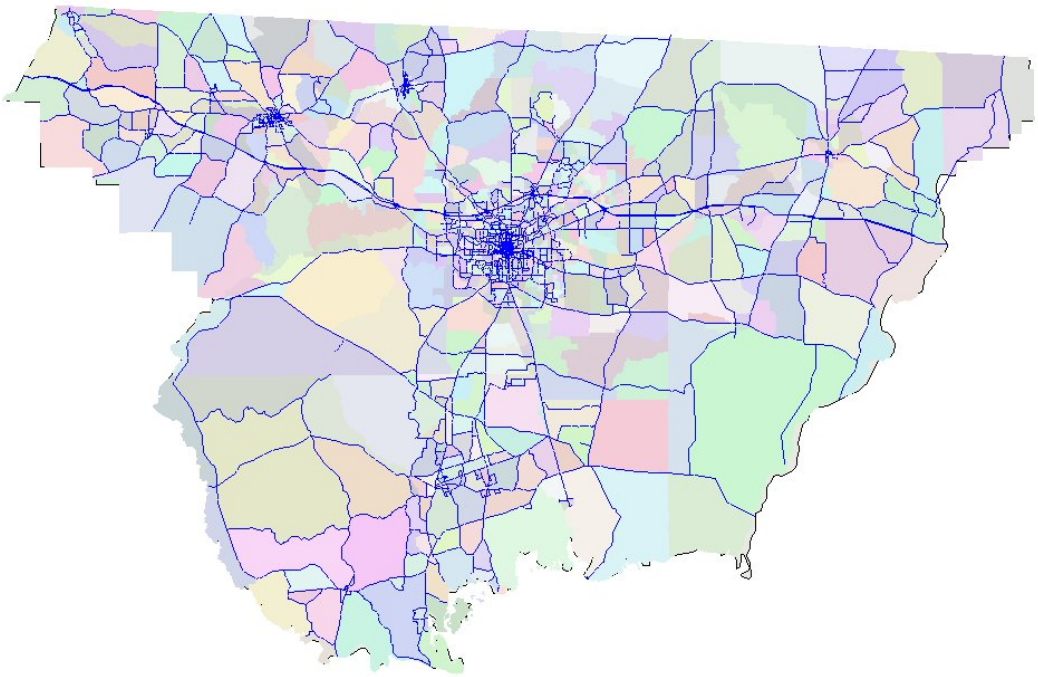
Capital Region Transportation Planning Agency

2035 Long Range Transportation Plan

Year 2007 Model Validation

Technical Report # 2 Model Validation



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1. Introduction

This report is the second of two technical reports for the Capital Region Transportation Planning Agency (CRTPA) 2007 Model Validation study. This technical report describes the validation of the base year 2007 model. The purpose of the CRTPA model validation study is to validate the CRTPA model to base year 2007 conditions and assess travel demand in the region in support of the 2035 Regional Mobility Plan for the Tallahassee metropolitan area.

This study is being conducted for Florida Department of Transportation (FDOT) District 3. The base year 2007 CRTPA travel demand forecasting model uses procedures consistent with the Florida Standard Urban Transportation Model Structure (FSUTMS) / Cube Voyager (CV). The current FSUTMS/CV model structure follows the conventional four-step modeling process that has been widely used in the United Sates over the past few decades. Four-step travel demand models have served as a valuable tool in forecasting future traffic conditions and are the basis for the determination of the need for new road capacity, transit service changes, and changes in land use policies and patterns. The four-step modeling process includes trip generation, trip distribution, mode choice and trip assignment. Each step is briefly described below:

- **Trip Generation** Convert the household and employment data into person trip ends based on production and attraction trip rates established for the study area. The total person trip productions and attractions are then balanced for each traffic analysis zone for each trip purpose.
- **Trip Distribution** Use gravity model theory to determine the trip origins and destinations between all traffic analysis zones. The distribution is primarily based on the number of person trip productions and attractions in each zone but also includes other factors that relate to the likelihood of travel between two zones such as travel time by trip purpose.
- **Mode Choice** Determine the portions of total person trips using single occupant vehicles, ridesharing modes, and public transit for travel between each pair of zones.
- **Trip Assignment** Determine the highways and transit routes to be used. Usually there are numerous routes that can be taken by the vehicles represented in the origin-destination table from the mode choice module. This step involves selecting the path that the actual traveler would select – generally the shortest and/or fastest route between two locations.

The previous 2003 CRTPA model is a highway only model. With the growth of public transit needs in Tallahassee Region, the transit service provided by StarMetro has been greatly enhanced in recent years. Public transportation service is playing a more important role in the transportation system now and will be one of the key elements in the future transportation system. By foreseeing the future needs, at the beginning of this study, FDOT District 3 made the decision to include the transit component in the travel demand model. This is the first time a transit mode will be included in the CRTPA model. To be consistent with the FSUTMS model structure, the 2007 CRTPA model includes the following main groups:

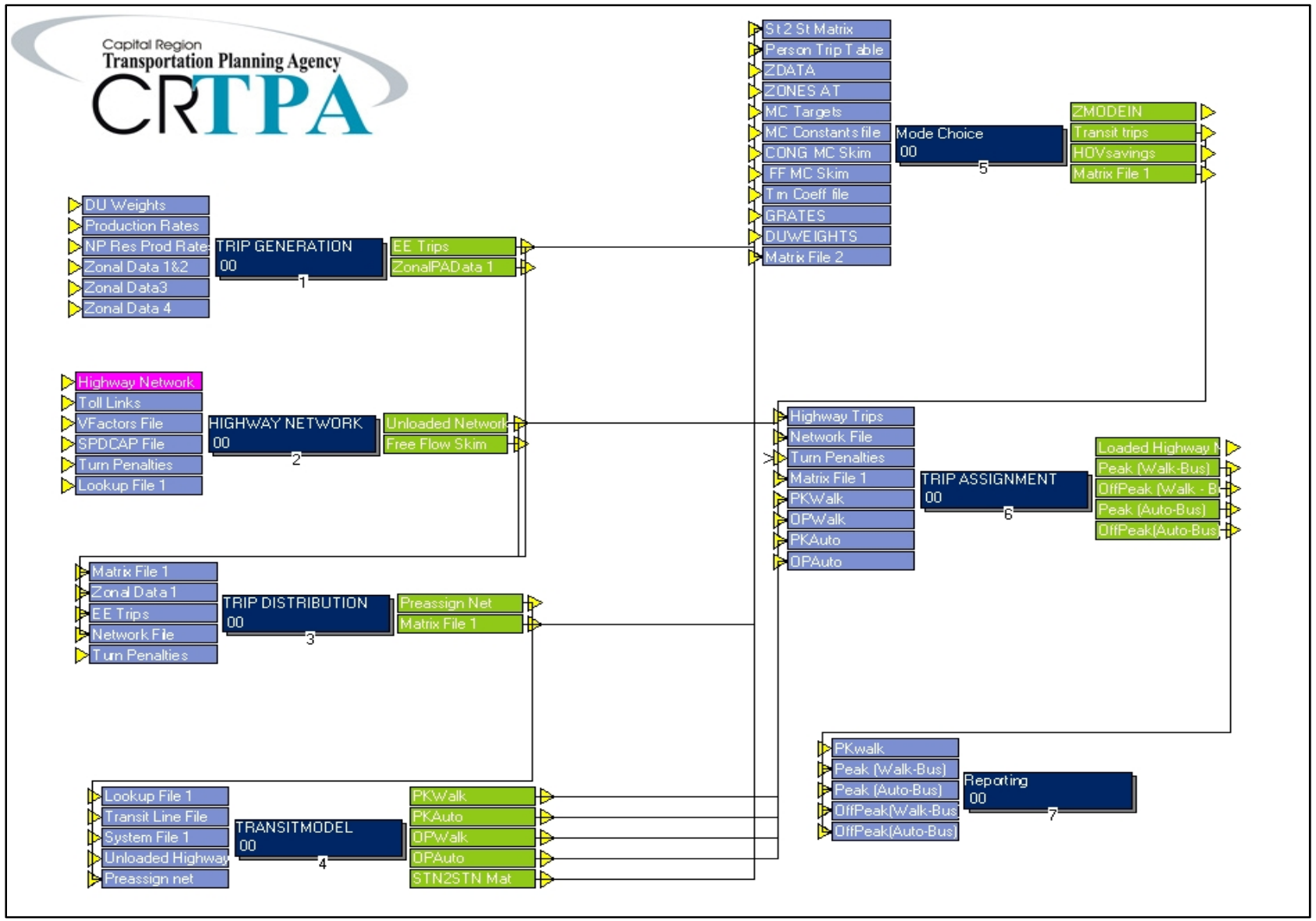
- Trip Generation
- Highway Network

- Trip Distribution
- Transit Model
- Mode Choice
- Trip Assignment
- Reporting

The flow chart appearance of the model is shown in Figure 1.

