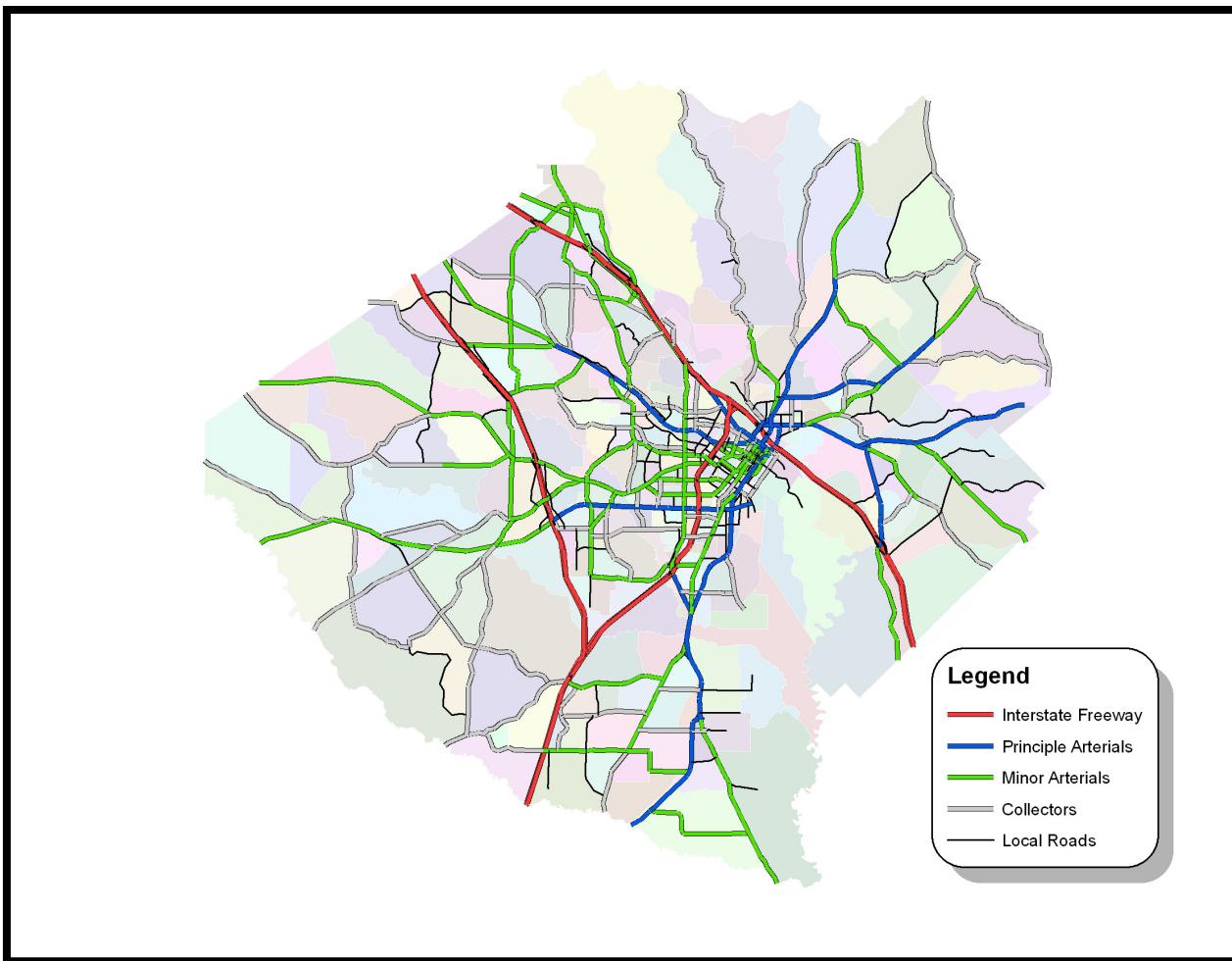
2.2.3 Household Stratification Model

The household stratification model subdivides the total number of households by TAZ into sixteen household strata defined by household size and the number of automobiles available. Stratification is done using zonal income, Macon area specific data from the Census Transportation Planning Package (CTPP), and data from the Augusta household survey. The model distributes the total households in a TAZ to each cross-classification cell by calculating a

relative[1] probability that a household will be a particular size with a particular number of automobiles. The relative probability is calculated with the following equation:

$P(i,j) = S * I * CF$, where

$P(i,j)$	=	Relative probability that a household will be size i and own j autos
S	=	Household size factor from CTPP lookup table
I	=	Income factor from CTPP lookup table
CF	=	Composite household factor from Augusta household survey lookup table.

An estimate of the number of households in a particular cross-classification cell is then calculated by multiplying the total number of households in the TAZ by the corresponding relative probability. The final number of households in each cross-classification cell is calculated by applying an adjustment factor to each calculated value. The adjustment factor is applied to insure that the sum of the resulting disaggregated households equals the original aggregate number of households. This process is represented mathematically with the following equations:

$HHij(est.) = HH * P(i,j)$, where

$HHij(est.)$	=	Estimated number of households of size i that own j autos
HH	=	Total number of households in the TAZ

$HHij = HHij(est.) * F$, where

$HHij$	=	Final number of households[2] of size i that own j autos
F	=	$HH / \Sigma HHij(est.)$, control total adjustment factor.

The three lookup tables used in the household stratification model are shown on the following pages.

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1 The term relative probability is used because the value is not technically a statistical probability.
2 Not rounded to an integer value to eliminate problems with round off errors.

Table 2.2.3-1

MATS 2000 Household Size CTPP Distribution						
Computed Persons/HH Ranges			HOUSEHOLD SIZES			
			1	2	3	4+
0.00	to	1.00	1.0000	0.0000	0.0000	0.0000
1.00	to	1.20	0.8839	0.0804	0.0357	0.0000
1.20	to	1.40	0.7353	0.1706	0.0553	0.0388
1.40	to	1.60	0.6200	0.2581	0.0791	0.0428
1.60	to	1.80	0.4562	0.3624	0.0991	0.0823
1.80	to	2.00	0.3849	0.3900	0.1072	0.1179
2.00	to	2.20	0.3445	0.3600	0.1425	0.1530
2.20	to	2.40	0.2755	0.3461	0.1806	0.1978
2.40	to	2.60	0.2232	0.3267	0.2012	0.2489
2.60	to	2.80	0.1969	0.3178	0.1978	0.2875
2.80	to	3.00	0.1541	0.2818	0.2123	0.3519
3.00	to	3.20	0.1400	0.2457	0.2137	0.4006
3.20	to	3.40	0.1300	0.2176	0.2035	0.4489
3.60	to	3.80	0.1200	0.2158	0.1912	0.4730
3.80	to	4.00	0.1100	0.2100	0.1789	0.5011
4.00	to	4.20	0.0700	0.1600	0.1200	0.6500
4.20	to	4.40	0.0900	0.1800	0.1400	0.5900
4.40	to	4.60	0.0300	0.1300	0.1400	0.7000
4.60	to	4.80	0.0500	0.1400	0.1079	0.7021
4.80	to	5.00	0.0300	0.1200	0.1000	0.7500

Table 2.2.3-2

MATS 2000 CTPP Household Income[3] Distributions					
TAZ-Level Median HH Income		Income Group 1	Income Group 2	Income Group 3	Income Group 4
$0	$4,999	0.8732	0.0981	0.0144	0.0144
$5,000	$9,999	0.7132	0.1863	0.0610	0.0396
$10,000	$14,999	0.5830	0.2553	0.1005	0.0612
$15,000	$19,999	0.4239	0.3674	0.1264	0.0823
$20,000	$24,999	0.3566	0.3151	0.2009	0.1275
$25,000	$29,999	0.2514	0.3005	0.2790	0.1691
$30,000	$39,999	0.1760	0.2859	0.2996	0.2386
$40,000	$49,999	0.1174	0.2065	0.3012	0.3749
$50,000	$59,999	0.0889	0.1783	0.2509	0.4818
$60,000	$69,999	0.0605	0.1123	0.1804	0.6469
$70,000	$79,999	0.0476	0.1004	0.1766	0.6754
$80,000	$89,999	0.0346	0.0885	0.1535	0.7233
$90,000	$99,999	0.0095	0.0870	0.1406	0.7629
$100,000	$109,999	0.0075	0.0851	0.1202	0.7872
$110,000	$119,999	0.0055	0.0825	0.0949	0.8171
$120,000	$124,999	0.0035	0.0800	0.0765	0.8400

3 Income Group 1: <=$14999; Group 2: $15000-$29999; Group 3: $30000-$47499; Group 4: >=$47500

Table 2.2.3-3

Household Size/Income/Auto Ownership Distribution (Augusta Household Travel Survey)					
Income Group	Persons Per Household	Autos Available			
		0	1	2	3+
1	1	0.3063	0.6689	0.0248	0.0000
	2	0.0978	0.6578	0.2222	0.0222
	3	0.0733	0.6909	0.1628	0.0730
	4	0.1000	0.5694	0.1765	0.1541
2	1	0.2548	0.4776	0.2259	0.0417
	2	0.0400	0.2140	0.6320	0.1140
	3	0.1111	0.1256	0.6033	0.1600
	4	0.0900	0.1080	0.5942	0.2078
3	1	0.1833	0.6056	0.1578	0.0533
	2	0.0274	0.1677	0.6343	0.1707
	3	0.0900	0.1050	0.5033	0.3017
	4	0.0600	0.0438	0.3862	0.5100
4	1	0.0577	0.6654	0.2000	0.0769
	2	0.0694	0.1044	0.5322	0.2939
	3	0.0200	0.0581	0.5098	0.4121
	4	0.0189	0.0405	0.5405	0.4000

2.2.4 Trip Production

The routine for computing trip productions uses cross-classified data from the household stratification model and applies trip rates to calculate Home Based Work, Home Based Other, Home Based Shopping, and Non Home Based Productions. Trip rates for each purpose are shown below.

Table 2.2.4-1

MATS Trip Generation Trip Rates				
Home Based Work				
	Household Size			
Autos Available	1	2	3	4+
0	0.285	0.750	1.556	1.000
1	0.751	1.165	1.780	1.727
2	0.733	1.305	1.625	2.109
3+	0.909	1.422	1.983	2.387
Home Based Other				
	Household Size			
Autos Available	1	2	3	4+
0	0.694	1.350	4.444	5.833
1	1.190	1.835	4.195	6.523
2	1.300	2.360	4.048	8.122
3+	1.818	2.688	3.600	7.312
Home Based Shopping				
	Household Size			
Autos Available	1	2	3	4+
0	0.367	0.558	0.222	0.417
1	0.411	0.882	0.585	1.023
2	0.200	0.675	0.490	0.769
3+	0.636	0.688	0.733	1.151
Non Home Based				
	Household Size			
Autos Available	1	2	3	4+
0	0.245	0.500	0.889	1.333
1	1.081	1.518	2.976	2.886
2	1.033	1.939	2.154	3.184
3+	1.364	2.016	2.667	3.720

Trip end productions for other purposes are calculated using the following regression equations:

I-I Truck Productions = 0.8404*Manufacturing Employment + 0.7971*Retail Employment + 1.0197*Wholesale Employment + 0.3424*Service Employment + 0.2481*Households
I-E Passenger Car Productions = 0.331*Households + 0.724*Total Employment
I-E Truck Productions = 0.078*Retail Employment + 2.149*Wholesale Employment + 0.228*Manufacturing Employment

2.2.5 Trip Attraction Sub-model

The trip attraction routine to compute the estimated number of trips attracted to each TAZ uses the following regression equations:

Home Based Work Attractions = 1.196*Total Employment
Home Based Other Attractions = 0.5077*Population + 0.967*Total Employment + 1.5258*School Enrollment
Home Based Shopping Attractions = 2.655*Retail Employment
Non-Home Based Attractions = 0.293(Population) + 2.82108*(Retail Employment + Wholesale Employment) + 0.6984*Service Employment
Internal Truck Attractions = Internal Truck Productions

Internal-External Attractions = Based on counts and EE% (internal zones=0)
Internal-External Truck Attractions = Based on counts, EE%, and Truck% (internal zones=0)

The total number of Internal-External (I-E) trips for each external station is calculated by subtracting the estimated number of External-External trips (based on an assumed percentage) from the station's daily traffic volume. Then the total I-E trips are separated into I-E truck trips and other I-E trips based on an assumed truck percentage at each external station. The following table displays the percentages that are used to calculate I-E and E-E Attractions at each external station for truck and passenger cars. For example, 60% of the daily traffic at station number 414 – I-75S is I-E while 40% is E-E.