In this technical report, section 2 describes the estimation of base year external trips. Section 3 provides information on the trip generation model while section 4 explains the trip distribution model. Section 5 describes transit accessibility and path building. Section 6 explains the mode choice model. Section 7 provides information on the highway assignment model, and section 8 covers the transit assignment model. The report concludes with a summary and discussion of conclusions in section 9

Figure 1-1 Cube/CV Model Layout



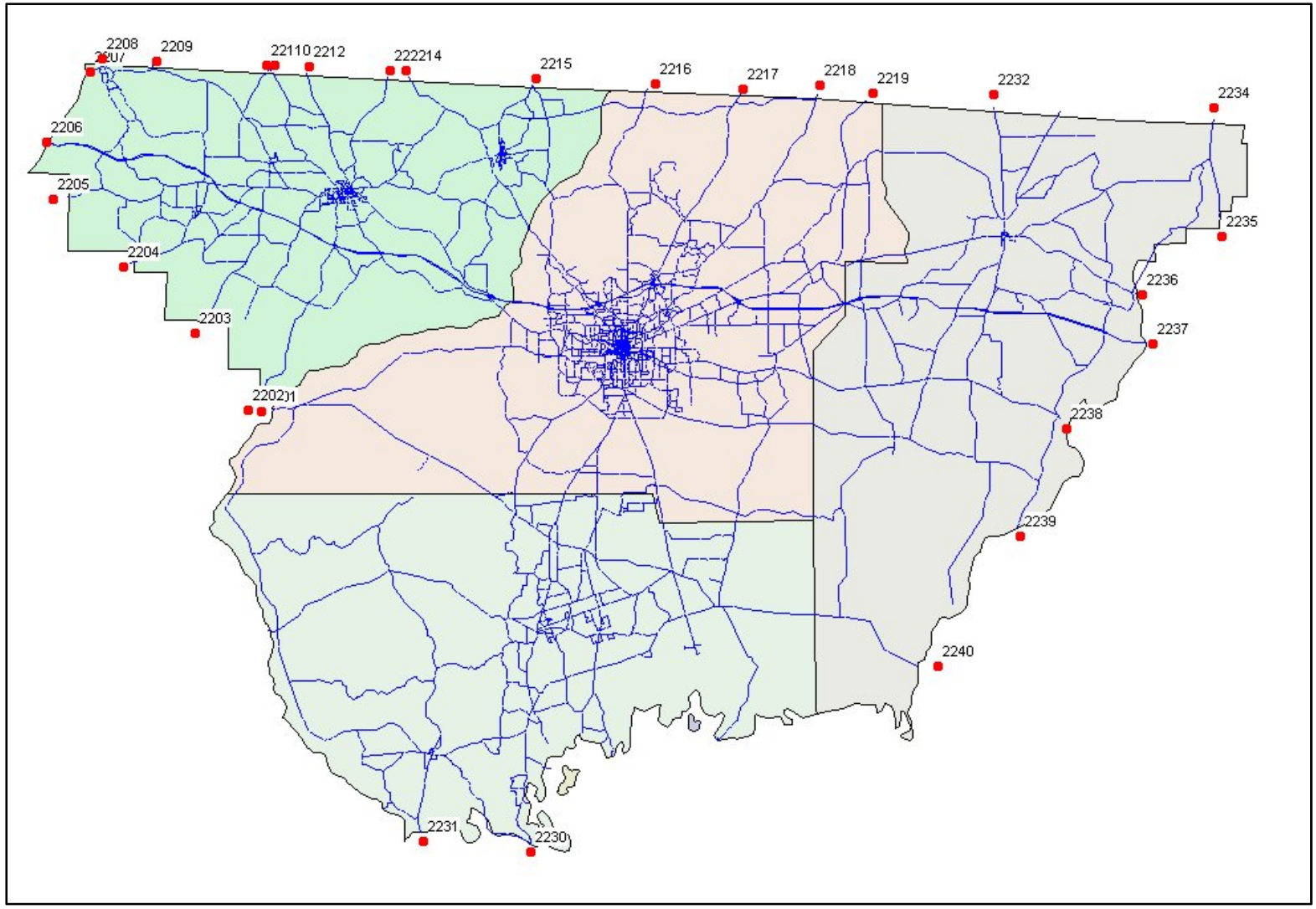
2. External Trips

This section presents the validation for external trips. Initial development of an external model for FSUTMS requires that external trips be divided into two categories: internal to external (IE) trips and external to external (EE) trips. IE trips are those trips that either have an origin outside of the study area and a destination within the study area or vice versa. EE trips have both an origin and a destination outside of the study area, but must pass through the study area.

2.1 Revised External Zone System

The expansion of the 2007 CRTPA base year model to include the Jefferson County requires the creation of the new external zones in Jefferson County and the relocation or deletion of others. The numbering system for the external zones was revised due to the addition of the new internal and external zones to the model. The external zones for the 2007 model are numbered consecutively based on location along the study area boundary. There are 29 external zones in the CRTPA 2007 model as opposed to 31 external zones in the earlier 2003 CRTPA model. External zone numbering begins with zone 2201, representing SR 20 at the Leon/Liberty County line, and continues clockwise ending with zone 2240, representing US 98 at the Jefferson/Franklin County line. Figure 2-1 shows the external zone system for the 2007 CRTPA base year model.

Figure 2-1 External Zone System



2.2 Assessment of Data Sources

The CRTPA model covers all of Leon, Gadsden, Wakulla and Jefferson counties. All external stations are at the county line. Base year 2007 external station volumes were taken from the 2007 Florida Traffic Information CD. Table 2-1 shows the 2007 base year external trips. Targets for EE and IE productions usually rely upon recently collected roadside or cordon line surveys to determine the proportion of the vehicle traffic that passes through the study area. No recent survey was available for this model validation effort, and state of Florida Policies generally prohibit the collection of roadside survey data. Therefore, the percent IE/EE splits for each external zone were derived from the CRTPA 2003 external model. The percent IE trips were applied to the 2007 Peak Season Weekday Average Daily Traffic (PSWADT) to calculate the total number of IE trips at each external zone.

Table 2-1 2007 Base Year Total External Trips

2003 model zone number	2007 model zone number	Location	2007 External Totals
1714	2201	SR 20 W @ Leon/Liberty line	4,535
1715	2202	SR 267 @ Gadsden/Liberty Line	4,896
1716	2203	SR 65 @ Gadsden/Liberty Line	1,458
1717	2204	SR 12 @ Gadsden/Liberty Line	2,003
1718	2205	CR 270 @ Gadsden/Liberty Line	573
1719	2206	I-10 W @ Gadsden/Jackson Line	23,438
1720	2207	US 90 W @ Gadsden/Jackson Line	7,292
1721	2208	CR 0425 @ Georgia Line	2,396
1722	2209	SR 269 A @ Georgia Line	1,771
1723	2210	CR 379 @ Georgia Line	677
1724	2211	SR 379A @ Georgia Line	677
1725	2212	SR 267 N @ Georgia Line	1,690
1726	2213	SR 65 N @ Georgia Line	1,250
1727	2214	CR 159 N @ Georgia Line	3,021
1728	2215	US 27 N @ Georgia Line	8,198
1729	2216	CR 155 N @ Georgia Line	1,298
1730	2217	US 319 N @ Georgia Line	9,897
1731	2218	Centerville Rd @ Georgia Line	368
1732	2219	CR 59 N @ Georgia Line	1,443
1743	2230	US 98 @ Wakulla @ Franklin Line	2,660
1744	2231	US 319 @ Wakulla/Franklin Line	2,128
New	2232	US 19 @ Georgia Line	3,093
New	2234	US 221 N @ Georgia Line	1,186
New	2235	US 221 S @ Jefferson / Madison	979
New	2236	US 90 @ Jefferson/Madison Line	1,753
New	2237	I-10 E @ Jefferson / Madison Line	26,088
New	2238	US 27 @ Jefferson / Madison Line	3,588
New	2239	S Salt Rd @ Jefferson / Taylor Line	567
New	2240	US 98 @ Jefferson / Taylor Line	2,354

2.3 Internal-External Trips

Based on the methodology described in the previous section, an estimate was prepared for the total number of IE trips at each CRTPA external zone. Initially, all the IE trips were then entered into zdata4 files. Adjustments to the zdata4 file were made based on volume-to-count ratios at the external zones. Table 2-2 shows a summary of all external trips (I-E & E-E)

Table 2-2 2007 Base Year Internal-External & External-External Trips

2007 model zone number	Location	2007 Internal-External %	2007 Internal-External Trips	2007 External-External %	2007 External-External Trips
2201	SR 20 W @ Leon/Liberty line	87%	3,943	13%	592
2202	SR 267 @ Gadsden/Liberty Line	82%	4,014	18%	881
2203	SR 65 @ Gadsden/Liberty Line	100%	1,458	0%	0
2204	SR 12 @ Gadsden/Liberty Line	97%	1,940	3%	63
2205	CR 270 @ Gadsden/Liberty Line	100%	573	0%	0
2206	I-10 W @ Gadsden/Jackson Line	75%	17,629	25%	5,808
2207	US 90 W @ Gadsden/Jackson Line	92%	6,682	8%	610
2208	CR 0425 @ Georgia Line	100%	2,392	0%	4
2209	SR 269 A @ Georgia Line	66%	1,165	34%	606
2210	CR 379 @ Georgia Line	100%	677	0%	0
2211	SR 379A @ Georgia Line	100%	677	0%	0
2212	SR 267 N @ Georgia Line	90%	1,526	10%	163
2213	SR 65 N @ Georgia Line	100%	1,250	0%	0
2214	CR 159 N @ Georgia Line	100%	3,021	0%	0
2215	US 27 N @ Georgia Line	99%	8,089	1%	109
2216	CR 155 N @ Georgia Line	91%	1,175	9%	123
2217	US 319 N @ Georgia Line	96%	9,466	4%	431
2218	Centerville Rd @ Georgia Line	100%	368	0%	0
2219	CR 59 N @ Georgia Line	100%	1,443	0%	0
2230	US 98 @ Wakulla @ Franklin Line	99%	2,644	1%	16
2231	US 319 @ Wakulla/Franklin Line	98%	2,090	2%	38
2232	US 19 @ Georgia Line	93%	2,876	7%	216
2234	US 221 N @ Georgia Line	34%	402	66%	784
2235	US 221 S @ Jefferson / Madison	20%	195	80%	784
2236	US 90 @ Jefferson/Madison Line	91%	1,598	9%	155
2237	I-10 E @ Jefferson / Madison Line	73%	19,139	27%	6,949
2238	US 27 @ Jefferson / Madison Line	99%	3,549	1%	39
2239	S Salt Rd @ Jefferson / Taylor Line	100%	567	0%	0
2240	US 98 @ Jefferson / Taylor Line	100%	2,354	0%	0

2.4 External-External Trips

The EE trips input file is generally the residual left after estimating IE trips in ZDATA4. The percentage of EE trips was applied to the PSWADT for each external zone and then distributed from each zone to each destination zone using distribution patterns from the CRTPA 2003 model EETRIPS file. Adjustments were made where appropriate after reviewing the external-external model flows for reasonability. EE movements between minor facilities that were not in close proximity were either removed or adjusted downward to better match volume-to-count ratios along screenlines. Table 2-3 shows a summary of base year 2007 EE trips.