Table 2.2.5-1

MATS Proportion of External-Internal Trips by External Station						Trucks		PC's	
2006 Station	2002 Station		2006	Percent	Percent	Percent	Percent	Percent	Percent
Number	Number	Road Name	Volume	Trucks	PC's	E-E	I-E	E-E	I-E
414	404	I-75/SR 401 (South)	77,186	30.0	70.0	20.0	10.0	20.0	50.0
415	405	Hartley Bridge/CR 716	3,930	5.0	95.0	0.0	5.0	0.0	95.0
416	406	Knoxville/CR 715	3,420	5.0	95.0	0.0	5.0	0.0	95.0
417	407	US 80/SR 22 (West)	5,240	5.0	95.0	3.0	2.0	0.0	95.0
418	408	Hopewell/CR 721	1060	5.0	95.0	0.0	5.0	0.0	95.0
419	409	Lower Thomaston	480	5.0	95.0	0.0	5.0	0.0	95.0
420	410	SR 74	2,730	11.0	89.0	1.0	10.0	4.0	85.0
421	411	Zebulon/CR 726	2,470	5.0	95.0	1.0	4.0	5.0	90.0
422	412	I-475/SR 408	59,630	25.0	75.0	20.0	5.0	25.0	50.0
423	413	US 41/SR 19 (North)	4,270	10.0	90.0	2.0	8.0	5.0	85.0
424	414	I-75/SR 401(North)	34,390	25.0	75.0	15.0	10.0	15.0	60.0
425	415	New Forsyth/CR 732	1,860	10.0	90.0	1.0	9.0	5.0	85.0
426	416	SR 87	8,510	10.0	90.0	2.0	8.0	5.0	85.0
427	417	Upper River Rd./SR 11	1610	5.0	95.0	0.0	5.0	0.0	95.0
428	418	Gray Hwy./US 129	18,120	10.0	90.0	2.0	8.0	5.0	85.0
429	419	SR 290	2,720	5.0	95.0	0.0	5.0	3.0	92.0
430	420	SR 49	8,130	10.0	90.0	2.0	8.0	3.0	87.0
431	421	Henderson Rd.	1,770	5.0	95.0	0.0	5.0	5.0	90.0
432	422	SR 57	5,990	10.0	90.0	1.0	9.0	3.0	87.0
433	423	Davis Road	850	5.0	95.0	0.0	5.0	0.0	95.0
434	424	US 80 (East)	2,070	10.0	90.0	1.0	9.0	3.0	87.0
435	425	Mill Road	620	5.0	95.0	0.0	5.0	0.0	95.0
436	426	I-16/SR 404	22,380	15.0	85.0	10.0	5.0	25.0	60.0
437	427	US 23/SR 87	3,220	10.0	90.0	1.0	9.0	3.0	87.0
438	428	US129 / SR247	25,210	10.0	90.0	1.0	9.0	3.0	87.0
439	429	US 41 (South)	7,850	10.0	90.0	1.0	9.0	3.0	87.0
440	430	Houston Rd.	6,340	5.0	95.0	1.0	4.0	2.0	93.0

2.2.6 External-External Trips

Two external-external (E-E) trip tables were estimated for the 2006 calibration. One for passenger cars and one for trucks. The external-external trip tables were developed based on the 2002 E-E trip patterns. A matrix summarizing the distance in miles between all external stations was developed using the 2006 network with illogical movements eliminated. This distance matrix serves as a "seed" to develop the E-E trip tables. The theory behind using distance between external stations to help predict external-external trips is that the greater the distance between external stations, the more likely there will be external-external trips between these external stations. For example, typically, the distance between two external stations on either end of an interstate facility would be longer and, likewise, the number of trips that will travel between the two external stations on either end of the interstate would be higher. The final 2006 external trip tables were estimated by applying the FRATAR procedure on the distance matrix to match the estimated E-E trips at each external station. Because E-E traffic volumes on collectors and local streets are relatively low, it is assumed these movements were negligible.

2.2.7 Special Generators

Special generators are used for zones or activity centers having trip rates that are not represented well by the standard trip generation process. During the MATS travel model calibration process, one area was identified where assigned trips were not matching observed traffic counts reasonably well. The location was in the vicinity of Arkwright Road/Tom Hill Sr. Blvd. and I-75. The I-E passenger car production trip ends were multiplied by a factor of 5 for zones 299, 368 and 369 in the Arkwright Road/Tom Hill Sr. Blvd. area around I-75 to make I-E trips more attractive.

2.2.8 Balancing Productions and Attractions

A TP+ script was developed for the trip generation process. Using 2006 socioeconomic data, the script calculates and balances the productions and attractions, writes the productions and attractions to a file, builds the E-E trip table, calculates Fratar factors, and applies the Fratar model to adjust the E-E table so that traffic volumes at external stations closely match traffic counts. The calculated productions and attractions for 2006 by zone are in Appendix B.

For most trip purposes in the MATS model, production and attraction trip ends are computed separately. As such, the sum of productions across all zones does not necessarily equal the sum of attractions. In reality though, each trip has two trip ends; one is a production/origin and one is an attraction/destination. In theory, it makes sense to equalize the sum of productions with the attractions across all zones which, in effect, "balances" the two types of trip ends. This balancing or reconciliation is performed in the trip generation script. The script uses the process listed below.

Balancing Productions and Attractions

1. Productions and Attractions are calculated for all internal TAZs by purpose.
2. Zonal attractions for each trip purpose are proportionally adjusted so the total attractions equal the total productions by purpose (i.e. attractions balanced to productions) for all internal zones.
3. Special generator productions and attractions are added/subtracted.
4. Non-home based productions are set equal to non-home based attractions (NHB trip productions were generated in the "home" zone, but by definition, NHB trips do not begin or end at the home. Therefore, the assumption is that the attraction variables are a better indicator of total trips than home based characteristics).
5. Attractions are balanced to productions for all internal zones (except NHB).
6. Internal-External Attractions (including trucks) are calculated for external stations.
7. I-E productions (including trucks) are balanced to the calculated attractions (assumes that since I-E attractions are based on traffic counts or external station projections, they provide the best controls).
8. The I-E productions and attractions are appended to the I-I trip end file to produce the final productions and attractions.

2.3   Trip Distribution

Trips are calculated for persons, by trip purpose, from the production and attraction trip ends. The trip distribution step uses the gravity model process, which is commonly used for this purpose in urban models. The estimated number of trips between any two origin-destination zones will, in general, be proportional to the number of trip ends (mass) and inversely proportional to the travel time. The gravity model computes trips such that the resulting distribution matches an observed distribution of trips by travel time for each of the trip purposes.

Minimum time paths for the network were calculated using the TP+ Hwyload function. These times include all turn prohibitory and turn penalties. The minimum times were then adjusted to include the intrazonal times, terminal times, and topographical penalties. Intrazonal times, the average time it takes to make a trip inside a particular TAZ, were created by the TP+ Matrix function using travel time to the nearest four TAZ's. Terminal times were assigned based on the employment density of the origin and destination TAZ's. At the trip origin, terminal time generally refers to the walk from one's residence to their car. At the destination end, it generally represents the time it takes to go from one's car to their destination. The following table summarizes the terminal time criteria:

Table 2.3-1

MATS Terminal Time Criteria						
	Employment Density (Total Employees per Acre)					
Zone	0-1.00	1.01-15.00	15.01-25.00	25.01-50.00	50.01-75.00	>75.00
Origin	1 minute	1 minute	2 minutes	2 minutes	2 minutes	2 minutes
Destination	1 minute	2 minutes	3 minutes	5 minutes	6 minutes	7 minutes

Topographic penalties were added during the model calibration process. These penalties were added to improve the estimated travel patterns between large sections of the model. They take the form of a time handicap that is added to specific inter-zonal times. It tends to reduce the number of trips calculated during the trip distribution process for those origin-destination pairs where they are applied. In Macon, time handicaps were applied to interzonal times for origin-destination pairs located on opposite sides of the Ocmulgee River, for trips with an origin-destination in Downtown/Intown Macon, and South Bibb. The latter reflects the proximity of Warner Robins and Robins Air Force Base.

Average trip travel times are displayed in the following table. These are typical trip travel times, found in urban areas the size of Macon. Home Based Work trips have the longest trip travel time at 21.8 minutes while Non Home Based trips have the shortest travel time at 16.4 minutes. The comparison of the model results with the target values is shown in Appendix C.

Table 2.3-2

MATS Average Trip Travel Times	
Trip Purpose	**Average Trip Travel Time (Time)**
Home Based Work	21.8
Home Based Other	16.8
Home Based Shopping	16.3
Non Home Based	16.4
Trucks	19.1

Gravity model input consists of a set of travel time impedance factors (friction factors), in addition to the production trip ends, attraction trip ends and minimum time skim. These parameters force the gravity model to produce sets of trips by trip purpose, whose distributions approximate an observed travel time distribution.

2.4 Mode Split

The mode split process determines what mode of travel will be used to make the trips between zones. A trip-end model was used to determine the number of transit trips. Trip-end models are based on socio-economic characteristics within traffic zones (i.e., income, auto-ownership, etc.), rather than service characteristics between zones. Trip-end models can serve as a reasonable tool for estimating changes in regional transit ridership levels in response to changes in regional transit investments and policies.

Since trip-end models are based on zonal attributes, the implied assumption is that transit ridership consists primarily of "captive" riders who must use transit, and a fixed share of those who choose to use transit over other available modes. A trip-end modeling approach has been developed that can be used to test the effectiveness of system-wide transit improvements. The general approach is as follows:

1. Transit trip rates are calibrated to replicate base year transit ridership totals. Transit trip rates are stratified by auto ownership level (0 autos; 1 auto; 2 autos; 3+ autos)[4].
2. Each Traffic Analysis Zone (TAZ) is coded with attributes that designate whether a zone is within three transit service area buffers (0.25-mile, 0.5-mile and 1-mile).
3. Transit service area attributes are used to estimate the percentage of households in each zone that have access to transit.
4. Transit trips are estimated by applying transit trip rates to households that are within the transit service area.
5. Highway person trip tables are estimated by subtracting transit trips from the total person trip tables estimated in the trip generation model.

Future regional-level transit policies can be tested, including transit service area expansion, fare adjustments and headway[5] changes. Trip rates can also be factored to test the effects of attracting more choice riders. Base year operating costs and revenues are used to estimate the costs of the regional transit policies.

After the transit trips are calculated and subtracted, the remaining person trips are converted to vehicle trips for the internal trip purposes (HBW, HBO, HBS and NHB). Average auto occupancy rates by purpose from various sources such as the Census Journey-to-Work data and other national travel surveys were used to estimate the Macon average auto occupancy rate. The other trip tables, internal truck and I-E and E-E passenger car and truck trips were calculated in

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4 Initial trip rates were calculated from the 1997 Augusta Household Travel Survey, and are scaled proportionally to produce observed trip totals.
5 Using typical fare and headway elasticities.

terms of vehicle trips at their inception. Conversion to vehicle trip table enables comparison to vehicle counts and capacity analyses.

The following trip table factors or vehicle occupancy rates were used in the MATS model:

Table 2.4-1

MATS Vehicle Occupancy Rates	
Trip Purpose	**Occupancy Rate**
Home Based Work	1.12
Home Based Other	1.65
Home Based Shopping	1.48
Non Home Based	1.68
Internal Trucks	No adjustment – already vehicle trips
Internal-External	No adjustment – already vehicle trips
Internal-External Trucks	No adjustment – already vehicle trips

2.5 Traffic Assignment

The last step in the modeling sequence is the assignment or simulation of the trip tables to logical routes in the highway network. Trip assignment for the MATS model was accomplished using the equilibrium assignment technique. The traffic assignment algorithm is iterative, running through successive applications until equilibrium occurs. Equilibrium occurs when no trip can be made by an alternate path without increasing the total travel time of all trips in the network. The equilibrium assignment is an iterative process that reflects travel demand assigned to minimum time paths as well as the effects of congestion. In each iteration, traffic volumes are loaded onto network links and travel times are adjusted in response to the volume to capacity relationships. Final assigned volumes are derived by summing a percentage of the loadings from each iteration. The percentages reflect congested conditions that usually influence motorists' path selection for a portion of the day, not the entire day.

During the model run, additional network link attributes are attached to the input network to store assignment results as well as values used in the traffic assignment. These additional attributes provide volumes, travel time, speed, and so on for each link, and can be used to summarize network-wide link statistics. A list of these attributes is shown in Table 2.5-1.

Table 2.5-1

MATS Travel Demand Model – Output Network Attributes	
Attribute Name	**Description**
Taz	Nearest Taz ID
Atype	Area Type
Hcap	Hourly Capacity
Capacity	Daily Capacity

MATS Travel Demand Model – Output Network Attributes	
Attribute Name	**Description**
Speed	Freeflow Speed in Mile per Hour
Time_ff	Free Flow Travel Time
Time_op	Off-peak Travel Time
Linkclass	Linkclassification Used in Assignment
V_1	Daily Volume (One-way)
Vc_1	Daily Volume over Capacity Ratio
Cspd_1	Congested Speed in Mile per Hour
Vht_1	Vehicle Hour of Travel
Vt_1	Daily Volume (Two-way)
Count	Base Year Traffic Count (One-way)
V_hbw	Daily Volume (Home Based Work)
V_hbo	Daily Volume (Home Based Other)
V_hbs	Daily Volume (Home Based Shopping)
V_trk	Daily Volume (Truck)
V_ie	Daily Volume (Internal-external Passenger Cars)
V_ietrk	Daily Volume (Internal-external Trucks)
V_eepc	Daily Volume (External-external Passenger Cars)
V_eetrk	Daily Volume (External-external Trucks)
V_Totalpc	Daily Volume (Total Passenger Cars)
V_tottrk	Daily Volume (Total Trucks)
Vmt_1	Total Daily Vehicle Mile of Travel
Vcnt	Daily Volume over Base Year Count Ratio

2.5.1 Model Calibration

Georgia DOT requires refinements to various model parameters until the base year (2006) model sufficiently replicates observed 2006-level travel patterns. The base year model was checked for accuracy by determining the percent error of assigned volumes compared to ground counts and by checking the reasonableness of the model's Vehicle-Miles Traveled (VMT) statistics. Also, the model was tested along screenlines to indicate if there were any broad areas where trips appeared to be consistently overestimated or underestimated. Results from each of these tests are presented in the following tables and figures.

Georgia DOT requires multiple validation checks to each of the major steps in the travel demand modeling process. Output modeled volumes are validated against traffic counts at several levels – regional, corridors (screenlines & cutlines) and link-by-link. Regional evaluations include VMT, Root Mean Squared Error (RMSE) and R-Squared calculations. Corridor evaluations are primarily screenline and cutline comparisons. Nationally recognized maximum desirable deviation standards are applied to analyze model performance at the link level. These include

FHWA's "*Calibration & Adjustment of System Planning Models*", 1990 and the NCHRP Report 365: "*Travel Estimation Techniques for Urban Planning*", 1998.

One of many steps in the validation process involves screenlines. Screenlines are defined by features such as railroads, creeks, and rivers. Since all roadways are not reflected in the travel demand model, these types of features serve to funnel traffic into corridors so that all trips can be analyzed where crossing of these features is possible. Cutlines are imaginary lines drawn perpendicular to roadways to assist with analyzing traffic flow between geographic areas, such as north to south, east to west, etc. Figure 2.5.1-1 depicts the locations of screenlines and cutlines used during the validation process. Where each screenline or cutline crosses a roadway can be identified by following the color coded links across the MATS area.