Table 2-3 2007 Base Year External Trip

External Zone	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2230	2231	2232	2234	2235	2236	2237	2238	2239	2240	Total
2201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	9	0	0	0	0	0	0	0	0	563	17	0	0	592
2202	0	0	0	0	0	352	0	0	0	0	0	132	0	0	0	0	0	0	0	0	0	0	0	0	0	398	0	0	0	882
2203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2204	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	63
2205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2206	0	352	0	60	0	0	0	0	0	0	0	31	0	0	0	0	53	0	0	0	0	0	0	0	0	5,313	0	0	0	5,809
2207	0	0	0	0	0	0	0	4	606	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	610
2208	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
2209	0	0	0	0	0	0	606	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	606
2210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2212	0	132	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	163
2213	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	66	22	0	0	110
2216	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	0	0	0	123
2217	9	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	369	0	0	0	431
2218	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	16
2231	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	38
2232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	62	0	0	0	217
2234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	784	0	0	0	0	0	784
2235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	784	0	0	0	0	0	0	784
2236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	0	0	0	0	0	0	0	155
2237	563	398	0	0	0	5,313	0	0	0	0	0	0	0	66	117	369	0	0	0	0	0	62	0	0	0	0	0	0	0	6,888
2238	17	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
2239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2.5 External Validation Results

A review of the external cordon line and other screenlines close to the model boundary indicate a reasonable match of external travel movements. The external cordon lines achieve a volume-to-count ratio of 1.00. A more in depth discussion of volume-to-count ratios can be found in section 8 of this report.

3. Trip Generation

Trip generation determines the number of person or vehicle trips produced by or attracted to each zone according to the trip generation rates derived from statistical analysis of trip making behavior. The CRTPA 2007 model uses the standard FSUTMS trip generation process. The trip generation process is the first module in the Cube Voyager (CV) application. The process of trip generation was completely scripted in the model chain. This section summarizes production and attraction data used in the 2007 CRTPA model and lists few elements of the trip generation model. It then summarizes the overall model results.

3.1 Trip Generation Process

To be consistent to the new FSUTMS/CV standards, socioeconomic data for the trip generation model were modified from the FSUTMS/Tranplan format. Production (ZDATA1) and attraction (ZDATA2) zonal data were converted into a single zonal data file (ZDATA) in DBF format.

Cross-classification and regression models are used in the CRTPA 2007 trip generation model. Cross-classification analysis is used to group households with common socioeconomic characteristics (i.e., single, multi-family or hotel/motel dwelling unit types, household size and number of vehicles) together to create relatively homogenous groups for four home-based trip purposes. The total number of trips produced for a given TAZ is determined by applying the appropriate trip generation rate to the number of occupied dwelling units in each classification cell and summing the trips based on each class of dwelling unit in the zone. Dwelling units are grouped into categories of size using a set of household stratification curves included in the model.

While the model calculates zonal trip productions for the four home-based trip purposes using cross-classification rates, trip attractions are calculated for all trip purposes by using trip rate equations. After this process, trip attractions are scaled down or up so that the total attractions for each trip purpose match those calculated at the production end. The only exception is that nonhome-based productions are assumed equal to nonhome-based attractions in each TAZ. The CRTPA model is stratified into seven trip purposes:

- Home-based work
- Home-based shop
- Home-based social/recreation
- Home-based other
- Nonhome-based
- Truck-Taxi
- Internal-External

3.2 Trip Generation Model Development

Model validation and travel demand forecasting require accuracy in the generation of trips. The number of trips generated will impact the accuracy of subsequent trip distribution, mode choice and assignment steps.

The trip production and attraction rates used for the 2007 CRTPA model were developed in 1990 from the Tallahassee Urban Travel Characteristics Study. No recent household survey has been completed in the study area; therefore, the trip rates from 2003 CRTPA model served as the starting point for the 2007 model validation. Because validation results were within an acceptable range when compared to the previous model and other models in Florida, the 2003 trip generation rates were maintained for this model validation. Table 3-1 shows the trip production rates and Table 3-2 shows the trip attraction rates.

Dwelling unit weights were maintained from the 2003 CRTPA model. The number of trips generated was within an acceptable range when compared with 2003 model and other models in Florida. Table 3-3 depicts the 2007 dwelling unit weights.

Special generators are certain land use activities such as recreational areas, colleges/universities, military bases, and shopping malls. No special generators were used during the initial validation run of the model. Later, a set of special generators were included. The values were then slightly adjusted based on model performance (volume-to-count ratios) near special generators. Table 3-4 shows the special generator trips for the 2007 model.

Table 3-1 Trip Production Rates

Dwelling Unit Type	Number of Autos Available	Number of Persons in Household				
		1	2	3	4	5+
Single-Family	0	0.31	0.66	0.93	1.16	1.27
	1	0.68	1.21	1.48	1.5	1.54
	2+	0.9	1.7	1.98	2.31	2.74
Multi-Family	0	0.18	0.64	0.91	1.14	1.33
	1	0.64	1.05	1.32	1.55	1.74
	2+	0.88	1.63	1.77	2.22	2.4
Hotel/Motel Units		0.95	0.65	0.45	0.35	0.35

Home-Based Work

Dwelling Unit Type	Number of Autos Available	Number of Persons in Household				
		1	2	3	4	5+
Single-Family	0	0.31	0.36	0.41	0.46	0.46
	1	0.56	1.06	1.21	1.32	1.32
	2+	0.91	1.11	1.55	1.62	2
Multi-Family	0	0.23	0.27	0.31	0.35	0.35
	1	0.47	0.94	1.17	1.29	1.33
	2+	0.63	1.04	1.29	1.44	1.52
Hotel/Motel Units		0.3	1.3	2	2.5	2.9

Home-Based Shop

Dwelling Unit Type	Number of Autos Available	Number of Persons in Household				
		1	2	3	4	5+
Single-Family	0	0.13	0.16	0.19	0.25	0.28
	1	0.44	0.47	0.68	0.85	1.06
	2+	0.53	0.66	0.86	1.26	1.68
Multi-Family	0	0.15	1.18	0.20	0.23	0.28
	1	0.36	0.51	0.73	0.96	1.34
	2+	0.38	0.72	0.80	1.26	1.55
Hotel/Motel Units		0.60	1.65	2.70	3.90	5.90

Home-Based Social/Recreation

Dwelling Unit Type	Number of Autos Available	Number of Persons in Household				
		1	2	3	4	5+
Single-Family	0	0.20	0.66	1.38	2.50	4.48
	1	1.17	1.96	3.23	4.48	7.18
	2+	1.32	2.17	3.56	5.66	9.74
Multi-Family	0	0.52	0.87	1.35	2.13	3031.00
	1	1.17	2.13	3.00	4.09	5.44
	2+	1.13	2.38	4.05	4.96	6.62
Hotel/Motel Units		1.15	2.50	3.95	5.40	7.20

Home-Based Other

Table 3-2 Trip Attraction Rates

1	Home Base Work Attractions	= 0.89 (Total Employment)
2	Home Base Shopping Attractions	= 2.45(Commercial Employment)
3	Home Base Social-Recreation Attractions	= 0.14(Dwelling Units) + 1.5 (Commercial + Service Employment)
4	Home Base Other Attractions	= 0.16 (Dwelling Units)+1.02(Commercial + Service Employment)+1.02 (School Enrollment)
5	NonHome Based ATTRS	= 0.27(Dwelling Units)+2.61(Commercial)+1.26(Service Employment)
6	Truck/Taxi Attractions	= 0.27 (Dwelling Units)+0.41(Total Employment)
7	Internal-External Attractions	= Total Internal-External Productions * (Total Zonal Internal Attractions/Total Area wide Internal Attractions)

Table 3-3 Dwelling Unit Weights

Person Per DU	Average Person Per Dwelling Unit																
	0.00-1.12	1.13-1.37	1.38-1.62	1.63-1.87	1.88-2.12	2.13-2.37	2.38-2.62	2.63-2.87	2.88-3.12	3.13-3.37	3.38-3.62	3.63-3.87	3.88-4.12	4.13-4.37	4.38-4.62	4.63-5.99	6.00+
1	0.93	0.79	0.54	0.42	0.34	0.28	0.23	0.19	0.15	0.13	0.12	0.11	0.10	0.03	0.06	0.02	0.00
2	0.07	0.17	0.41	0.46	0.45	0.42	0.38	0.34	0.30	0.26	0.22	0.19	0.18	0.10	0.11	0.04	0.00
3	0.00	0.02	0.04	0.07	0.11	0.15	0.17	0.20	0.21	0.21	0.20	0.19	0.18	0.12	0.10	0.08	0.02
4	0.00	0.01	0.01	0.03	0.06	0.10	0.13	0.17	0.19	0.21	0.22	0.21	0.20	0.30	0.24	0.17	0.05
5+	0.00	0.01	0.01	0.02	0.03	0.06	0.07	0.11	0.15	0.19	0.25	0.29	0.35	0.45	0.50	0.69	0.93

Table 3-4 Special Generator Trips

ZONE	PA	OPERAND	TRIPS_DIFF	PCT_HBW	PCT_HBSH	PCT_HBSR	PCT_HBO	PCT_NHB
240	P	+	5,000	0	0	0	80	20
128	P	+	4,000	0	0	0	100	0
248	P	+	3,800	0	0	0	80	20
246	P	+	3,500	0	0	0	80	20
376	P	+	3,500	0	0	10	90	0
226	P	+	3,000	0	0	10	40	50
243	P	+	3,000	0	0	0	80	20
247	P	+	1,000	0	0	20	60	20
244	P	+	1,000	0	0	20	60	20
754	A	+	13,500	0	0	0	100	0
127	A	+	12,000	0	0	0	40	60
245	A	+	16,000	0	0	0	40	60
250	A	+	12,000	0	0	0	40	60
375	A	+	25,000	0	0	0	40	60
201	A	+	12,000	0	0	0	40	60

3.3 Trip Generation Model Results

Throughout the validation process, summaries of trip generation statistics were used to assess model validity. Comparison between the 2007 CRTPA and 2003 CRTPA models were made. Statistical comparisons also were made to other regional models in Florida. Statistics from other models were aggregated to account for different trip purposes schemes.

Table 3-5 shows a summary the aggregate trip rates. The total number of trips per dwelling unit was slightly lower than the Polk County and NERPM, slight higher than OUATS models used in the comparison. Trips per person were higher than the 2003 CRTPA model. Trips per employee were lower than the 2003 CRTPA model and the Polk County models, but higher than NERPM and OUATS models.