Figure 2.5.1-1
MATS Screenline Locations
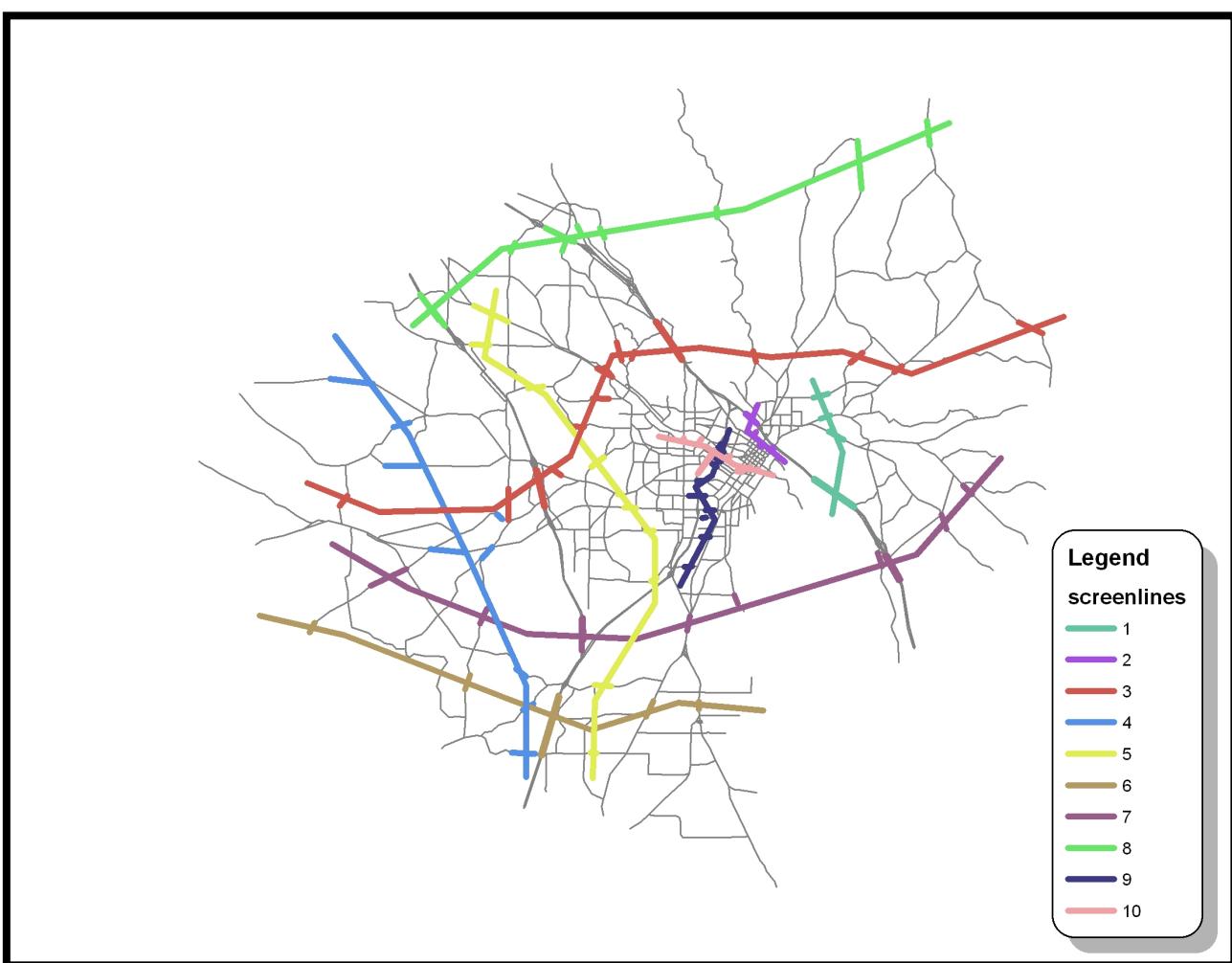
Table 2.5.1-1 lists the results of the screenline/cutline analysis. All of the model volumes for the screenlines are well within the acceptable range of error when compared to the observed traffic volumes.

Table 2.5.1-1

MATS Summary of the Screenlines – Delta Matrix		
Screenlines	**Target Range / Value**	**MATS 2006 Model**
All Counts	+/- 9%	1 %
East of I-16	+/- 23 %	1 %
West of I-16	+/- 22 %	3 %
North of Macon	+/- 17 %	3 %
West of Macon	+/- 36 %	3 %
Central Macon	+/- 19 %	0 %
Far South of Macon	+/- 23 %	-1 %
South of Macon	+/- 20 %	1 %
Far North of Macon	+/- 21 %	-1 %
East of I-75	+/- 26 %	0 %
South of Downtown	+/- 23 %	-3 %

Table 2.5.1-2 lists the results of the comparison between the MATS model assigned volumes and the observed volumes for each link within each screenline. In most cases, the largest differences between the model and observed counts occur on the less traveled facilities.

Table 2.5.1-2

MATS 2006 Screenline/Cutline Results					
Screenline 1: East of I-16					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Jeffersonville	10,040	11,140	0.9	-9.87%	36.50%
SR 11/Gray Hwy	23,320	21,470	1.09	8.62%	27.42%
Emery Hwy.	17,880	16,400	1.09	9.02%	30.84%
I-16	22,780	22,525	1.01	1.13%	26.85%
I-16	21,620	22,525	0.96	-4.02%	26.85%
SR 49/Shurling	23,060	23,780	0.97	-3.03%	26.22%
Total	118,700	117,840	1.01	0.73%	23.30%

Screenline 2: West of I-16					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
I-16	41,750	39,635	1.05	5.34%	20.99%
I-16	42,610	39,635	1.08	7.51%	20.99%
Second	12,840	10,660	1.20	20.45%	37.21%
M.L.King	20,220	19,720	1.03	2.54%	28.46%
Spring	20,600	23,870	0.86	-13.70%	26.18%
Total	138,020	133,520	1.03	3.37%	22.22%
Screenline 3: North of Macon					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Upper River Rd	2,460	2,000	1.23	23.00%	77.19%
SR 11/Gray Hwy	23,320	21,470	1.09	8.62%	27.42%
New Clinton	3,980	3,230	1.23	23.22%	62.63%
Henderson Rd.	1250	1,450	0.86	-13.79%	88.82%
I-475	32,420	30,505	1.06	6.28%	23.53%
I-475	31,220	30,505	1.02	2.34%	23.53%
Milledgeville Rd	15,480	15,850	0.98	-2.33%	31.30%
I-75	31,220	29,430	1.06	6.08%	23.90%
I-75	29,980	29,430	1.02	1.87%	23.90%
North Lizella Rd	3,050	2,800	1.09	8.93%	66.66%
Forest Hill	8,910	8,020	1.11	11.10%	42.13%
Heath	6,850	7,640	0.90	-10.34%	43.03%
SR 19/US 41	23,600	23,890	0.99	-1.21%	26.17%
Riverside	23,310	25,160	0.93	-7.35%	25.59%
SR 74	18,190	19,190	0.95	-5.21%	28.80%
Wimbish	8,310	8,200	1.01	1.34%	41.72%
Mumford	3,580	1,300	2.75	175.38%	93.15%
Total	267,130	260,070	1.03	2.71%	17.23%
Screenline 4: West of Macon					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Mt. Pleasant	6,320	7,300	0.87	-13.42%	43.89%
Hartley Bridge	5,410	4,000	1.35	35.25%	57.06%
Columbus Rd	6,050	5,510	1.10	9.80%	49.62%
Thomaston	2,880	2,820	1.02	2.13%	66.45%
SR 74	3,440	3,500	0.98	-1.71%	60.48%
Fulton Mill Rd	5,290	5,380	0.98	-1.67%	50.14%
SR 22/US 80	8,920	8,380	1.06	6.44%	41.33%
Sardis Church	1,860	1,930	0.96	-3.63%	78.40%
Total	40,170	38,820	1.03	3.48%	35.58%

Screenline 5: Central Macon					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Sardis Church	4,300	2,080	2.07	106.73%	75.89%
Tucker	9,660	9,810	0.98	-1.53%	38.58%
I-75	16,490	17,470	0.94	-5.61%	30.00%
Rocky Creek Rd	23,270	21,450	1.08	8.48%	27.43%
Hartley	12,520	11,000	1.14	13.82%	36.70%
Log Cabin	12,400	12,140	1.02	2.14%	35.16%
SR 74	35,450	34,940	1.01	1.46%	22.17%
US 80/SR 22	28,970	29,860	0.97	-2.98%	23.75%
I-75	16,100	17,470	0.92	-7.84%	30.00%
Williamson Rd	8,110	8,950	0.91	-9.39%	40.16%
SR 19/US41	3,300	3,600	0.92	-8.33%	59.74%
Zebulon	25,960	27,130	0.96	-4.31%	24.76%
Total	196,530	195,900	1.00	0.32%	19.20%
Screenline 6: Far South of Macon					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
I-75	38,570	39,175	0.98	-1.54%	21.09%
I-75	38,600	39,175	0.99	-1.47%	21.09%
US129 / SR247	29,630	28,890	1.03	2.56%	24.09%
Houston Rd	9,370	10,100	0.93	-7.23%	38.10%
Knoxville	3,420	3,420	1.00	0.00%	61.09%
Fulton Mill	2,580	2,600	0.99	-0.77%	68.85%
Total	122,170	123,360	0.99	-0.96%	22.90%
Screenline 7: South of Macon					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Riggins Mill	2,580	2,950	0.87	-12.54%	65.16%
I-475	28,920	28,145	1.03	2.75%	24.37%
I-75	16,490	17,470	0.94	-5.61%	30.00%
I-16	11,180	11,185	1.00	-0.04%	36.44%
I-16	11,190	11,185	1.00	0.04%	36.44%
Jeffersonville	2,190	2,090	1.05	4.78%	75.73%
SR 87/US 129	5,640	4,200	1.34	34.29%	55.86%
Mead Rd	5,140	3,490	1.47	47.28%	60.55%
SR247	43,000	43,000	1.00	0.00%	20.25%
I-75	16,100	17,470	0.92	-7.84%	30.00%
I-475	28,420	28,145	1.01	0.98%	24.37%
Knoxville	3,040	3,270	0.93	-7.03%	62.30%
Fulton	3,690	3,960	0.93	-6.82%	57.31%
Total	177,580	176,560	1.01	0.58%	19.98%

Screenline 8: Far North of Macon					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Gray Hwy. (US129)	17,770	18,120	0.98	-1.93%	29.52%
Lite-N-Tie Rd.	2,720	2,720	1.00	0.00%	67.51%
Arkwright	1620	1,630	0.99	-0.61%	84.40%
SR 87	12,350	12,580	0.98	-1.83%	34.62%
Forest Hill	2,630	2,400	1.10	9.58%	71.29%
I-75	20,300	20,335	1.00	-0.17%	28.08%
I-475	29,820	29,815	1.00	0.02%	23.76%
Upper River Rd	1,380	1,610	0.86	-14.29%	84.85%
I-75	20,730	20,335	1.02	1.94%	28.08%
Bass Rd	10,680	11,320	0.94	-5.65%	36.25%
I-475	29,800	29,815	1.00	-0.05%	23.76%
Total	149,800	150,680	0.99	-0.58%	21.22%
Screenline 9: East of I-75					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Hardeman Ave	12,700	16,500	0.77	-23.03%	30.76%
US 80	13,840	15,410	0.90	-10.19%	31.69%
man	6,510	7,000	0.93	-7.00%	44.70%
Little	17,790	14,510	1.23	22.61%	32.53%
Anthony	6,570	4,500	1.46	46.00%	54.20%
Newberg	4,340	4,500	0.96	-3.56%	54.20%
Rocky Creek	8,330	5,500	1.51	51.45%	49.66%
Hightower	2,220	2,300	0.97	-3.48%	72.63%
Forsyth	11,910	14,160	0.84	-15.89%	32.88%
Total	84,210	84,380	1.00	-0.20%	26.47%
Screenline 10: South of Downtown					
Road Name	**2006 Assign Volume**	**2006 Observed Count**	**Volume /Count Ratio**	**Percent Deviation From Base**	**Maximum Desirable Deviation**
Fifth St	5,030	2,650	1.90	89.81%	68.28%
College St	5,990	7,000	0.86	-14.43%	44.70%
First St	7,410	7,940	0.93	-6.68%	42.31%
I-75	39,750	42,045	0.95	-5.46%	20.45%
Second	6,350	6,540	0.97	-2.91%	46.05%
I-75	40,050	42,045	0.95	-4.74%	20.45%
SR 247	20,170	21,000	0.96	-3.95%	27.69%
Total	124,750	129,220	0.97	-3.46%	22.50%

Another way of viewing link validation is through the use of a scatter plot that depicts the relationship between traffic counts and modeled volumes. The following graphic depicts this relationship for the MATS 2006 network. The graphic indicates that the majority of modeled volumes are consistent with the traffic counts. It should be noted that it is normal to have outliers, both high and low. The R^2 value of 0.9483 indicates the model successfully replicates base year travel characteristics.

Figure 2.5.1-2
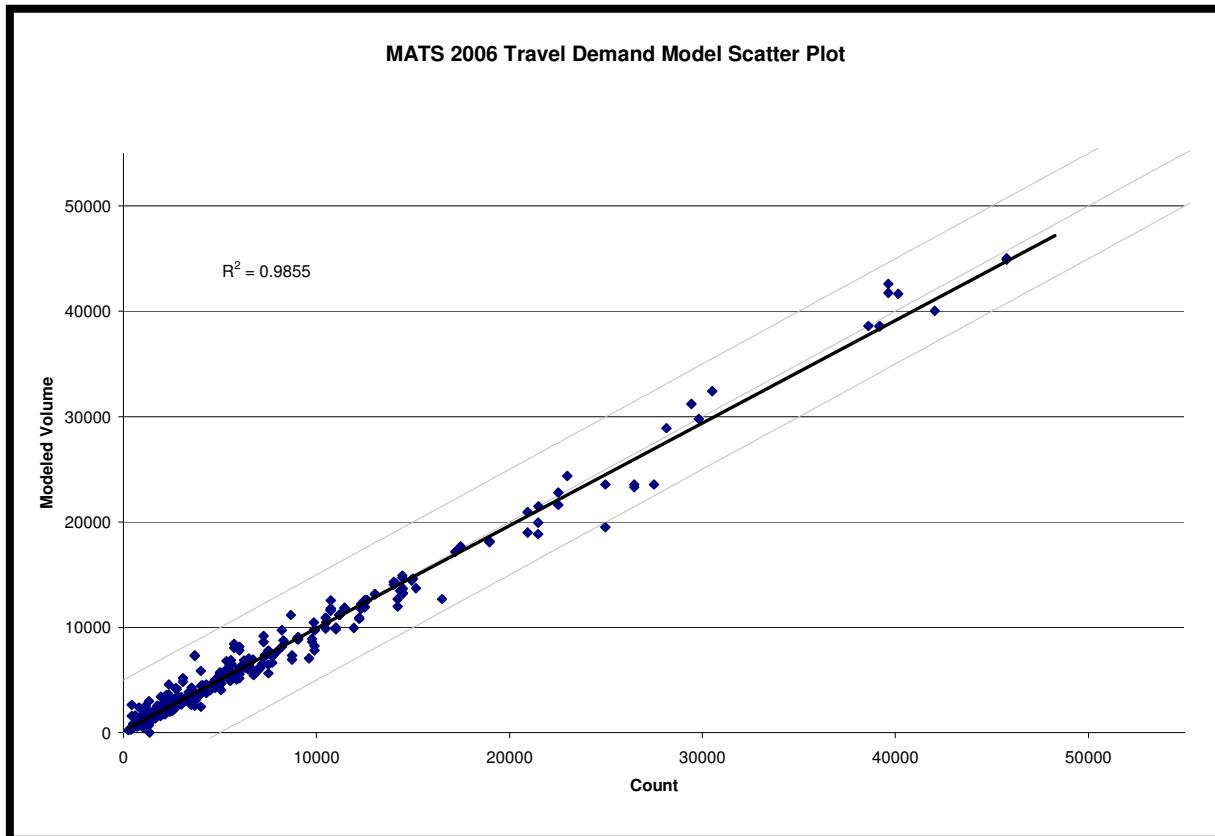
Collector and local streets were not included in the model deviation validation analysis.

The modeled traffic volumes summarized by facility type are shown in Table 2.5.1-3. The HPMS VMT is based on the Georgia Department of Transportation's Office of Transportation Data "445" report as well as on the 2006 RC database. The HPMS VMT numbers represent the average annual daily VMT for the year 2006 for all of Bibb County and a third of Jones County. The HPMS VMT for Jones County was prorated based on roadway mileage.

The highway network and trip table are considered to provide a good representation of travel conditions on the existing system if the total percent error region-wide is less than +/-5 percent. For the MATS model, the total percent error region-wide is less than 1.0% excluding the local streets. Calculating the percent error by facility type indicates whether the model is loading trips in a reasonable manner. The MATS model is performing very well estimating traffic volumes for all of the facility types except for local roads. This is not surprising or alarming since most of

the local roads in an urban area are usually not included in a regional travel demand model. These volumes are provided below just for informational purposes only.

Table 2.5.1-3

MATS Model Area VMT Statistics				
	VMT		Between Model and HPMS	
Facility Type	**Model**	**HPMS**	**Difference**	**Percent**
Interstate	2,316,953	2,381,608	-64,655	-3%
Principal Arterials	968,211	966,347	1,864	0%
Minor Arterials	1,297,517	1,242,472	55,045	4%
Collectors	511,537	493,135	18,402	4%
Total excluding Local Roads	5,094,218	5,083,561	10,657	0%
Local	792,897	389,723	403,174	51%
Total including Local Roads	5,887,115	5,473,285	413,830	7%

Comparing the deviation of assigned link volumes with the maximum desirable deviation is also a method for validation and calibration check. The higher the link traffic count, the smaller the maximum desired deviation allowed on that link. Generally, models should be able to replicate traffic volumes on higher facilities more accurately than those on lower facilities. Higher facilities have higher usage and often are focuses of transportation policy making. Therefore, how well the model assigns trips on these facilities is another indicator for how well the model is validated and calibrated and how useful the model would be. Figure 2.5.1-3 shows the comparison of the maximum desired deviation curve and the model assigned volumes. Figure 2.5.1-4 illustrates trip-loaded network. The model performed very well system-wide with almost all major facilities within the maximum desired deviation allowed.

Figure 2.5.1-3
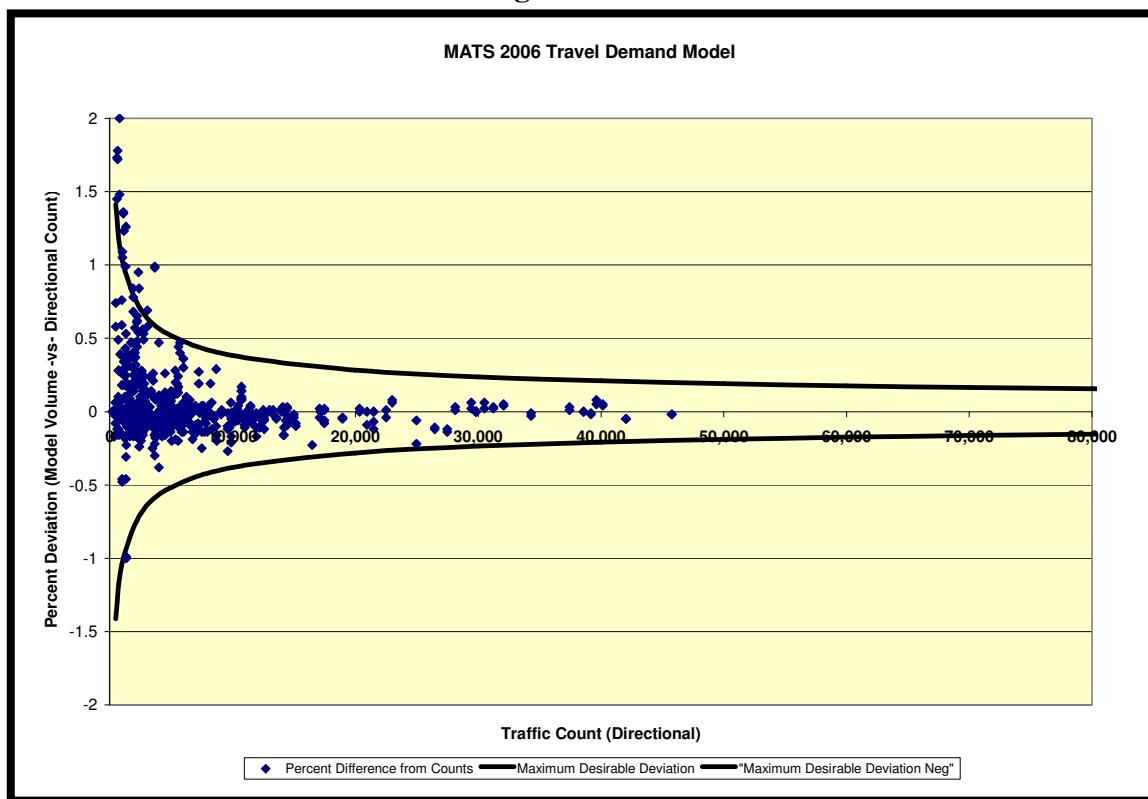
Figure 2.5.1-4
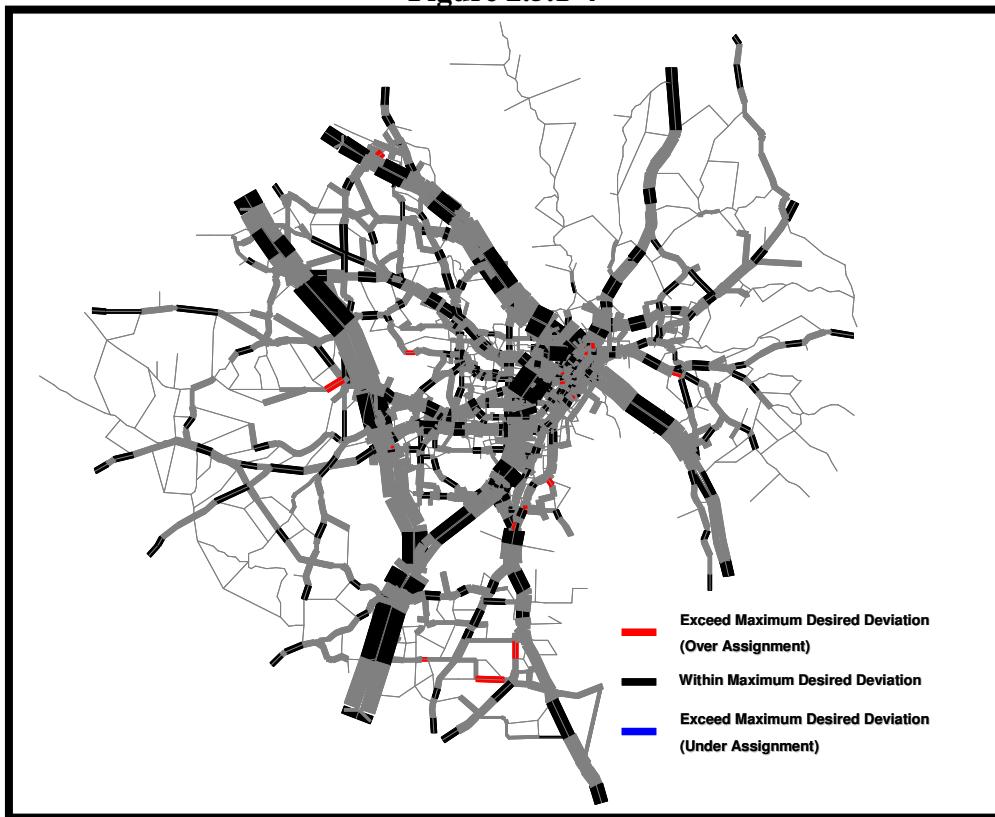
2.5.2 Delta Matrix Process

Due to the many variables involved, estimated traffic volumes from travel demand models will inevitably differ from observed traffic counts. As a result, it is usually necessary to post-process modeled volumes for use in traffic studies. National Cooperative Highway Research Program (NCHRP) Report 255 outlines a widely used methodology for post-processing model results, but like many approaches to refining travel demand models, the procedures are intended for specific projects or corridors and are not easily applied to an entire region.

Matrix estimation techniques to post-process travel demand model volumes for an entire region have been developed for the GDOT MPO areas. This region level post-processing is done by developing a delta matrix, which is a trip table that is combined with the normal travel demand model trip table to produce traffic assignments that closely replicate observed traffic counts.

Figure 2.5.2-1 outlines how a delta matrix is developed. The delta matrix process uses the travel demand model trip table as a seed for a matrix estimation process. The matrix estimation process attempts to closely replicate observed traffic counts, while also controlling the trip ends and trip lengths implied in the seed matrix. This is accomplished by iteratively assigning a trip table, adjusting the trip table to match traffic counts, then applying a tri-proportional fitting process to match trip ends and trip lengths. Once a trip table is produced that sufficiently matches the traffic counts, a delta matrix is produced by subtracting the initial seed trip table from the estimated trip table.

Figure 2.5.2-1 – Delta Matrix Process
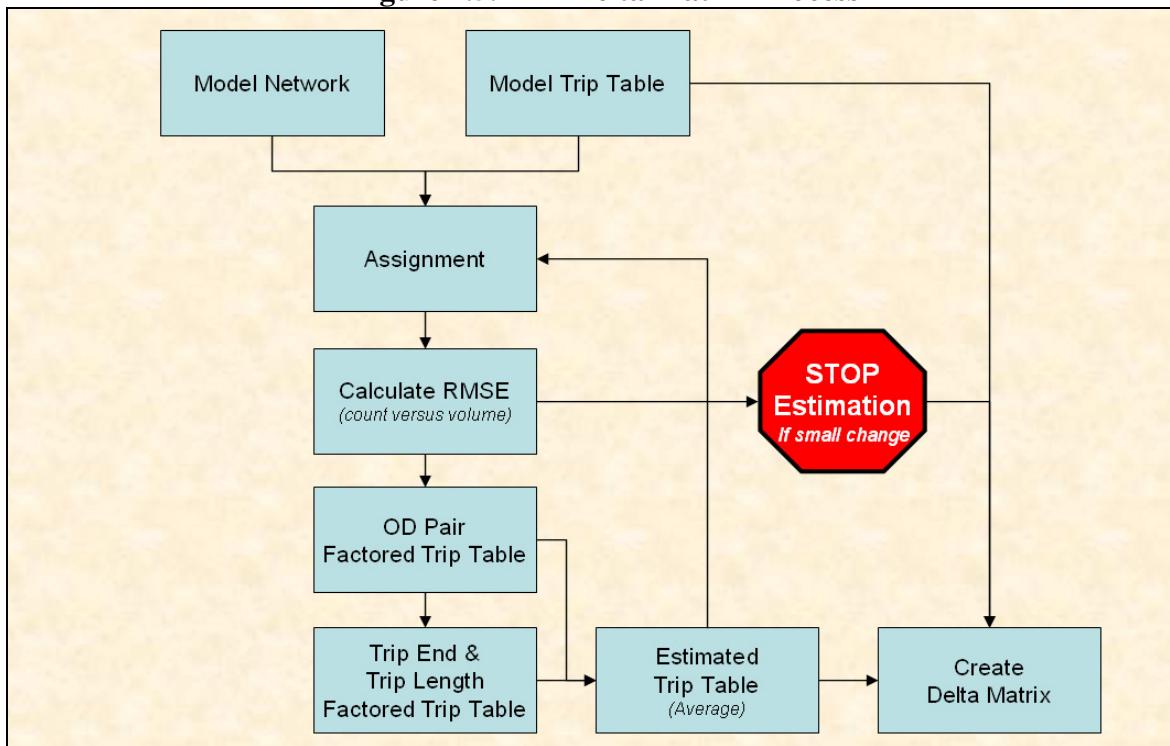
Conceptually the resulting delta matrix represents the localized factors that the regional travel demand modeling process does not reproduce well. Future travel demands are post-processed by applying the same local corrections that are represented in the delta matrix without adjustment since similar localized issues cannot be identified for future conditions. Therefore, the delta matrix is simply added to future trip tables before assigning the trips.