Table 3-5 Aggregated Trip Rates

Unit of Measure	2007 CRTPA Model	2003 CRTPA model	2005 NERPM	Polk County 2000	2000 OUATS
Person per Household	2.23	2.39	2.43	2.6	2.54
Internal Trips per Household	8.79	9.26	8.864	9.7	8.62
Internal Trips per Person	3.95	3.87	3.65	3.73	3.39
Internal Trips per Employee	7.62	7.68	6.905	8.68	6.36

The percent of trips by purpose didn't significantly differ from other models used in the comparison. Home-base shop, home-based social/recreation, and home-based other trips represented almost the same proportion of trips than found in 2003 CRTPA model. Table 3-6 displays a summary of trips by purpose.

Table 3-6 Summary of Trips by Purpose

Trip Purpose	2007 CRTPA Model		2003 CRTPA Model		2005 NERPM	Polk County 2000	2000 OUATS
	Productions	% by Productions	Productions	% by Productions	% by Productions	% by Productions	% by Productions
Home-Based Work	203,970	14%	183,376	14%	22%	16%	12%
Home-Based Shop	155,100	11%	144,104	11%	11%	10%	12%
Home-Based Socrec.	106,484	7%	98,874	7%	10%	9%	9%
Home-Based Other	426,799	29%	392,334	30%	23%	25%	23%
Nonhome-Based	346,049	24%	322,583	24%	22%	24%	29%
Truck-Taxi	114,413	8%	104,483	8%	9%	8%	10%
Internal-External	102,748	7%	78,017	6%	3%	8%	5%
Total	1,455,563	100%	1,323,771	100%	100%	100%	100%

4. Highway Network and Skims

Highway Networks represent the transportation system in the travel demand model study area. The highway network includes a series of interconnected "links" each containing a set of attributes relevant to simulating highway conditions. Highway network processing is the second module in the CV application. The highway network module also includes the highway path and skim building procedures. Minimum travel time paths are calculated using time over the highway system. In building paths, a turn penalty file is used. Paths are not built through prohibited movements defined in the turn penalty file. Initial paths are built using free-flow speeds. This section describes the development of the highway network and highway path building.

4.1 Highway Network

The critical highway network attributes in FSUTMS are area type, facility type, and number of lanes. With these attributes, the highway network module of the model calculates speeds and capacities that the model uses later in the model stream for trip distribution and trip assignment.

Speed, capacities and volume/delay functions play an important role in nearly all facets of the travel demand model. Initially, a speed-capacity table was developed base on FSUTMS default speeds and capacities. Speed adjustment involved an iterative, trial-and-error process. The continual adjustment of speed is intended to provide a better model validation by moving trips from over-assigned facilities to under-assigned facilities. This process involved careful factoring of speeds both upward and downward while maintaining a logical hierarchy of speeds based on area type, facility type, and number of lanes. Table 4-1 shows the speed-capacity table format

Table 4-1 FSUTMS SPDCAP File Format

Column	Contents
A	Two Digit Area Type Code + Two Digit Facility Type Code + Two Digit Number of Lanes Code
B	Capacity/Lane
C	Speed

4.2 Highway Paths and Skims

The CRTPA highway path module uses standard CV procedures to build time and distance skim matrices. These paths are defined as the shortest time path through the highway network for each zone pair. Terminal time and intrazonal times are also added to the interzonal skims. Intrazonal times represent the travel time assumed for trips that begin and end in the same TAZ. Theses times are calculated as one-half the travel time from one zone to the nearest adjacent zone. Terminal times represent the time at either end of a trip to travel from an origin to the network or from the network to a final destination. This accounts for the time necessary to walk to or from the vehicle used for any given trip and to park. It was decided that the terminal time from the 2003 CRTPA model would be used for this validation because the validation results were within an acceptable range. Table 4-2 lists the terminal time by area type used in CRTPA 2007 model.

Table 4-2 Terminal Time

Terminal Times	Area Type	Area Type Descriptions
5	12	Urbanized Area (Under 500,000) CBD
3	13	Other Urbanized Area CBD and Small City Downtown
2	14	Non-Urbanized City Downtown
4	21	All CBD Fringe Areas
1	31	Residential Area of Urbanized Areas
2	32	Undeveloped Portions of Urbanized Areas
1	33	Transitioning Areas/Urban Area Over 5,000 Population
4	41	High Density Outlying Business District
3	42	Other Outlying Business District
2	51	Developed Rural Areas/Small Cities Under 5,000 Population
1	52	Undeveloped Rural Areas

Skims are updated with terminal times which are a function of area type and with intrazonal times. Turn prohibitors are also added at this stage. Free-flow travel time skims between zone pairs are developed during the “HIGHWAY NETWORK” module. Highway network characteristics are input into this process.

Turn prohibitors are applied in the base year model validation based on information from the 2003 CRTPA model and local knowledge. Appendix A lists the prohibitors used in the 2007 CRTPA model.

5. Trip Distribution

The CRTPA trip distribution model distributes trips between pairs of TAZs using a gravity model, and produces the congested highway skims that are used for the transit model. This section of the report describes validation of the trip distribution model, including an overview of the model structure and development, and a summary of model results.

5.1 Trip Distribution Model Process

The trip Distribution model connects trip productions and attractions between each pair of TAZs. These connections typically are calculated by a Gravity Model. A Gravity model distributes trips between zones directly proportional to the relative attractiveness of each individual zone and inversely proportional to the friction between them (i.e., time). The result is a matrix of person trips defined in terms of production and attractions as opposed to origins and destinations. Resulting trip matrices are processed later in the model chain during model choice to allocate trips by auto occupancy and transit categories to create the basis for vehicle trips.

The general distribution process includes building travel time skims as well as the application of the gravity model. The CRTPA model uses the Cube Voyager gravity model to distribute trips between production and attraction zones for all trips and purposes. The CRTPA trip distribution module performs the following functions:

- Distribute all trips with free flow skims
- Perform pre-assignment
- Develop congested skims

The primary input data used for Distribution is the friction factor file. This file is used by the Gravity Model to measure the effects of spatial separation between zones for trip distribution. It is generally assumed that trips are less likely to be allocated to destinations further away if alternative destinations with shorter travel times and similar attractiveness are available. Because no recent travel survey was available for the Tallahassee Urbanized Area, the 2003 CRTPA model friction factors were used for this model validation. The personal trips generated from trip generation are distributed for each of 7 trip purposes. These person trips are converted into vehicle trips during mode choice and then loaded onto the network during highway assignment.

The 2007 CRTPA model derives congested highway skims from a preliminary mode choice and highway assignment step during distribution. The mode choice step in the distribution module is a person-to-auto trip conversion model that uses the auto occupancy conversion factor from 2003 CRTPA Model.

5.2 Trip Distribution Model Validation

Errors in the trip distribution module can lead to significant problems in the execution of subsequent steps in the model chain. The validation efforts included modifications to network speeds and capacities and deployment of K factors (socioeconomic adjustment factors). The CRTPA 2007 model uses the set of friction factors from the CRTPA 2003 model. Friction Factors are listed in Appendix B.

K factors were applied to trip purposes 1-4 (home-based-work, home-based-shop, home-based-soc/rec, home-based-other) to factor down the attractiveness of the Leon/Tallahassee area to trips produced in Gadsden and Wakulla counties. This method was utilized due to the larger study area with a centralized urban area surrounding by a large rural area. The CRTPA model was considered appropriate for the use of K-factors because of the significant coverage of rural development and the presence of multiple urban areas separated by undeveloped areas.

Table 5-1 depicts average trip length by purpose for the 2007 CRTPA model, 2003 CRTPA model and other comparable models in Florida. In comparing the 2007 and 2003 models, average trip lengths have increased since 2003 for HBW and HBS trips purposes.

Table 5-1 Average Trip Length by Purpose

Trip Purpose	2007 CRTPA Model	2003 CRTPA Model	2005 NERPM	Polk County 2000	2000 OUATS
Home-Based Work	20.51	19.95	25.67	17.05	21.5
Home-Based Shop	17.55	18.03	18.14	14.04	13.87
Home-Based Soc/rec	18.95	17.95	19.5	15.08	16.53
Home-Based Other	18.03	19.05	19.73	15.08	14.69
Nonhome-Based	16.72	17.1	17.96	13.74	16.84
Truck-Taxi	16.67	16.82	15.04	15.55	16.8
Internal-External	54.41	47.11	51.64	26.23	36.69
Total	23.26	22.29	22.11	16.68	19.56

Table 5-2 depicts the number and percent of intrazonal trips in the 2007 CRTPA model.

Table 5-2 Intrazonal Trip Summary

	2007 CRTPA Model			**% of Intrazonal**			
Trip Purpose	**Total Trips**	**Intrazonal Trips**	**% of Intrazonal**	**2003 CRTPA Model**	**2005 NERPM**	**Polk County 2000**	**2000 OUATS**
Home-Based Work	203,970	1,079	0.53%	0.25%	0.58%	3.18%	4.32%
Home-Based Shop	155,100	1,914	1.23%	0.45%	4.20%	3.68%	25.02%
Home-Based Socrec.	106,484	1,687	1.58%	0.73%	4.98%	10.58%	8.78%
Home-Based Other	426,799	7,509	1.76%	0.63%	2.09%	4.21%	16.74%
Nonhome-Based	346,049	9,801	2.83%	0.81%	4.97%	4.95%	11.10%
Truck-Taxi	114,413	3,018	2.64%	1.27%	5.76%	5.72%	17.16%
Total	1,352,815	25,008	1.85%	0.66%	3.25%	4.96%	13.06%