Appendix A: Socio-Economic Variables By Zone for 2006

Traffic Zone	Households	Pop	School	Retail	Employment Service	Manuf	Whole	Total Emp
1	0	0	0	9	210	0	6	225
2	0	0	0	6	179	0	0	185
3	0	0	0	0	109	0	2	111
4	0	0	0	19	34	0	0	53
5	0	0	0	16	133	0	0	149
6	4	50	0	0	135	0	0	135
7	0	0	0	3	126	0	2	131
8	0	0	0	33	73	0	0	106
9	0	0	0	19	103	4	2	128
10	0	0	0	18	50	13	0	81
11	0	0	0	35	27	4	0	66
12	0	0	0	13	668	4	0	685
13	0	0	0	16	52	0	0	68
14	4	14	0	56	188	0	0	244
15	0	0	0	0	565	0	0	565
16	0	0	0	0	199	0	0	199
17	0	0	0	0	0	0	0	0
18	0	0	0	9	7	0	31	47
19	0	0	0	31	19	9	307	366
20	39	39	0	29	126	19	0	174
21	208	208	0	138	1032	0	2	1172
22	0	0	0	13	608	0	28	649
23	0	0	0	13	197	0	15	225
24	0	0	0	13	98	0	0	111
25	0	0	0	12	295	0	0	307
26	0	0	0	54	52	0	0	106
27	0	0	0	63	806	0	8	877
28	15	19	0	5	188	0	0	193
29	0	0	0	3	119	4	0	126
30	0	0	0	0	3	0	0	3
31	0	0	0	0	0	8	11	19
32	0	0	0	18	179	0	0	197
33	0	0	0	3	18	9	0	30
34	0	0	0	3	247	4	28	282
35	0	0	0	0	42	19	0	61
36	0	0	0	6	228	0	0	234
37	0	0	0	19	0	0	0	19
38	15	29	0	0	150	9	6	165
39	0	0	0	0	33	9	0	42
40	0	0	0	45	47	0	0	92
41	0	0	0	0	238	9	0	247
42	0	0	0	0	0	0	0	0
43	0	0	0	0	1,207	0	0	1207
44	0	0	0	3	4,228	0	2	4233
45	69	341	0	5	216	0	0	221
46	0	0	0	0	662	0	0	662

Traffic Zone	Households	Pop	School	Retail	Service	Manuf	Whole	Total Emp
47	113	469	0	0	8	0	0	8
48	0	0	0	0	3	0	2	5
49	10	10	0	80	167	0	0	247
50	182	510	0	5	110	0	0	115
51	34	75	0	0	92	0	12	104
52	74	166	0	22	0	0	0	22
53	99	257	0	5	35	0	0	40
54	129	297	421	0	102	0	0	523
55	74	152	0	3	3	0	0	6
56	73	173	0	0	16	0	0	16
57	204	478	0	3	34	0	0	37
58	10	19	0	5	31	0	0	36
59	380	1099	1183	3	162	0	0	1348
60	98	245	0	125	42	0	0	167
61	166	344	0	57	43	0	0	100
62	245	593	0	608	462	19	0	1089
63	20	73	0	28	31	0	12	71
64	262	658	0	178	107	4	0	289
65	306	1004	20	6	260	0	0	286
66	225	563	0	0	15	0	0	15
67	661	1825	410	31	204	0	28	673
68	117	314	0	3	212	0	0	215
69	246	657	0	15	93	0	0	108
70	432	1156	0	0	19	0	0	19
71	289	696	0	3	26	54	2	85
72	264	457	0	213	463	9	6	691
73	196	367	0	0	0	0	0	0
74	127	425	0	5	99	0	0	104
75	84	157	0	0	0	0	0	0
76	59	132	0	0	0	0	0	0
77	178	422	0	0	51	0	0	51
78	196	315	909	6	224	0	0	1139
79	143	212	0	0	10	0	0	10
80	9	37	0	6	7	0	0	13
81	69	161	0	0	10	0	0	10
82	197	203	0	155	197	0	24	376
83	339	627	0	78	389	0	2	469
84	542	1129	0	0	54	96	0	150
85	0	0	0	0	0	0	0	0
86	109	258	0	0	8	0	1	9
87	30	80	0	25	17	0	1	43
88	57	137	0	0	0	0	0	0
89	514	1460	0	0	31	0	0	31
90	13	37	0	0	152	0	0	152
91	191	504	0	0	13	0	7	20
92	85	170	0	18	27	0	3	48
93	13	26	0	0	4	0	0	4
94	100	338	0	0	24	3	0	27

Traffic Zone	Households	Pop	Employment					
			School	Retail	Service	Manuf	Whole	Total Emp
95	58	204	0	0	13	0	0	13
96	133	342	0	0	8	0	0	8
97	137	389	0	0	8	0	0	8
98	205	518	560	0	65	39	1	665
99	189	501	0	10	41	0	0	51
100	267	724	0	37	27	0	1	65
101	277	788	0	34	62	0	0	96
102	86	328	0	53	65	6	3	127
103	106	249	0	0	24	0	0	24
104	462	1232	0	4	16	0	1	21
105	135	353	0	0	0	0	0	0
106	284	654	0	4	12	3	0	19
107	169	487	0	16	33	0	0	49
108	264	590	0	27	33	0	0	60
109	79	255	0	0	0	0	0	0
110	182	480	0	0	8	0	0	8
111	121	434	680	4	200	0	3	887
112	0	0	0	80	230	0	81	391
113	0	0	0	18	59	101	41	219
114	0	0	0	9	98	141	112	360
115	0	0	0	0	54	0	12	66
116	4	14	0	16	17	19	36	88
117	0	0	0	24	62	149	7	242
118	0	0	0	5	276	384	105	770
119	0	0	0	0	43	141	38	222
120	69	95	0	0	15	4	5	24
121	34	79	0	67	24	0	0	91
122	0	0	0	3	7	13	150	173
123	0	0	0	0	0	0	0	0
124	104	255	0	11	162	4	30	207
125	35	48	0	10	14	45	5	74
126	0	0	0	0	0	0	0	0
127	40	91	0	16	1916	0	0	1932
128	0	0	0	0	8	0	0	8
129	106	231	0	0	0	225	0	225
130	17	17	0	32	3	0	0	35
131	62	239	0	16	73	0	6	95
132	93	288	0	0	11	0	0	11
133	262	826	0	3	253	0	12	268
134	321	916	0	0	17	0	0	17
135	0	0	0	0	28	0	0	28
136	3	6	0	0	1699	0	0	1699
137	4	4	0	0	0	0	0	0
138	40	82	453	3	329	963	29	1777
139	527	1420	0	55	192	45	0	292
140	110	264	0	10	3	4	0	17
141	258	673	0	3	36	0	0	39
142	112	235	0	0	8	0	0	8

Traffic Zone	Households	Pop	School	Retail	Employment Service	Manuf	Whole	Total Emp
143	170	455	0	0	8	3	0	11
144	130	390	0	0	0	0	0	0
145	0	0	0	89	487	13	31	620
146	4	14	0	13	1343	0	0	1356
147	20	62	0	0	7	0	0	7
148	15	34	0	9	8	0	11	28
149	0	0	0	22	22	0	69	113
150	0	0	0	0	83	0	11	94
151	0	0	0	46	183	0	2	231
152	191	353	686	9	315	0	0	1010
153	39	84	0	61	2335	0	0	2396
154	104	209	0	0	15	4	2	21
155	82	138	0	3	276	0	0	279
156	226	822	577	0	160	9	0	746
157	64	123	0	0	33	0	0	33
158	0	0	0	0	40	0	0	40
159	24	1410	0	0	0	0	0	0
160	73	89	0	0	0	0	0	0
161	0	0	3500	0	3465	0	0	6965
162	427	980	0	0	47	0	0	47
163	210	502	467	8	144	0	0	619
164	138	409	0	3	31	0	0	34
165	25	38	0	3	17	0	17	37
166	119	276	0	0	32	19	2	53
167	116	271	472	12	83	0	0	567
168	71	229	0	9	32	0	0	41
169	225	545	345	19	357	0	28	749
170	266	872	0	13	32	0	0	45
171	185	548	0	29	37	0	5	71
172	187	480	0	0	17	0	11	28
173	43	131	0	3	25	0	0	28
174	206	482	0	8	73	0	0	81
175	274	639	0	19	53	0	0	72
176	270	749	0	0	18	0	0	18
177	294	757	536	37	106	0	0	679
178	240	513	0	5	49	0	0	54
179	276	757	0	38	25	0	0	63
180	430	1063	0	28	283	0	5	316
181	148	360	0	10	60	0	2	72
182	257	832	0	14	104	0	8	126
183	10	24	0	3	28	4	6	41
184	0	0	0	16	25	0	18	59
185	0	0	0	80	65	9	0	154
186	0	0	0	159	95	0	183	437
187	30	98	0	58	99	986	15	1158
188	0	0	0	0	11	1024	0	1035
189	0	0	0	0	0	0	0	0
190	0	0	0	19	241	148	75	483

Traffic Zone	Households	Pop	School	Retail	Employment Service	Manuf	Whole	Total Emp
191	0	0	0	0	39	9	30	78
192	292	827	0	48	219	1466	100	1833
193	0	0	0	20	18	0	35	73
194	53	97	0	8	68	19	2	97
195	1	3	0	0	0	0	0	0
196	359	924	0	195	64	0	34	293
197	484	1318	530	18	106	0	0	654
198	318	842	0	9	47	0	0	56
199	129	302	2195	19	331	0	6	2551
200	0	0	0	0	3	0	0	3
201	139	342	0	3	0	0	0	3
202	557	1314	895	5	149	0	0	1049
203	128	364	0	0	3	0	0	3
204	224	379	0	0	20	0	0	20
205	214	673	0	54	135	0	2	191
206	409	999	0	0	94	0	66	160
207	132	317	0	63	319	53	69	504
208	300	654	0	0	7	0	0	7
209	47	125	0	0	0	0	0	0
210	84	262	0	57	268	9	0	334
211	119	316	0	0	25	0	2	27
212	102	313	0	329	26	0	28	383
213	110	211	0	86	996	2569	84	3735
214	105	197	0	8	31	0	66	105
215	36	74	0	0	3	0	0	3
216	137	437	0	16	107	0	0	123
217	91	223	0	3	3	45	20	71
218	377	922	656	185	100	0	34	975
219	240	619	0	3	31	0	0	34
220	144	429	0	17	138	0	0	155
221	143	289	381	24	109	0	0	514
222	300	812	0	18	41	0	0	59
223	230	517	102	3	58	0	6	169
224	369	971	0	13	27	0	0	40
225	384	885	0	73	148	9	0	230
226	416	1143	319	256	224	0	75	874
227	159	379	0	264	82	9	0	355
228	198	461	0	40	28	9	0	77
229	20	34	0	205	35	0	61	301
230	182	486	0	488	39	0	0	527
231	186	470	0	73	93	0	0	166
232	104	266	0	199	141	0	2	342
233	0	0	1575	216	311	0	18	2120
234	421	1039	112	16	110	0	0	238
235	113	311	0	332	128	19	8	487
236	59	127	0	0	28	0	0	28
237	345	937	0	217	157	4	2	380
238	531	1216	0	453	192	4	7	656

Traffic Zone	Households	Pop	School	Retail	Service	Manuf	Whole	Total Emp
239	0	0	0	1831	365	17	11	2224
240	419	1058	399	372	220	0	18	1009
241	303	798	1800	219	517	9	0	2545
242	84	185	0	407	587	0	0	994
243	147	395	0	0	15	0	0	15
244	162	419	0	14	10	0	0	24
245	725	2077	511	27	384	9	11	942
246	621	1546	425	22	196	0	2	645
247	231	716	64	0	85	0	142	291
248	767	2073	475	0	35	0	0	510
249	548	1853	246	0	83	0	0	329
250	534	1397	0	3	49	0	0	52
251	273	721	0	0	36	0	0	36
252	211	516	405	87	252	19	66	829
253	132	356	0	246	361	13	178	798
254	395	1028	0	188	145	0	12	345
255	732	1630	0	39	45	0	5	89
256	423	1056	6243	38	266	0	2	6549
257	156	1372	0	35	461	0	0	496
258	354	1003	0	0	3	0	0	3
259	132	366	0	0	209	0	2	211
260	127	301	0	5	123	4	8	140
261	238	621	0	14	3	0	0	17
262	327	818	790	5	105	0	0	900
263	125	291	0	0	3	140	0	143
264	244	672	0	0	7	0	0	7
265	162	396	0	0	7	4	0	11
266	41	73	0	8	61	0	0	69
267	132	338	0	33	170	0	2	205
268	279	774	1782	14	276	0	2	2074
269	176	425	972	108	641	0	49	1770
270	306	378	0	6	573	0	12	591
271	95	260	0	18	22	13	5	58
272	438	928	0	22	78	9	0	109
273	470	1296	0	16	100	0	5	121
274	256	721	0	15	75	0	0	90
275	247	632	0	0	14	0	0	14
276	81	218	0	3	32	0	0	35
277	74	173	0	3	7	0	0	10
278	169	365	0	3	7	0	0	10
279	45	80	0	0	0	0	0	0
280	140	307	0	0	3	0	0	3
281	50	190	0	0	3	0	0	3
282	1042	2775	0	9	103	0	0	112
283	127	274	866	9	127	0	0	1002
284	689	1585	0	6	64	0	0	70
285	271	724	0	0	32	0	0	32
286	247	542	0	0	11	4	0	15

The header spans "Employment" over School, Retail, Service, Manuf, Whole, Total Emp.

Traffic Zone	Households	Pop	Employment School	Retail	Service	Manuf	Whole	Total Emp
287	160	387	0	19	77	0	2	98
288	49	94	0	0	3	0	0	3
289	54	114	0	0	0	0	0	0
290	42	132	0	5	20	0	0	25
291	162	467	0	0	0	0	0	0
292	0	0	0	75	101	0	2	178
293	194	310	0	106	498	51	6	661
294	147	259	0	3	204	0	2	209
295	231	337	0	38	656	0	6	700
296	117	229	336	29	539	23	5	932
297	396	657	0	11	670	4	66	751
298	0	0	0	6	940	0	0	946
299	79	213	0	867	414	9	0	1290
300	300	548	0	3	58	0	0	61
301	59	132	0	5	119	0	6	130
302	213	490	0	13	84	0	15	112
303	162	448	0	0	7	0	0	7
304	113	231	0	0	85	0	0	85
305	220	497	241	0	210	0	0	451
306	137	357	0	5	3	0	0	8
307	203	398	0	5	321	19	24	369
308	432	683	609	159	310	4	0	1082
309	465	836	0	0	237	0	2	239
310	65	139	0	0	0	0	0	0
311	245	517	0	43	280	19	0	342
312	117	192	391	89	259	4	0	743
313	369	843	0	143	133	0	0	276
314	290	604	0	271	161	0	5	437
315	0	0	440	225	42	0	0	707
316	74	133	0	3	86	0	0	89
317	143	388	0	43	18	0	12	73
318	176	375	735	9	43	0	0	787
319	79	133	1202	0	314	0	0	1516
320	29	74	0	10	92	0	12	114
321	166	408	0	11	180	19	32	242
322	29	135	0	15	15	0	2	32
323	403	1062	0	22	117	19	6	164
324	188	532	0	5	76	0	0	81
325	238	495	0	44	374	49	92	559
326	93	197	0	30	53	45	0	128
327	338	588	0	44	512	0	0	556
328	122	216	0	206	262	32	8	508
329	176	333	0	39	270	0	0	309
330	93	155	0	3	113	19	0	135
331	436	898	0	18	75	0	6	99
332	191	290	0	3	17	0	0	20
333	411	902	0	3	103	0	0	106
334	468	971	0	131	161	0	8	300

Traffic Zone	Households	Pop	School	Retail	Employment Service	Manuf	Whole	Total Emp
335	599	1355	500	237	876	0	8	1621
336	154	246	0	16	125	0	17	158
337	0	0	0	30	0	0	0	30
338	440	917	0	0	10	4	2	16
339	284	569	0	0	30	0	0	30
340	667	1289	422	245	250	0	5	922
341	240	576	0	302	1111	8	16	1437
342	227	550	0	0	10	0	0	10
343	181	492	433	23	103	0	0	559
344	428	1238	0	13	259	0	0	272
345	120	370	0	0	58	4	0	62
346	235	533	0	16	87	0	6	109
347	59	170	0	0	126	0	0	126
348	253	643	0	10	111	0	12	133
349	861	2269	402	41	150	0	0	593
350	468	1074	0	47	31	0	2	80
351	732	1275	52	96	1176	4	2	1330
352	343	922	0	0	24	4	2	30
353	250	882	0	0	475	0	2	477
354	241	716	0	3	216	0	8	227
355	235	517	0	472	106	0	6	584
356	139	310	0	9	91	0	6	106
357	184	501	0	0	0	0	6	6
358	131	362	0	3	40	0	2	45
359	31	74	0	0	0	0	0	0
360	190	430	0	3	209	0	6	218
361	519	1349	1494	683	800	54	6	3037
362	615	1363	707	16	137	0	0	860
363	967	2585	889	40	312	0	0	1241
364	353	1075	0	495	171	0	0	666
365	145	464	0	0	0	0	0	0
366	234	602	0	0	43	0	0	43
367	135	274	0	3	0	0	0	3
368	1	2	0	338	321	0	0	659
369	177	403	0	773	412	0	8	1193
370	84	232	0	162	604	37	112	915
371	161	261	0	400	949	0	0	1349
372	473	1434	0	0	44	0	0	44
373	1324	3629	647	21	452	0	8	1128
374	1006	2392	0	24	68	19	0	111
375	656	1852	827	5	420	9	2	1263
376	429	1084	10	3	256	0	8	277
377	123	327	0	5	82	0	0	87
378	24	49	1025	0	199	0	0	1224
379	31	65	0	0	0	0	0	0
380	93	215	0	0	0	0	0	0
381	304	798	0	95	106	0	0	201
382	0	0	0	0	3	45	0	48

Traffic Zone	Households	Pop	School	Retail	Employment Service	Manuf	Whole	Total Emp
383	172	495	0	0	68	321	6	395
384	40	146	0	0	3	0	0	3
385	157	306	0	0	30	0	0	30
386	348	875	0	0	0	0	0	0
387	86	160	0	180	70	0	6	256
388	0	0	0	35	7	0	0	42
389	21	235	0	17	374	0	31	422
390	401	948	0	3	43	0	0	46
391	196	409	0	3	26	0	0	29
392	45	103	0	92	27	0	0	119
393	211	506	0	40	83	39	11	173
394	4	4	0	3	0	0	0	3
395	98	301	0	0	3	0	0	3
396	29	60	0	0	7	0	0	7
397	14	79	0	9	921	0	41	971
398	609	881	0	16	1466	9	11	1502
399	104	281	0	19	183	0	33	235
400	78	216	0	3	0	0	0	3
401	264	837	0	0	368	0	0	368
402	540	824	0	0	47	0	0	47
403	255	408	0	119	101	0	0	220
404	0	0	0	13	3	0	0	16
405	0	0	0	64	172	0	0	236
406	0	0	0	596	584	19	2	1201
407	0	0	0	105	81	0	0	186
408	0	0	0	96	75	0	11	182
409	0	0	0	0	91	0	2	93

Appendix B: Production and Attraction Trip Ends By Zone for 2006

Traffic	Production							Attraction						
Zone	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
1	0	0	0	153	85	306	27	239	228	24	153	85	0	0
2	0	0	0	115	66	252	1	197	188	16	115	66	0	0
3	0	0	0	66	39	151	9	118	113	0	66	39	0	0
4	0	0	0	62	27	72	3	56	54	51	62	27	0	0
5	0	0	0	111	58	203	3	158	151	43	111	58	0	0
6	6	16	3	88	47	186	0	143	163	0	88	47	0	0
7	0	0	0	82	48	178	9	139	133	8	82	48	0	0
8	0	0	0	116	51	144	5	113	107	89	116	51	0	0
9	0	0	0	106	56	174	13	136	130	51	106	56	0	0
10	0	0	0	69	42	110	9	86	82	49	69	42	0	0
11	0	0	0	95	41	90	7	70	67	95	95	41	0	0
12	0	0	0	406	242	932	4	728	694	35	406	242	0	0
13	0	0	0	66	31	93	3	72	69	43	66	31	0	0
14	8	21	3	237	110	335	9	259	255	151	237	110	0	0
15	0	0	0	319	193	769	0	600	573	0	319	193	0	0
16	0	0	0	112	68	271	0	211	202	0	112	68	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	95	41	64	136	50	48	24	95	41	0	0
19	0	0	0	780	352	498	1338	389	371	84	780	352	0	0
20	29	60	19	146	92	261	13	185	197	78	146	92	0	0
21	144	286	104	950	517	1725	30	1245	1299	373	950	517	0	0
22	0	0	0	436	247	883	123	689	658	35	436	247	0	0
23	0	0	0	175	93	306	67	239	228	35	175	93	0	0
24	0	0	0	85	44	151	2	118	113	35	85	44	0	0
25	0	0	0	194	111	418	2	326	311	32	194	111	0	0
26	0	0	0	152	61	144	8	113	107	146	152	61	0	0
27	0	0	0	616	334	1194	45	932	889	170	616	334	0	0
28	13	28	8	122	72	272	1	205	206	14	122	72	0	0
29	0	0	0	74	47	171	2	134	128	8	74	47	0	0
30	0	0	0	2	1	4	0	3	3	0	2	1	0	0
31	0	0	0	25	18	26	51	20	19	0	25	18	0	0
32	0	0	0	142	76	268	3	209	200	49	142	76	0	0
33	0	0	0	17	16	41	5	32	30	8	17	16	0	0
34	0	0	0	210	119	384	124	300	286	8	210	119	0	0
35	0	0	0	24	30	83	9	65	62	0	24	30	0	0
36	0	0	0	142	83	319	1	249	237	16	142	83	0	0
37	0	0	0	43	15	26	3	20	19	51	43	15	0	0
38	20	44	11	105	69	234	30	175	183	0	105	69	0	0
39	0	0	0	19	19	57	4	45	43	0	19	19	0	0
40	0	0	0	129	52	125	7	98	93	122	129	52	0	0
41	0	0	0	134	89	336	4	262	250	0	134	89	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	680	413	1643	0	1282	1223	0	680	413	0	0
44	0	0	0	2395	1452	5762	9	4497	4290	8	2395	1452	0	0
45	149	418	61	214	95	344	1	235	405	14	214	95	0	0

Traffic Zone	Production							Attraction						
	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
46	0	0	0	373	227	901	0	703	671	0	373	227	0	0
47	221	600	97	115	31	81	0	9	258	0	115	31	0	0
48	0	0	0	6	3	7	9	5	5	0	6	3	0	0
49	7	14	5	279	123	342	13	262	256	216	279	123	0	0
50	314	776	148	194	87	270	1	122	388	14	194	87	0	0
51	48	110	26	97	52	163	52	110	145	0	97	52	0	0
52	109	250	57	89	36	76	3	23	111	59	89	36	0	0
53	161	389	79	92	41	116	1	42	177	14	92	41	0	0
54	189	436	101	128	67	219	0	108	935	0	128	67	0	0
55	102	224	57	44	22	54	0	6	87	8	44	22	0	0
56	109	254	58	50	24	67	0	17	108	0	50	24	0	0
57	310	723	159	139	65	177	0	39	292	8	139	65	0	0
58	13	29	7	33	17	55	1	38	47	14	33	17	0	0
59	675	1687	313	358	152	461	0	175	2644	8	358	152	0	0
60	154	367	78	366	138	288	20	177	300	338	366	138	0	0
61	229	509	127	235	101	239	9	106	284	154	235	101	0	0
62	384	909	192	1785	720	1635	104	1157	1419	1643	1785	720	0	0
63	40	107	17	126	50	109	56	75	111	76	126	50	0	0
64	437	1054	209	621	247	556	30	307	643	481	621	247	0	0
65	584	1526	254	398	170	552	1	283	836	16	398	170	0	0
66	370	888	179	142	61	160	0	16	315	0	142	61	0	0
67	1187	2934	548	681	287	769	126	279	1893	84	681	287	0	0
68	207	508	96	201	104	365	0	228	385	8	201	104	0	0
69	422	1034	199	242	105	300	2	115	459	41	242	105	0	0
70	754	1847	354	284	114	295	0	20	634	0	284	114	0	0
71	476	1134	229	191	130	296	34	90	457	8	191	130	0	0
72	327	704	185	868	407	1105	64	734	944	576	868	407	0	0
73	271	597	145	87	49	122	0	0	195	0	87	49	0	0
74	243	637	105	168	69	221	1	110	332	14	168	69	0	0
75	118	258	63	37	21	52	0	0	84	0	37	21	0	0
76	94	219	46	31	15	37	0	0	70	0	31	15	0	0
77	297	705	143	129	62	180	0	54	276	0	129	62	0	0
78	231	495	130	214	130	435	1	244	1854	16	214	130	0	0
79	155	331	89	56	39	103	0	11	123	0	56	39	0	0
80	19	53	8	26	9	23	1	14	33	16	26	9	0	0
81	114	270	55	44	21	57	0	11	96	0	44	21	0	0
82	141	280	99	567	264	634	128	399	489	419	567	264	0	0
83	451	983	249	550	282	849	21	498	809	211	550	282	0	0
84	785	1769	413	297	234	541	44	159	753	0	297	234	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	180	426	87	68	31	80	4	10	146	0	68	31	0	0
87	54	132	25	88	34	77	8	46	86	68	88	34	0	0
88	94	224	46	32	14	35	0	0	73	0	32	14	0	0
89	192	480	87	73	28	72	0	7	162	0	73	28	0	0
90	5	12	2	19	11	43	0	32	35	0	19	11	0	0
91	338	828	157	142	59	146	30	21	288	0	142	59	0	0
92	123	275	66	103	48	118	16	51	139	49	103	48	0	0
93	19	42	10	8	5	14	0	4	18	0	8	5	0	0