6. Transit Network

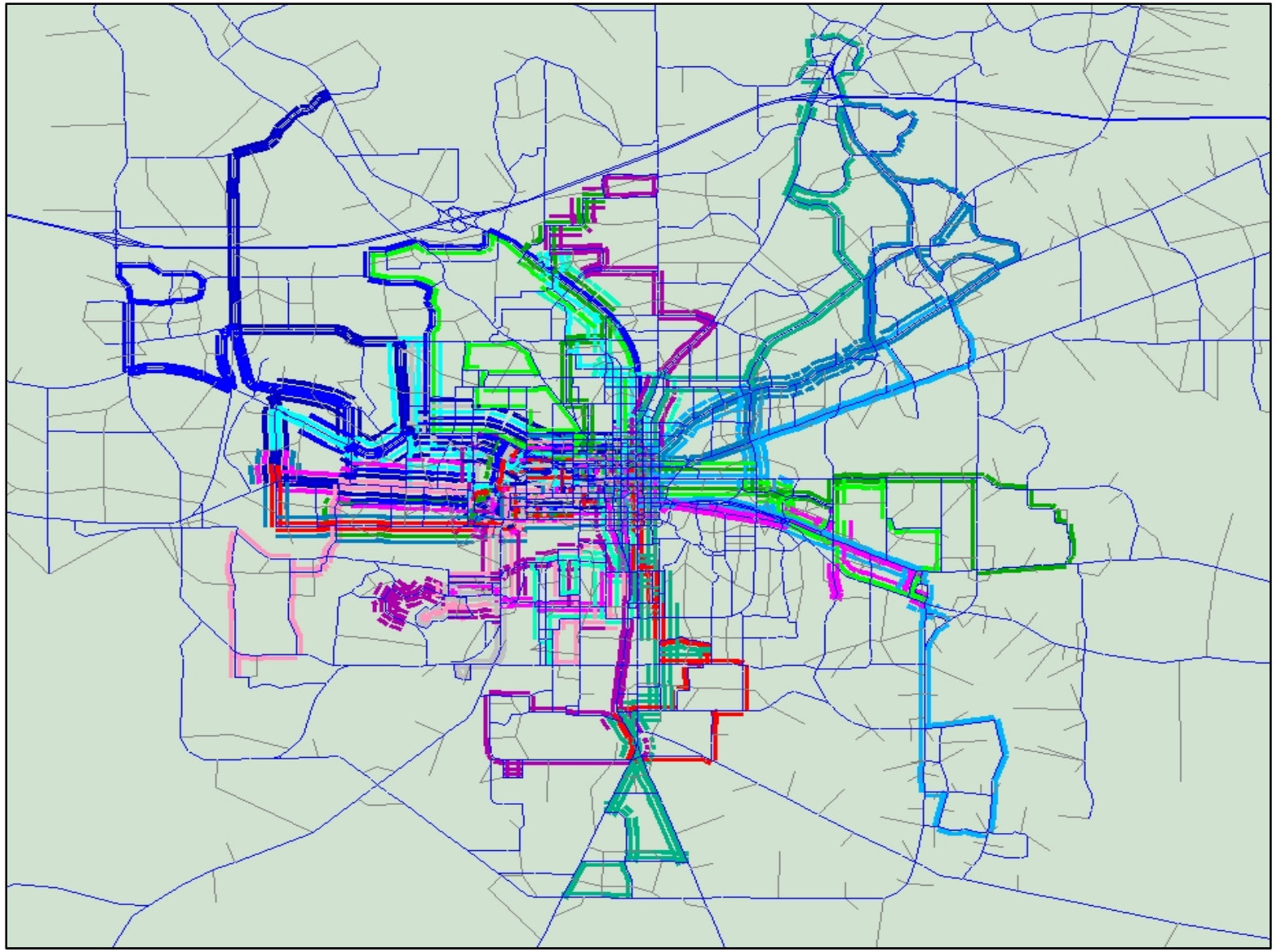
StarMetro provides the transit service for the Tallahassee area. The transit service in the region is a radial fixed-route bus network. All routes in the system originate at C.K. Street Plaza and provide service to the north, south, east and west within the urban area. The Cube Public Transport (PT) program is used to represent the transit networks in CRTPA model. Transit path building involves the generation of zone-to-zone transit paths, transit skims, and transit fares. These files are built for peak and off-peak periods.

This section of the report provides information about the transit network and transit paths for the transit service in Tallahassee area.

6.1 Transit Network

StarMetro provided shapefiles and bus schedules for the 2007 transit network. A transit line file that represents the transit network was developed for this effort. As mentioned in Technical Memorandum 1, the transit line file is a standard PT line file. Transit networks are predominantly based on the unloaded highway network and supplemented with transit data such as route alignments, stop locations, and headways. The transit network in CRTPA has been established to accommodate walk and auto access modes for local bus service. Like other FSUTMS models, CRTPA uses the "AM" designation for "peak" transit trips and "MD" for "off-peak" transit trips. There is not a true time of day description. Rather, the "peak" period refers to HBW trips while "off-peak" refers to all other internal person trip purposes from trip distribution. The year 2007 StarMetro transit network is shown in Figure 6-1. The mode definitions have also been developed to conform to recent experience with the Federal Transit Administration. The FTA considers all bus service to be identical and should be treated as such in the mode choice model. A bus should be designated as 'premium' only if it is supposed to experience significant travel time improvements. Consequently, all local and express bus service is now considered "local". The general boarding fare is $1.50 and transfers are free. The use of monthly and weekly passes is encouraged.

Figure 6-1 StarMetro Transit Service Network



6.2 Transit Paths

The PT scripts are used to obtain travel times and costs for transit service based on access mode. The transit path application first identifies the minimum paths between all pair of zones by all available transit modes. After paths are created and travel time skims are constructed, the transit cost for each preferred path is calculated based on boarding and transfer fares. Multiple paths are built both for AM peak and Midday periods. The nested logit model requires three sets of transit paths for each peak and midday period. The path parameters are defined in the individual path factor files.

Transit skims are the travel cost components obtained from the transit paths. These are required by the mode choice model in calculating the share of the different paths. There is a skim matrix for each path and each of these matrices has 15 tables, which are listed in Table 6-1

Table 6-1 Tables in the transit skim matrices

Table #	Name	Modes Included
1	Walk Access Time	Walk-access, walk-egress, station access
2	Drive access Time to Bus	Weighted drive-access time plus weighted auto occupancy cost, parking cost & terminal time
3	Sidewalk/transfer Time	Transfer time
4	Bus In-vehicle Time	All local, express and BRT bus service
5	Premium Bus In-vehicle Time	Limited stop service
6	Circulator In-vehicle Time	Circulators, streetcars, trolleys
7	Light/Heavy Rail In-vehicle Time	Light rail, heavy rail
8	Commuter Rail In-vehicle Time	Commuter rail
9	Other Mode	Typically mode introduced before project mode
10	Project Mode In-vehicle Time	New mode that is object of alternatives analysis
11	Boarding	All transit modes
12	Initial Wait Time	"
13	Transfer Wait Time	"
14	Fare	"
15	Total Transit Time	All modes

7. Mode Choice

The CRTPA mode choice model uses a nested logit formulation. A nested logit model is a behavioral model that is used to estimate the probability of a decision maker's choice of taking an alternative from a set of alternatives. This section of the report describes the mode choice structure, development and validation.

7.1 Mode Choice Structure

In a mode choice mode, for any given choice, the probability of a mode being chosen is given by:

$$p_m = \frac{e^{u_m}}{\sum_{i=1}^{M} e^{u_i}}$$

Where:

P_m = Probability of choosing mode m,

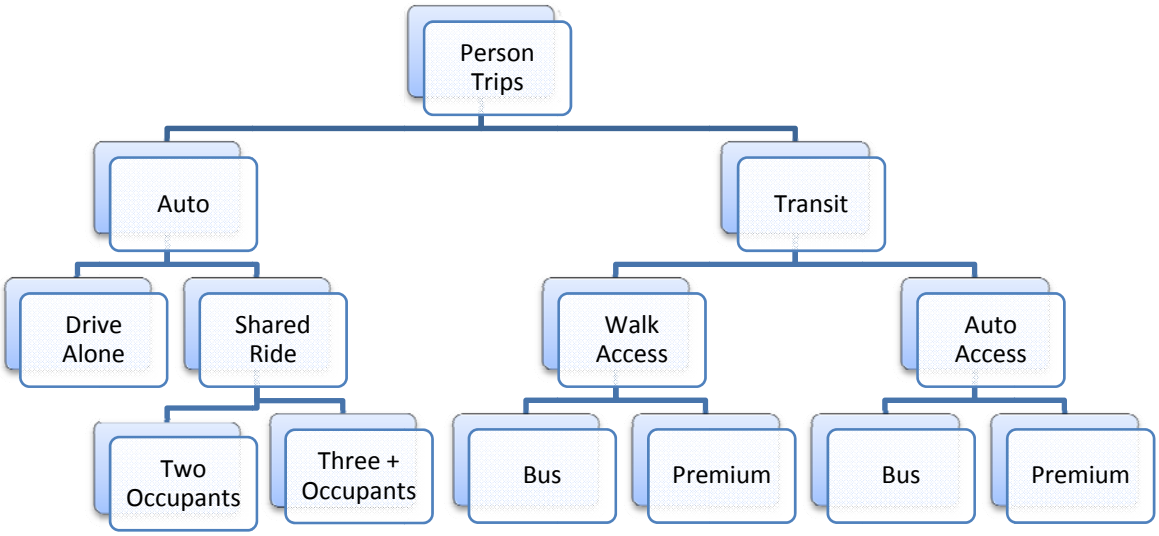
u_m= Utility of mode m

M = Number of different modes to be chosen among

A nested logit mode choice model works by computing the utility for each of the bottom level choices. This utility represents the total economic "cost" in terms of travel time, fare or other cost and other impediments/inducements to travel associated with each mode. It is typically constructed as a linear function of the different components of time and cost. The choices at the top level are auto and transit. The auto nest is divided into drive alone and shared ride trips. Shared ride trips are further divided into 2 passenger trips and 3+ passenger trips. The transit nest is divided into the access markets: walk access and auto access. The access trips are further divided into bus and project modes. Figure 7-1 depicts the mode choice nest structure.

The total person trips aredivided into zero-car, one-car and two+-car households for the HBW and non-work (HBNW) purposes. No market segmentation is done for the NHB purpose. The mode choice module is run separately for these markets.