Traffic Zone	Production HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	Attraction HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
94	206	543	87	93	36	99	1	29	207	0	93	36	0	0
95	24	63	10	11	4	11	0	3	24	0	11	4	0	0
96	47	114	22	17	7	19	0	2	38	0	17	7	0	0
97	51	127	23	19	7	19	0	2	43	0	19	7	0	0
98	357	865	168	161	107	270	22	112	1278	0	161	107	0	0
99	322	784	154	164	69	187	2	54	318	27	164	69	0	0
100	479	1181	222	273	106	255	10	69	451	100	273	106	0	0
101	509	1271	232	299	117	303	5	102	517	92	299	117	0	0
102	181	485	75	242	94	226	24	135	303	143	242	94	0	0
103	173	409	85	72	35	99	0	25	157	0	72	35	0	0
104	814	1996	380	312	124	316	5	22	677	11	312	124	0	0
105	234	571	111	83	33	84	0	0	188	0	83	33	0	0
106	448	1047	224	171	80	203	2	20	367	11	171	80	0	0
107	319	801	143	170	66	172	3	52	309	43	170	66	0	0
108	400	921	207	220	98	246	4	64	375	73	220	98	0	0
109	158	411	68	60	20	49	0	0	136	0	60	20	0	0
110	320	784	150	118	48	124	0	9	264	0	118	48	0	0
111	249	660	105	231	105	357	14	220	1528	11	231	105	0	0
112	0	0	0	496	225	532	363	415	396	216	496	225	0	0
113	0	0	0	168	161	298	227	233	222	49	168	161	0	0
114	0	0	0	331	273	490	551	382	365	24	331	273	0	0
115	0	0	0	58	31	90	52	70	67	0	58	31	0	0
116	7	19	3	131	72	122	167	93	97	43	131	72	0	0
117	0	0	0	106	173	329	103	257	245	65	106	173	0	0
118	0	0	0	406	528	1048	632	818	780	14	406	528	0	0
119	0	0	0	111	172	302	229	236	225	0	111	172	0	0
120	67	139	43	42	31	76	23	25	75	0	42	31	0	0
121	54	127	27	185	70	145	11	97	134	181	185	70	0	0
122	0	0	0	352	169	235	656	184	175	8	352	169	0	0
123	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124	172	412	84	245	124	346	133	220	345	30	245	124	0	0
125	34	72	21	53	64	123	44	79	101	27	53	64	0	0
126	0	0	0	0	0	0	0	0	0	0	0	0	0	0
127	62	145	32	1138	679	2655	3	2052	2007	43	1138	679	0	0
128	0	0	0	5	3	11	0	9	8	0	5	3	0	0
129	161	368	83	55	215	372	103	239	351	0	55	215	0	0
130	12	24	9	79	31	58	5	37	45	86	79	31	0	0
131	127	342	53	148	59	168	28	101	223	43	148	59	0	0
132	181	465	79	74	27	73	0	12	164	0	74	27	0	0
133	499	1287	220	372	166	528	52	285	711	8	372	166	0	0
134	594	1483	269	226	85	223	0	18	505	0	226	85	0	0
135	0	0	0	16	10	38	0	30	28	0	16	10	0	0
136	4	10	2	959	582	2314	0	1805	1725	0	959	582	0	0
137	3	6	2	1	1	2	0	0	2	0	1	1	0	0
138	60	135	31	278	964	1827	568	1406	2110	8	278	964	0	0
139	899	2200	426	569	278	725	29	310	1052	149	569	278	0	0
140	177	418	88	87	40	92	3	18	158	27	87	40	0	0
141	450	1099	211	186	79	214	0	41	398	8	186	79	0	0

Traffic			Production							Attraction			
Zone	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
142	166	376	87	60	31	81	0	9	133	0	60	31	0	0
143	301	740	140	112	47	121	1	12	253	0	112	47	0	0
144	246	626	110	92	32	81	0	0	208	0	92	32	0	0
145	0	0	0	548	280	844	154	659	628	241	548	280	0	0
146	8	21	3	790	471	1848	2	1440	1382	35	790	471	0	0
147	38	98	17	19	7	22	0	7	40	0	19	7	0	0
148	23	53	12	58	25	47	49	30	46	24	58	25	0	0
149	0	0	0	220	95	154	302	120	115	59	220	95	0	0
150	0	0	0	72	40	128	48	100	95	0	72	40	0	0
151	0	0	0	212	101	314	16	245	234	124	212	101	0	0
152	251	544	141	282	162	560	1	344	1613	24	282	162	0	0
153	56	126	30	1475	858	3286	10	2545	2473	165	1475	858	0	0
154	142	312	80	62	36	93	10	22	133	0	62	36	0	0
155	99	212	56	195	117	431	0	296	356	8	195	117	0	0
156	419	1102	189	285	118	371	4	180	1531	0	285	118	0	0
157	84	183	48	48	27	85	0	35	99	0	48	27	0	0
158	0	0	0	23	14	54	0	42	41	0	23	14	0	0
159	43	106	19	333	6	15	0	0	750	0	333	6	0	0
160	59	119	41	21	18	45	0	0	47	0	21	18	0	0
161	0	0	0	1953	1186	4716	0	3681	9109	0	1953	1186	0	0
162	617	1413	335	258	122	330	0	50	569	0	258	122	0	0
163	324	761	165	218	108	338	1	161	1168	22	218	108	0	0
164	249	629	113	121	47	132	0	36	252	8	121	47	0	0
165	27	57	16	64	32	66	74	39	58	8	64	32	0	0
166	176	406	93	88	58	146	17	56	201	0	88	58	0	0
167	170	393	91	138	67	201	2	101	995	32	138	67	0	0
168	134	347	59	93	36	100	1	44	163	24	93	36	0	0
169	354	837	177	437	222	690	124	429	1251	51	437	222	0	0
170	493	1281	219	254	87	227	2	48	510	35	254	87	0	0
171	322	808	152	228	87	212	26	75	364	78	228	87	0	0
172	302	726	149	148	63	154	48	30	284	0	148	63	0	0
173	79	201	35	52	22	65	0	30	98	8	52	22	0	0
174	321	749	163	173	82	238	1	86	339	22	173	82	0	0
175	404	935	215	224	101	269	3	76	413	51	224	101	0	0
176	467	1148	221	187	73	193	0	19	417	0	187	73	0	0
177	491	1189	235	323	139	378	6	152	1405	100	323	139	0	0
178	346	782	183	160	80	223	1	57	328	14	160	80	0	0
179	483	1192	225	280	107	258	6	67	467	103	280	107	0	0
180	692	1650	340	486	231	698	26	336	886	76	486	231	0	0
181	231	545	117	146	67	190	10	76	265	27	146	67	0	0
182	471	1219	212	306	119	331	37	134	570	38	306	119	0	0
183	16	37	8	42	24	62	28	44	54	8	42	24	0	0
184	0	0	0	92	40	80	80	63	60	43	92	40	0	0
185	0	0	0	219	94	210	17	164	156	216	219	94	0	0
186	0	0	0	832	346	595	817	464	443	430	832	346	0	0
187	54	140	25	245	932	1595	527	1230	1226	157	245	932	0	0
188	0	0	0	6	864	1409	470	1099	1049	0	6	864	0	0
189	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Traffic			Production						Attraction				
Zone	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
190	0	0	0	350	299	657	396	513	490	51	350	299	0	0
191	0	0	0	90	52	106	134	83	79	0	90	52	0	0
192	504	1248	237	656	1520	2677	1114	1947	2298	130	656	1520	0	0
193	0	0	0	135	58	99	155	78	74	54	135	58	0	0
194	69	148	40	84	61	165	19	103	150	22	84	61	0	0
195	2	4	1	1	0	1	0	0	2	0	1	0	0	0
196	637	1552	296	776	301	622	178	311	789	527	776	301	0	0
197	873	2153	402	412	171	470	3	132	1675	49	412	171	0	0
198	570	1400	264	246	102	274	1	59	505	24	246	102	0	0
199	212	502	103	315	167	565	29	378	4032	51	315	167	0	0
200	0	0	0	2	1	4	0	3	3	0	2	1	0	0
201	237	568	113	88	37	91	0	3	185	8	88	37	0	0
202	922	2182	447	406	193	556	1	164	2287	14	406	193	0	0
203	239	597	108	88	33	84	0	3	197	0	88	33	0	0
204	283	611	157	101	62	167	0	21	222	0	101	62	0	0
205	411	1060	180	363	144	393	17	203	552	146	363	144	0	0
206	693	1660	331	440	201	472	286	170	694	0	440	201	0	0
207	214	505	106	555	307	768	333	535	680	170	555	307	0	0
208	465	1070	234	159	77	196	0	7	355	0	159	77	0	0
209	80	195	38	30	12	29	0	0	67	0	30	12	0	0
210	160	412	71	343	166	507	13	355	478	154	343	166	0	0
211	212	521	98	93	40	111	9	29	196	0	93	40	0	0
212	195	499	86	902	325	585	173	407	555	889	902	325	0	0
213	155	341	84	999	2682	5152	1557	3968	3898	232	999	2682	0	0
214	144	314	79	233	110	208	287	112	211	22	233	110	0	0
215	53	118	28	19	10	26	0	3	42	0	19	10	0	0
216	267	693	116	200	83	253	3	131	357	43	200	83	0	0
217	147	348	73	107	84	153	108	75	191	8	107	84	0	0
218	626	1496	304	773	310	669	176	339	1863	500	773	310	0	0
219	386	927	192	171	73	196	0	36	364	8	171	73	0	0
220	259	655	118	218	97	301	3	165	385	46	218	97	0	0
221	199	440	109	184	92	270	4	141	898	65	184	92	0	0
222	497	1210	242	256	103	267	3	63	492	49	256	103	0	0
223	338	775	177	175	85	234	26	71	506	8	175	85	0	0
224	618	1501	300	274	111	284	2	42	557	35	274	111	0	0
225	599	1398	303	459	212	552	16	244	704	197	459	212	0	0
226	725	1786	339	1150	460	1014	365	590	1681	692	1150	460	0	0
227	243	568	125	737	286	582	46	377	561	714	737	286	0	0
228	295	682	155	216	98	228	10	82	323	108	216	98	0	0
229	23	49	14	634	243	422	296	320	323	554	634	243	0	0
230	321	786	149	1248	447	831	77	560	793	1319	1248	447	0	0
231	308	743	148	330	136	342	11	176	418	197	330	136	0	0
232	172	415	83	600	235	530	40	363	488	538	600	235	0	0
233	0	0	0	708	297	742	112	579	3071	584	708	297	0	0
234	700	1675	339	344	155	433	3	134	860	43	344	155	0	0
235	198	487	92	920	361	733	96	517	659	897	920	361	0	0
236	88	200	46	46	24	75	0	30	96	0	46	24	0	0
237	579	1410	283	809	318	732	45	404	884	587	809	318	0	0

Traffic			Production							Attraction				
Zone	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
238	818	1904	412	1443	569	1223	103	697	1312	1224	1443	569	0	0
239	0	0	0	4401	1610	3027	343	2362	2254	4949	4401	1610	0	0
240	685	1646	333	1262	494	1091	136	648	1819	1005	1262	494	0	0
241	513	1247	246	979	434	1203	39	791	4058	592	979	434	0	0
242	127	292	64	1302	546	1405	64	1056	1106	1100	1302	546	0	0
243	254	624	119	102	42	112	0	16	225	0	102	42	0	0
244	278	677	131	137	55	133	2	25	247	38	137	55	0	0
245	1311	3274	602	794	352	1038	56	458	2359	73	794	352	0	0
246	1047	2518	501	531	241	686	12	234	1725	59	531	241	0	0
247	442	1137	193	541	231	453	615	241	713	0	541	231	0	0
248	1345	3302	630	510	202	525	0	37	1898	0	510	202	0	0
249	1066	2806	457	485	164	454	0	88	1464	0	485	164	0	0
250	919	2244	431	365	152	403	0	55	796	8	365	152	0	0
251	446	1080	220	191	80	219	0	38	420	0	191	80	0	0
252	352	841	170	613	291	708	308	450	1352	235	613	291	0	0
253	219	535	106	1253	545	1168	815	848	998	665	1253	545	0	0
254	675	1645	318	780	310	715	81	366	897	508	780	310	0	0
255	1103	2542	563	511	233	577	28	95	958	105	511	233	0	0
256	707	1699	341	491	228	680	15	325	10856	103	491	228	0	0
257	274	681	125	664	224	772	5	527	1233	95	664	224	0	0
258	652	1625	297	239	89	224	0	3	537	0	239	89	0	0
259	243	603	111	209	106	369	9	224	409	0	209	106	0	0
260	209	496	102	170	89	270	37	149	302	14	170	89	0	0
261	422	1033	196	180	71	171	2	18	348	38	180	71	0	0
262	558	1345	266	264	121	353	1	117	1810	14	264	121	0	0
263	205	484	100	71	150	272	64	152	300	0	71	150	0	0
264	447	1105	204	163	63	161	0	7	365	0	163	63	0	0
265	271	648	131	98	46	116	2	12	222	0	98	46	0	0
266	55	121	30	70	37	119	1	73	109	22	70	37	0	0
267	230	558	108	255	119	361	14	218	388	89	255	119	0	0
268	510	1264	233	375	177	571	11	310	3558	38	375	177	0	0
269	295	703	142	819	399	1196	229	848	2589	292	819	399	0	0
270	254	513	171	453	289	995	53	628	800	16	453	289	0	0
271	169	418	79	126	61	138	30	62	197	49	126	61	0	0
272	668	1523	341	314	160	421	8	116	604	59	314	160	0	0
273	862	2134	394	411	169	457	24	129	812	43	411	169	0	0
274	475	1184	216	247	101	282	2	96	475	41	247	101	0	0
275	433	1054	203	157	66	173	0	15	350	0	157	66	0	0
276	145	358	67	76	33	98	0	37	151	8	76	33	0	0
277	119	279	59	52	23	60	0	11	102	8	52	23	0	0
278	253	578	132	97	47	119	0	11	204	8	97	47	0	0
279	59	129	33	19	11	28	0	0	43	0	19	11	0	0
280	212	486	109	74	36	91	0	3	166	0	74	36	0	0
281	106	284	44	47	13	35	0	3	104	0	47	13	0	0
282	1862	4573	863	735	301	801	1	119	1590	24	735	301	0	0
283	192	438	99	157	82	264	1	144	1669	24	157	82	0	0
284	1121	2632	548	425	198	524	1	74	914	16	425	198	0	0
285	490	1206	226	189	78	212	0	34	418	0	189	78	0	0