Figure 7-1 Mode Choice Nesting Structure



7.2 Mode Choice Model Development

The transit targets developed for a travel demand model typically include cross-tabulations of the average weekday linked trips along several dimensions such as trip purpose, mode of access, and auto ownership market obtained from transit survey. Since the recent transit survey conducted for StarMetro does not include some of these cross-tabulations, alternative methods were developed for the transit targets. After reviewing the transit rider characteristics for the Tallahassee region and other regions in Florida, it was found that Hillsboro Area Regional Transit (HART) system has very similar transit rider characteristics. In both systems, local bus is the dominant form of transit service, and key markets in both areas are captive riders (riders from 0 and 1 car household). Therefore, it was decided that the percentages of the average weekday linked trip cross-tabulations from the HART survey would be utilized to develop the Tallahassee transit targets. However, in Tallahassee area more than 50% of transit riders are students, while the percentage of student riders on HART is much smaller. The student trips from home to university were assumed to be home-based other (HBO)trips. Therefore the cross-tabulations from the HART survey were modified to include these student trips and other HBO trips as 60% of the total riders. The percentage of other trip purposes were proportionately scaled down. According to StarMetro, there were no park-n-ride facilities in the region; therefore, all transit trips were assumed to have accessed transit by walking. Table 7-1 shows the 2007 Tallahassee target shares.

Table 7-1 Tallahassee Target shares

	HBW			HBO			NHB		
	0 Car HHs	One Car HHs	Two+ Car HHs	0 Car HHs	One Car HHs	Two+ Car HHs	0 Car HHs	One Car HHs	Two+ Car HHs
Drive Alone	0.00%	3.90%	9.51%	0.00%	7.39%	13.07%	13.33%	0.00%	0.00%
Carpool 2	0.33%	0.79%	1.09%	0.70%	7.01%	12.16%	8.40%	0.00%	0.00%
Carpool 3+	0.14%	0.22%	0.29%	0.51%	5.19%	9.10%	6.09%	0.00%	0.00%
Walk-bus	0.10%	0.06%	0.03%	0.27%	0.13%	0.06%	0.12%	0.00%	0.00%
P-N-R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
K-N-R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

7.3 Mode Choice Results

Calibration of the mode choice consisted of adjusting the mode choice utility expression constants. Once the mode share targets were set, the constants were calibrated interactively by varying the values of the constants manually, running the mode choice model, and comparing the model estimations with the transit and auto targets. At the end of the calibration process, the model was able to replicate observed mode shares for each mode and market segment. Table 7-2 is the comparison of the model estimated and target trips.

Table 7-2 Comparison for Model Estimations and Target Trips

	HBW			HBO			NHB		
	0 Car HHs	One Car HHs	Two+ Car HHs	0 Car HHs	One Car HHs	Two+ Car HHs	0 Car HHs	One Car HHs	Two+ Car HHs
Drive Alone	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%
Carpool 2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Carpool 3+	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Walk-bus	0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.01%	0.00%	0.00%
P-N-R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
K-N-R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

8. Highway Assignment

The highway assignment model loads auto trips onto the highway network. The 2007 CRTPA model uses the standard FSUTMS assignment model which produces daily loaded networks using an equilibrium assignment algorithm. Validation of highway assignment involved the adjustment of the speeds, capacities, penalties and other trip distribution elements as well as centroid locations and assignment iterations. A number of key evaluation statistics are generated during the assignment phase of the model. Three of these (volume-to-count ratios, vehicle miles traveled, vehicle hours traveled) are compared by area type, facility type and number of lanes.

This section describes validation of the highway assignment model including the overview of the model structure, development and adjustment of the model parameters and a review of the model results.

8.1 Highway Assignment Model Structure

The highway assignment is a multi-class equilibrium assignment. The "BPR" equation is used as the volume-daily function, using the VFACTORS file. The BPR function is

$$T_c = T_f\{1 + \alpha(v/c)^\beta$$

Where,

T_c = congested link travel time

T_f = link free-flow travel time

V = assigned volume

C = link capacity

A,β =BPR parameters

The VFACTOR file contains a set of UROAD factors, CONFAC values, and BPR coefficients. The VFACTOR file used in the 2003 CRTPA model was used for the 2007 model validation. The VFACTOR parameters are listed in Appendix C.

8.2 Highway Assignment Development and Validation

Validation of a traffic assignment involves an examination of several statistics, most of which are related to actual ground counts taken on various links throughout the network. The final validation of the model usually deals with adjustments throughout the model chain aimed at replicating traffic counts as closely as possible, yet maintaining the balance of other values, relationships, and parameters in the model. Adjustments to the model stream included the following:

- A review of the VMT ratio produced by volumes and traffic counts for certain facility and area types indicated that adjustments to the speed-capacity table would be beneficial.

- Review of the model results showed that certain links were under-assigned, even though as judged statistically, the model results were good. Thus, the area type and facility type codes for these links were examined closely and in some cases minor adjustment were made.
- Examination of the model results showed that the model was underestimating travel near the universities FSU and FAMU. Thus, special generators were added for these areas.

8.3 Highway Assignment Validation Result

The key statistics analyzed as part of the validation process include the following:

- Ratios of volume-to-count vehicle-miles traveled (VMT);
- Ratios of volume-to-count vehicle-hours traveled (VHT);
- Ratios of volume-to-count volumes;
- Volume-to-count ratios along screenlines;
- Percent root mean square error.

FDOT assignment validation standards include an accuracy level of ± 5% for area-wide VMT, VHT and volume and a ± 15% error for each category of area type, facility type and number of lanes. The 2007 CRTPA model area-wide volume/count ratio of 1.02 (+ 2%) falls within the criterion. In only a few instances did any of the link groups fall outside the ± 15% level of accuracy recommend by FDOT. Considering the large number of different facility types in this model, the few categories that are outside the accuracy range is not a reason for concern. Table 8-1 and Table 8-2 summarized the model VMT by facility type and area type.

Table 8-1 Volume/Count VMT by Facility Type

Facility Type	Model/Count VMT
Freeway	1.09
Divided Arterial	1.03
Undivided Arterial	1.05
Collectors	0.94
One-way/Frontage	0.99
Total	1.02

Table 8-2 Volume/Count VMT by Area Type

Area Type	Model/Count VMT
CBD	1.02
Fringe	0.91
Residential	1.04
OBD	1.01
Rural	1.13
Total	1.02

Another measure of model validation is the ratio of volumes to counts at screenlines. An accuracy criterion of ± 20 percent is considered appropriate for certain low volume screenlines where summed highway count columns are less than 50,000 vehicles per day (VPD). An accuracy level of ± 15 percent is applied to screenlines that experience total highway count volumes between 50,000 and 75,000 VPD. The general ± 10 percent accuracy criterion is used to measure higher volume screenline where summed screenline volumes exceed 75,000 VPD. A summary of screenline volume, counts and ratios is displayed in Table 8-3. Screenline locations are shown in Figure 8-1 and Figure 8-2. Only 5 of 31 screens failed to meet FDOT's desirable range, indicating that the trip distribution model is working correctly, and that the model is doing a good job of replicating traffic in major corridors.

Table 8-3 Screenline Volumes and Ratios

SCREENLINE NUMBER	TOTAL VOLUME	TOTAL COUNT	VOLUME TO COUNT RATIO
1	89,544	70,838	*1.26*
2	105,796	91,752	*1.15*
3	188,993	182,536	1.04
4	154,597	146,243	1.06
5	117,087	99,740	*1.17*
6	128,897	131,734	0.98
7	32,897	34,757	0.95
8	125,418	134,856	0.93
9	47,947	43,244	1.11
10	107,689	119,888	0.90
11	53,364	58,246	0.92
12	117,557	110,718	1.06
13	40,656	39,128	1.04
14	106,087	95,828	1.11
16	108,821	104,364	1.04
17	98,485	108,950	0.90
18	40,575	39,309	1.03
19	97,011	87,891	1.10
20	58,257	53,766	1.08
21	43,548	37,500	1.16
22	33,952	23,720	*1.43*
23	14,222	14,220	1.00
24	4,034	4,036	1.00
25	32,500	32,502	1.00
26	15,514	15,516	1.00
27	13,008	12,956	1.00
28	52,772	44,234	*1.19*
29	24,287	21,958	1.11
30	4,390	4,280	1.03
31	35,224	35,332	1.00