Traffic			Production						Attraction				
Zone	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
286	375	861	193	134	68	174	2	16	304	0	134	68	0	0
287	273	653	130	183	83	233	12	104	305	51	183	83	0	0
288	70	154	37	24	13	35	0	3	53	0	24	13	0	0
289	83	190	42	27	13	34	0	0	61	0	27	13	0	0
290	82	212	36	54	21	60	1	27	96	14	54	21	0	0
291	305	766	137	110	40	101	0	0	249	0	110	40	0	0
292	0	0	0	232	96	242	20	189	180	203	232	96	0	0
293	215	453	127	609	352	1020	66	702	835	287	609	352	0	0
294	188	405	105	188	111	376	9	222	350	8	188	111	0	0
295	237	499	143	550	318	1097	32	744	889	103	550	318	0	0
296	163	361	88	435	261	884	37	633	1263	78	435	261	0	0
297	447	941	271	708	407	1269	289	798	1111	30	708	407	0	0
298	0	0	0	544	327	1288	1	1005	959	16	544	327	0	0
299	140	343	65	2258	860	9025	140	1370	1421	2343	2258	860	0	0
300	409	892	223	169	97	270	0	65	353	8	169	97	0	0
301	84	191	46	123	65	214	27	138	202	14	123	65	0	0
302	313	720	166	227	107	285	67	119	374	35	227	107	0	0
303	276	678	131	110	43	110	0	7	245	0	110	43	0	0
304	154	339	87	103	57	186	0	90	209	0	103	57	0	0
305	327	753	170	236	126	423	0	223	863	0	236	126	0	0
306	224	542	110	98	39	96	1	9	198	14	98	39	0	0
307	279	614	153	341	205	629	113	392	586	14	341	205	0	0
308	468	982	282	698	343	913	27	502	1817	430	698	343	0	0
309	614	1334	338	336	199	615	9	254	687	0	336	199	0	0
310	99	227	50	33	16	40	0	0	74	0	33	16	0	0
311	349	785	187	378	207	618	15	363	622	116	378	207	0	0
312	137	292	78	394	192	552	16	374	1084	241	394	192	0	0
313	577	1347	287	600	251	605	22	293	728	387	600	251	0	0
314	432	978	224	862	348	775	64	464	764	732	862	348	0	0
315	0	0	0	536	194	363	35	284	974	608	536	194	0	0
316	99	217	54	87	50	167	0	95	161	8	87	50	0	0
317	239	583	115	227	88	188	59	78	280	116	227	88	0	0
318	253	572	135	133	66	180	1	55	1428	24	133	66	0	0
319	94	200	54	208	127	477	0	334	2311	0	208	127	0	0
320	46	111	23	119	59	173	54	121	155	27	119	59	0	0
321	267	637	131	296	160	433	149	257	462	30	296	160	0	0
322	65	181	26	79	26	62	11	34	104	41	79	26	0	0
323	667	1619	323	381	180	474	38	174	731	59	381	180	0	0
324	334	829	154	180	77	227	1	86	365	14	180	77	0	0
325	340	764	181	638	357	909	428	594	830	119	638	357	0	0
326	133	300	71	145	103	232	25	136	235	81	145	103	0	0
327	425	916	238	528	294	967	7	591	876	119	528	294	0	0
328	154	331	88	686	319	767	82	540	630	557	686	319	0	0
329	240	528	130	320	167	530	6	328	490	105	320	167	0	0
330	113	245	63	107	80	242	9	143	219	8	107	80	0	0
331	640	1442	332	309	154	406	29	105	578	49	309	154	0	0
332	210	447	121	85	56	146	0	21	175	8	85	56	0	0
333	638	1470	320	278	140	400	0	113	587	8	278	140	0	0

Traffic			Production						Attraction				
Zone	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
334	691	1562	357	637	284	700	55	319	821	354	637	284	0	0
335	937	2183	465	1372	646	1899	72	1191	2657	641	1372	646	0	0
336	173	368	100	204	111	311	76	168	291	43	204	111	0	0
337	0	0	0	68	24	41	5	32	30	81	68	24	0	0
338	659	1491	340	227	118	296	10	17	504	0	227	118	0	0
339	419	936	219	152	81	218	0	32	333	0	152	81	0	0
340	947	2095	506	1015	451	1096	60	531	1868	662	1015	451	0	0
341	394	937	190	1487	704	2105	120	1526	1763	816	1487	704	0	0
342	383	914	183	136	60	155	0	11	303	0	136	60	0	0
343	310	760	146	227	99	284	4	134	1082	62	227	99	0	0
344	766	1918	351	468	205	637	2	289	934	35	468	205	0	0
345	217	552	100	120	53	159	2	66	260	0	120	53	0	0
346	350	809	181	225	107	295	28	116	394	43	225	107	0	0
347	108	270	49	111	58	208	0	134	218	0	111	58	0	0
348	419	1012	202	265	121	338	54	141	477	27	265	121	0	0
349	1497	3657	704	715	298	796	6	203	2044	111	715	298	0	0
350	719	1673	363	383	166	400	16	85	653	127	383	166	0	0
351	954	2070	524	1188	666	2195	26	1358	2057	259	1188	666	0	0
352	624	1539	286	236	99	254	10	32	521	0	236	99	0	0
353	521	1382	219	481	227	805	9	507	953	0	481	227	0	0
354	470	1195	206	316	144	459	35	241	611	8	316	144	0	0
355	364	839	183	1271	477	941	100	620	867	1276	1271	477	0	0
356	206	473	107	159	79	231	27	113	272	24	159	79	0	0
357	318	783	149	132	52	123	26	6	273	0	132	52	0	0
358	242	601	110	120	51	143	9	48	238	8	120	51	0	0
359	52	124	25	18	8	19	0	0	39	0	18	8	0	0
360	306	714	150	240	127	415	26	232	450	8	240	127	0	0
361	916	2238	426	2339	999	2423	158	1639	4671	1846	2339	999	0	0
362	956	2215	476	436	212	591	3	163	2011	43	436	212	0	0
363	1729	4250	801	878	379	1081	6	374	3154	108	878	379	0	0
364	691	1773	302	1478	541	1126	78	707	1247	1338	1478	541	0	0
365	281	730	123	110	36	90	0	0	247	0	110	36	0	0
366	402	975	191	167	73	204	0	46	364	0	167	73	0	0
367	203	457	104	72	36	88	0	3	149	8	72	36	0	0
368	1	3	1	951	380	4488	53	700	669	914	951	380	0	0
369	271	631	137	2106	809	8670	156	1267	1424	2089	2106	809	0	0
370	155	384	71	1019	502	1298	527	972	1051	438	1019	502	0	0
371	191	408	108	1508	684	1936	63	1433	1506	1081	1508	684	0	0
372	933	2391	407	364	132	354	0	47	808	0	364	132	0	0
373	2426	6002	1109	1179	508	1479	38	511	3453	57	1179	508	0	0
374	1678	3984	809	659	308	777	12	118	1385	65	659	308	0	0
375	1224	3051	553	691	320	1002	14	463	2750	14	691	320	0	0
376	754	1828	352	426	205	630	35	284	863	8	426	205	0	0
377	223	548	102	135	63	195	1	92	262	14	135	63	0	0
378	36	82	19	124	74	286	0	211	1867	0	124	74	0	0
379	47	106	24	15	8	19	0	0	35	0	15	8	0	0
380	150	351	74	51	23	58	0	0	114	0	51	23	0	0
381	532	1299	249	465	187	463	15	214	628	257	465	187	0	0

Traffic Zone	Production							Attraction						
	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
382	0	0	0	2	39	65	21	51	49	0	2	39	0	0
383	325	815	146	169	342	645	173	420	664	0	169	342	0	0
384	80	213	34	36	11	29	0	3	81	0	36	11	0	0
385	216	476	118	89	49	139	0	32	193	0	89	49	0	0
386	585	1410	281	207	86	217	0	0	466	0	207	86	0	0
387	113	246	64	501	195	402	54	272	345	487	501	195	0	0
388	0	0	0	84	30	57	5	45	43	95	84	30	0	0
389	36	89	16	376	178	587	137	448	553	46	376	178	0	0
390	616	1442	313	255	117	312	0	49	551	8	255	117	0	0
391	285	642	149	118	60	161	0	31	247	8	118	60	0	0
392	69	162	35	249	94	190	14	126	175	249	249	94	0	0
393	326	767	166	283	157	367	72	184	445	108	283	157	0	0
394	3	6	2	8	3	7	0	3	5	8	8	3	0	0
395	174	443	81	73	25	65	0	3	163	0	73	25	0	0
396	39	86	22	18	10	28	0	7	39	0	18	10	0	0
397	23	56	11	652	368	1330	179	1031	1026	24	652	368	0	0
398	650	1383	381	1096	685	2423	54	1596	1991	43	1096	685	0	0
399	183	448	85	288	137	385	146	250	388	51	288	137	0	0
400	144	357	66	58	22	53	0	3	118	8	58	22	0	0
401	504	1301	222	405	192	665	0	391	818	0	405	192	0	0
402	605	1289	349	221	150	400	0	50	486	0	221	150	0	0
403	292	619	170	424	193	458	19	234	440	322	424	193	0	0
404	0	0	0	31	11	22	2	17	16	35	31	11	0	0
405	0	0	0	243	110	321	10	251	239	173	243	110	0	0
406	0	0	0	1691	693	1635	111	1276	1217	1611	1691	693	0	0
407	0	0	0	285	111	253	16	198	189	284	285	111	0	0
408	0	0	0	286	113	248	63	193	184	259	286	113	0	0
409	0	0	0	56	33	127	9	99	94	0	56	33	0	0
410	0	0	0	0	0	0	0	0	0	0	0	0	0	0
411	0	0	0	0	0	0	0	0	0	0	0	0	0	0
412	0	0	0	0	0	0	0	0	0	0	0	0	0	0
413	0	0	0	0	0	0	0	0	0	0	0	0	0	0
414	0	0	0	0	0	0	0	0	0	0	0	3	8593	7719
415	0	0	0	0	0	0	0	0	0	0	0	0	3734	197
416	0	0	0	0	0	0	0	0	0	0	0	0	3249	171
417	0	0	0	0	0	0	0	0	0	0	0	0	4978	105
418	0	0	0	0	0	0	0	0	0	0	0	0	1007	53
419	0	0	0	0	0	0	0	0	0	0	0	0	456	24
420	0	0	0	0	0	0	0	0	0	0	0	0	2321	273
421	0	0	0	0	0	0	0	0	0	0	0	0	2223	99
422	0	0	0	0	0	0	0	0	0	0	0	2	9815	2982
423	0	0	0	0	0	0	0	0	0	0	0	0	3630	342
424	0	0	0	0	0	0	0	0	0	0	0	2	634	3439
425	0	0	0	0	0	0	0	0	0	0	0	0	1581	167
426	0	0	0	0	0	0	0	0	0	0	0	0	7234	681
427	0	0	0	0	0	0	0	0	0	0	0	0	1530	81
428	0	0	0	0	0	0	0	0	0	0	0	1	5402	1450
429	0	0	0	0	0	0	0	0	0	0	0	0	2502	136

Traffic	Production							Attraction						
Zone	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK	HBW	HBO	HBS	NHB	TRK	IEPC	IETRK
430	0	0	0	0	0	0	0	0	0	0	0	0	7073	650
431	0	0	0	0	0	0	0	0	0	0	0	0	1593	89
432	0	0	0	0	0	0	0	0	0	0	0	0	5211	539
433	0	0	0	0	0	0	0	0	0	0	0	0	808	43
434	0	0	0	0	0	0	0	0	0	0	0	0	1801	186
435	0	0	0	0	0	0	0	0	0	0	0	0	589	31
436	0	0	0	0	0	0	0	0	0	0	0	1	3428	1119
437	0	0	0	0	0	0	0	0	0	0	0	0	2801	290
438	0	0	0	0	0	0	0	0	0	0	0	2	1933	2269
439	0	0	0	0	0	0	0	0	0	0	0	0	6830	707
440	0	0	0	0	0	0	0	0	0	0	0	0	5896	254

Appendix C: Travel Demand Model Validation Sample Report

Travel Demand Model Validation Report		
Calibration Measure	**Target Range / Value**	**MATS 2006 Model**
Socio-Economic Data		
Persons / Household	2 - 4	2.5
Workers / Household	1 - 3	1.5
Trip Generation		
Person Trips Per Household	8.5 - 9.2	8.2
Person Trips Per Person	3 - 4	3.3
HBW Trips / Employee	< 2	1.1
Shopping Trips / Retail Employment	-	2.7
P/A Ratio Before Balancing (HBW)	0.9 - 1.1	0.9
P/A Ratio Before Balancing (HBO)	0.9 - 1.1	1.1
P/A Ratio Before Balancing (HBShop)	0.9 - 1.1	1.0
P/A Ratio Before Balancing (NHB)	0.9 - 1.1	0.8
Trip Distribution		
Average Trip Length (HBW)	22.2	21.8
Average Trip Length (HBO)	17.8	16.8
Average Trip Length (HBShop)	17.8	16.3
Average Trip Length (NHB)	16.6	16.4
Average Trip Length (Truck)	N/A	0.0
% Intrazonal Trips	< 10%	0.4%
Trip Assignment		
VMT-Interstates	2,381,608	2,316,953
VMT-Principal Arterials	966,347	968,211
VMT-Minor Arterials	1,242,472	1,297,517
VMT-Collectors	493,135	511,537
VMT-Total	5,083,561	5,094,218
VMT / Household	71.8	72.0
VMT / Person	28.9	28.9
Screenlines		
All Counts	+/- 9 %	1%
East of I-16	+/- 23 %	1%
West of I -16	+/- 22 %	3%
North of Macon	+/- 17 %	3%
West of Macon	+/- 36 %	3%
Central Macon	+/- 19 %	0%
Far South of Macon	+/- 23 %	-1%
South of Macon	+/- 20 %	1%
Far North of Macon	+/- 21 %	-1%
East of I-75	+/- 26 %	0%
South of Downtown	+/- 23 %	-3%

Travel Demand Model Validation Report

Calibration Measure	Target Range / Value	MATS 2006 Model
RMSE = Root Mean Squared Error (Vol)	< 30%	8%
% RMSE (0-5K)	< 100%	27%
% RMSE (5K-10K)	< 75%	15%
% RMSE (10K-15K)	< 50%	7%
% RMSE (15K-20K)	< 30%	11%
% RMSE (20K-30K)	< 30%	10%
% RMSE (>30K)	< 30%	4%