Figure 8-1 Screenline Locations

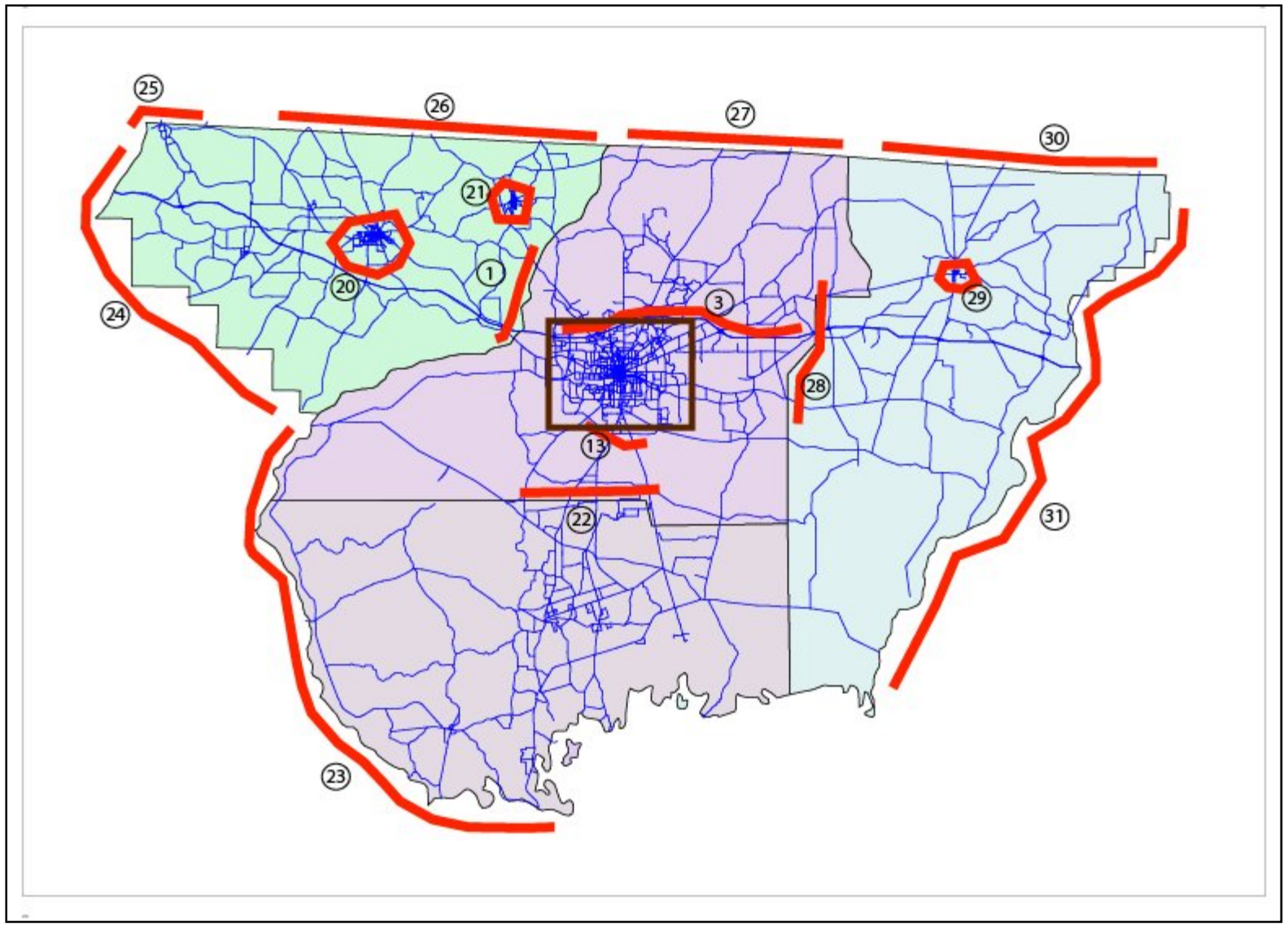
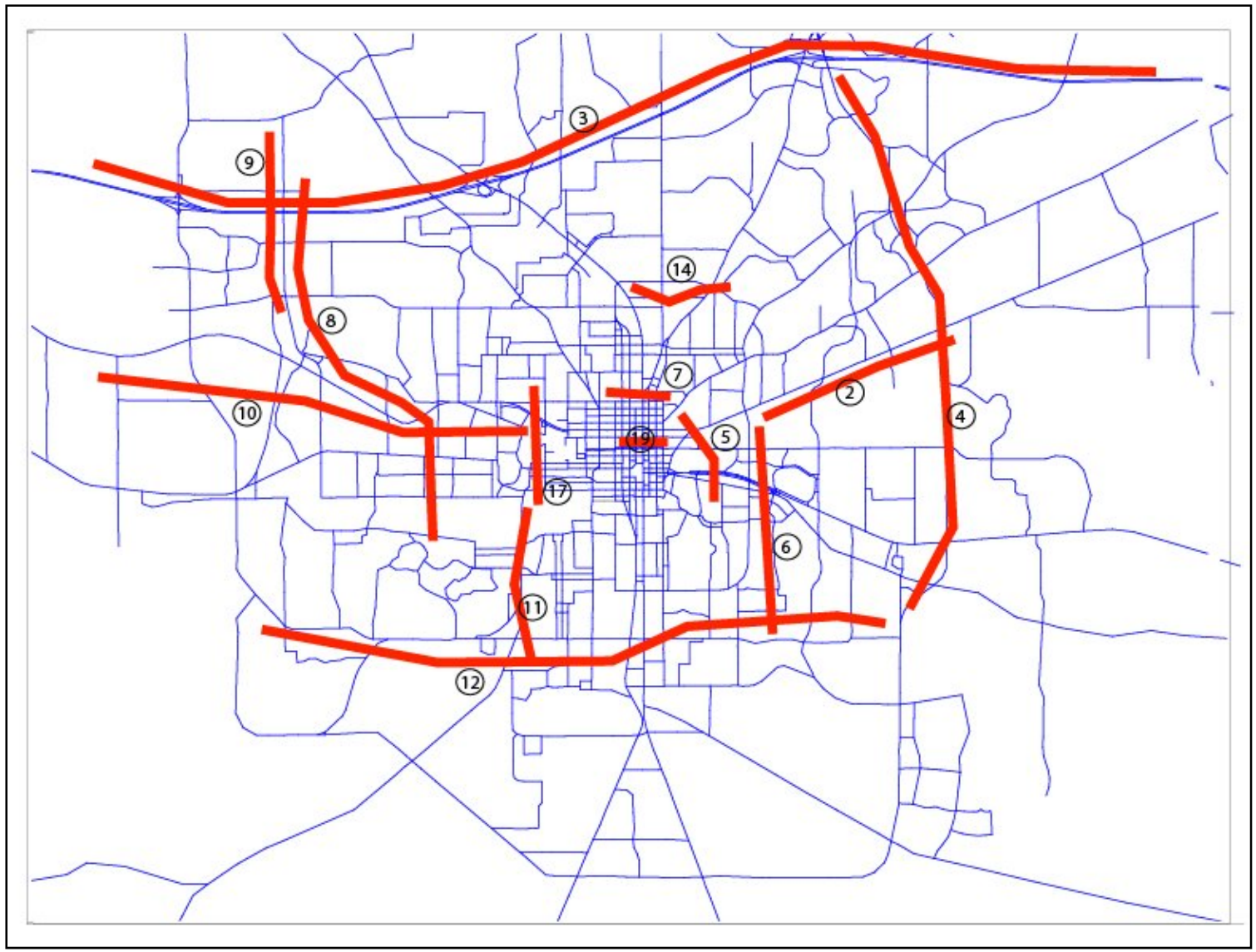


Figure 8-2 Internal Screenlines for Leon County Urban Area



Another indicator for model validation is the percent root mean squared error (RMSE). RMSE indicates whether the simulated network contains an acceptable level of assignment error. This is based on both the area wide and volume group summaries. Accuracy is more stringent for higher volume facilities than for lower volume facilities. Table 8-4 shows the RMSE for the 2007 CRTPA model. All volume groups achieved FDOT accuracy standards. The overall RMSE of 31 percent indicates that the model performance is good.

Table 8-4 Root Mean Squared Error

Percent RMSE for Volume Group 1	1- 5,000:	50.50%	Allowable RMSE	45 - 55%
Percent RMSE for Volume Group 2	5,000- 10,000:	25.60%	Allowable RMSE	35 - 45%
Percent RMSE for Volume Group 3	10,000- 20,000:	23.20%	Allowable RMSE	27 - 35%
Percent RMSE for Volume Group 4	20,000- 30,000:	18.50%	Allowable RMSE	24 - 27%
Percent RMSE for Volume Group 5	30,000- 40,000:	12.60%	Allowable RMSE	22 - 24%
Total		30.90%	Allowable RMSE	32 - 39%

9. Transit Assignment

Transit Assignment assigns the transit trip tables produced by the mode choice model onto the transit paths obtained during the path building step. The transit trips are assigned to the minimum time path by an all-or-nothing method for each combination of mode and access. This section of the report describes the transit assignment process and results

9.1 Transit Assignment Process

Transit assignment is the process of loading trips to the transit network. For the 24-hour transit model, HBW trips are assigned to the peak network and all non-work trips are assigned to the off-peak network. The PT assignment process produces an output file which contains a summary of boarding and alighting by route link. The transit trips are allocated independently of highway trips. The resulting loads are reported by line, mode and operator.

9.2 Transit Assignment Validation

The main validation statistic for the transit assignment model was a comparison of system-wide ridership as reported by the model and ridership reported by StarMetro. The modeled number of total daily linked trips is 9,574. StarMetro reports a total of 14,361 daily boarding (unlinked trips), and a transfer rate of about 50%, which is reasonable. Table 9-1 compared modeled transit trips to the ridership reported by StarMetro. Some of the routes show more variability in the ratio of the estimated trips to the observed trips. The variations are primarily due to the very low number of trips. The level of agreement between the model and the data provided by StarMetro is typical of bus transit network model.

Table 9-1 Unlinked Trips by Routes

Route Number	Route Name	Model Estimated Ridership	Observed Ridership
Route11OB	FAMU,PROVIDENCE	447	211
Route12OB	Eastwood office plaza & Capital circle N	702	181
Route13OB	FRENCHTOWN	554	773
Route14OB	Florida A&M University	703	839
Route15OB	FSU,Mabru Manor,and Tall. Museum	160	234
Route16OB	TMHC,Woodgate,and Thomas. Rd	648	146
Route17OB	FSU,Huntington Woods & US 27 N.	552	368
Route18OB	TMH,Capital Circle NE,Eastgate	447	295
Route19OB	Talla. Mall,Macon Coummunity	444	309
Route1OB	NorWood,Tallahassee Mall, Astoria Park,H	391	352
Route20OB	Alumni Village, Liberty Park	167	246
Route21OB	Mission Rd,Capital Cr NW,ComWel Ctr	832	411
Route22OB	Tom Brown Park, Lincoln High,WalMart	784	398
Route23OB	FSU, Bradford Manor,Health Dept,TCC	1,258	501
Route24OB	FSU,High&Ocala, TCC	760	807
Route25OB	Gov Square,Richland,Kirkman,Koger	346	294
Route26OB	Gov Sqr, Koger,Winewood	795	406
Route28	FSU,TCC,HEALTH DEP.	50	53
Route29	TMHC & VERNOR'S SQUARE	62	72
Route2OB	SOUTH CITY & FOURE POINT	576	548
Route30	Northwood Ctr,Tall Mall	102	79
Route31	FSU,Alumni Village	32	76
Route32	SouthCity,Four Points	70	79
Route33	FSU,TCC	118	98
Route35	FSU Breadford Manor, TCC	149	36
Route3OB	FSU,TCC,HEALTH DEP PENSACOLA	134	404
Route40	FSU Gold	271	820
Route41	FSU-Garnet	821	1,091
Route43OB	FAMU/FSU COLLEGE OF ENGINEERING	324	264
Route45	FSU-Tomahawk	366	562
Route46	FAMU Venom Express I	54	197
Route47	FAMU Venom Express II	71	188
Route48	FSU-Renegade	194	570
Route49	FSU-Heritage	449	455
Route4OB	TMH,CRMC,FLEISCHMANN	323	281
Route5OB	FAMU,GAITHER,AND SHERWOOD PARKS	527	566
Route6OB	FRENCHTOWN,NWD CENTER,TALL MALL,MACON	309	237
Route7OB	SOUTH CITY AND APALACHEE RIDGE	379	216
Route80XOB	80x Express	444	151
Route8OB	TALL MALL,NWD CENTER	613	242
Route9OB	FSU,FR HIGH,AST PK,TALL MALL,NW CTR	375	307
Total		16,801	14,362

10. Summary and Conclusion

The CRTPA 2007 travel demand forecasting model includes several major enhancements. The transit mode is included in the model. The mode choice module has been incorporated into the model and calibrated. A wide range of adjustments was made to the modeling system to produce good validation. All key model statistics and data were summarized and compared through numerous tables and figures. The model result was also compared to the validation criteria established for FSUTMS and elsewhere in Florida. In most cases, the performance of the model meets or exceeds the established criteria. The validation statistics demonstrate that CRTPA 2007 model replicates existing travel conditions well. The model is a reliable tool for system level transportation planning analyses. As with all models, however, the model results should be reviewed and adjusted as needed before using them in planning and design.

While model results have generally improved over those reported in the document, opportunities still exist for further enhancements to model validity in the future. One key element is the availability of travel data. It is recommended to have an O-D survey and Travel Characteristics Survey completed for future model updates. A Transit On-Board survey should be conducted for transit validation.

APPENDICES

Appendix A Prohibitors

```
16876   16842   16847       1      -1 Memorial Blue State Hwy US 90 @ I-10
16877   16858   16859       1      -1        ~
16876   16877   16842       1      -1        ~
16876   16842   16877       1      -1        ~
16872   16857   16856       1      -1        ~
16871   16841   16865       1      -1        ~
16871   16872   16841       1      -1        ~
16871   16841   16872       1      -1        ~
16872   16841   16865       1      -1
16877   16842   16847       1      -1
 6803    6805    6236       1      -1      Capital Circle NW @ I-10
 6803    6236    6805       1      -1
 6805    6236    6810       1      -1
 6809    6806    6235       1      -1
 6235    6806    6808       1      -1
 6809    6235    6808       1      -1
 5110    8006    5510       1      -1      Monroe St @ I-10
 8006    8047    8049       1      -1
 8047    8006    5510       1      -1
23593    8001    8016       1      -1
 8001    8060   23595       1      -1
 8060    8001    8016       1      -1
12231   16003     290       1      -1      Capital Circle NE @ I-10
  290   16003   12288       1      -1
12235   12231    5391       1      -1
16003   12231   12235       1      -1
 5493   16807    6033       1      -1
 5502   16807    6033       1      -1
 5489    5486    5296       1      -1      Thomasville @ Capital Circle NE
 5387    5389    5505       1      -1
 5489    5486    5490       1      -1
13400   13285   13249       1      -1      Thomasville @ Velda Dairy
14090   14156   14286       1      -1      Thomasville @ Kinhega
23603    6709    5480       1      -1      Mahan @ I-10
 6706    6707    5480       1      -1
23603    6709    6710       1      -1
16834    5481    6715       1      -1
16834    5481   23604       1      -1
 6725    6707    6715       1      -1
 6709    5480    6693       1      -1
 5481    6715    6727       1      -1
23575   23571   23490       1      -1      Gamble Rd @ I-10
23575   23490   23571       1      -1
23572   23491   23570       1      -1
23572   23570   23491       1      -1
23575   23490   23574       1      -1
23572   23491   23573       1      -1
23575   23571   23574       1      -1
23572   23570   23573       1      -1
23490   23571   23574       1      -1
23571   23490   23574       1      -1
23491   23570   23573       1      -1
23570   23491   23573       1      -1
23581   23576   23496       1      -1      Jefferson St. @ I-10
```

23581	23496	23576	1	-1	
23578	23497	23577	1	-1	
23578	23577	23497	1	-1	
23496	23576	23580	1	-1	
23497	23577	23579	1	-1	
23587	23502	23582	1	-1	Salt Rd @ I-10
23584	23503	23583	1	-1	
4158	10178	10474	1	-1	Apalachee Parkway
5973	10680	10632	1	-1	
5228	10763	5229	1	-1	
5228	10763	10891	1	-1	
11111	6354	6355	1	-1	
11125	11147	11111	1	-1	
6353	6352	11221	1	-1	
5230	6351	6350	1	-1	
11235	5345	5231	1	-1	
6350	6347	5230	1	-1	
5232	16831	11484	1	-1	
5332	16830	11484	1	-1	
16016	16017	11668	1	-1	
11712	11668	11674	1	-1	
5329	11733	16020	1	-1	
6339	16021	11712	1	-1	
11712	16020	16021	1	-1	
6361	5324	11802	1	-1	
6319	6335	209	1	-1	
6319	6335	12189	1	-1	
209	6335	6319	1	-1	
12189	6335	209	1	-1	
6361	6335	6319	1	-1	
92	6401	11435	1	-1	Tennesse @ Magnolia
5224	6401	92	1	-1	
9442	6055	6382	1	-1	Monroe @ John Knox
9589	6055	6382	1	-1	
6377	6389	6515	1	-1	
9805	6389	6377	1	-1	
23675	7963	23927	1	-1	Tennessee
7964	7963	23675	1	-1	
7964	8026	23927	1	-1	
8026	23927	7963	1	-1	
8026	7964	7963	1	-1	
8245	8092	16040	1	-1	
16037	8433	8434	1	-1	Tennessee @ Basin
8434	8433	8376	1	-1	
21556	8481	6159	1	-1	Tennesse@Brevard
241	6436	8915	1	-1	Tennessee@Woodward
5246	6436	241	1	-1	
6358	8916	8915	1	-1	
8925	8916	6358	1	-1	
243	5247	5562	1	-1	
5561	5247	243	1	-1	
6090	9814	10375	1	-1	Duval @ Bronough
10416	10419	10359	1	-1	Meridan Rd@ E 7th St
10359	10419	5361	1	-1	
173	6428	10125	1	-1	Monroe St @ Thomasville Rd
10116	6428	173	1	-1	
10113	10116	4179	1	-1	

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  172    6428     173       1      -1
  172    6428   10125       1      -1
10125    6428     172       1      -1
  173    6428     172       1      -1
 4182   10126    4069       1      -1        Monroe St @ Park Ave
10126    4182    4186       1      -1
 4090   10130    4080       1      -1        Monroe St @ College Ave
 4080   10130    4076       1      -1
 4088   10130    4090       1      -1
 4076   10130    4088       1      -1
 4089   10128   10127       1      -1        Monroe St @ Jefferson St
 4090   10128    4089       1      -1
```

Appendix B Friction Factors

TI	HBW	HBSH	HBSR	HBO	NHB	TT	IE
1.00	8823.00	43183.00	10143.00	177170.00	14762.00	12647.00	15268.00
2.00	8241.00	37962.00	9169.00	156576.00	13580.00	11429.00	15450.00
3.00	7697.00	33373.00	8288.00	138377.00	12493.00	10329.00	15633.00
4.00	7189.00	29338.00	7491.00	122292.00	11493.00	9335.00	15819.00
5.00	6715.00	25791.00	6772.00	108077.00	10573.00	8436.00	16007.00
6.00	6272.00	22673.00	6121.00	95515.00	9726.00	7624.00	16197.00
7.00	5858.00	19932.00	5533.00	84412.00	8947.00	6890.00	16389.00
8.00	5472.00	17522.00	5001.00	74600.00	8231.00	6227.00	16584.00
9.00	5111.00	15404.00	4521.00	65928.00	7572.00	5628.00	16781.00
10.00	4773.00	13541.00	4087.00	58265.00	6966.00	5086.00	16980.00
11.00	4458.00	11904.00	3694.00	51492.00	6408.00	4596.00	17182.00
12.00	4164.00	10465.00	3339.00	45506.00	5895.00	4154.00	17386.00
13.00	3889.00	9200.00	3018.00	40216.00	5423.00	3754.00	17593.00
14.00	3633.00	8088.00	2728.00	35541.00	4989.00	3393.00	17802.00
15.00	3393.00	7110.00	2466.00	31410.00	4589.00	3066.00	18014.00
16.00	3169.00	6250.00	2229.00	27759.00	4222.00	2771.00	18228.00
17.00	2960.00	5495.00	2015.00	24532.00	3884.00	2504.00	18444.00
18.00	2765.00	4830.00	1821.00	21680.00	3573.00	2263.00	18664.00
19.00	2582.00	4246.00	1646.00	19160.00	3287.00	2046.00	18885.00
20.00	2412.00	3733.00	1488.00	16932.00	3023.00	1849.00	19110.00
21.00	2253.00	3282.00	1345.00	14964.00	2781.00	1671.00	19337.00
22.00	2104.00	2885.00	1216.00	13224.00	2559.00	1510.00	19567.00
23.00	1965.00	2536.00	1099.00	11687.00	2354.00	1365.00	19800.00
24.00	1835.00	2229.00	994.00	10328.00	2165.00	1233.00	20035.00
25.00	1714.00	1960.00	898.00	9128.00	1992.00	1115.00	20274.00
26.00	1601.00	1723.00	812.00	8067.00	1832.00	1007.00	20515.00
27.00	1495.00	1515.00	734.00	7129.00	1686.00	910.00	20759.00
28.00	1397.00	1332.00	663.00	6300.00	1551.00	823.00	21006.00
29.00	1305.00	1171.00	600.00	5568.00	1426.00	744.00	21255.00
30.00	1218.00	1029.00	542.00	4920.00	1312.00	672.00	21508.00
31.00	1138.00	905.00	490.00	4348.00	1207.00	607.00	21764.00
32.00	1063.00	795.00	443.00	3843.00	1110.00	549.00	22023.00
33.00	993.00	699.00	400.00	3396.00	1022.00	496.00	22285.00
34.00	927.00	615.00	362.00	3001.00	940.00	448.00	22550.00
35.00	866.00	540.00	327.00	2652.00	864.00	405.00	22818.00
36.00	809.00	475.00	296.00	2344.00	795.00	366.00	23090.00
37.00	755.00	418.00	267.00	2072.00	732.00	331.00	23365.00
38.00	706.00	367.00	242.00	1831.00	673.00	299.00	23642.00
39.00	659.00	323.00	218.00	1618.00	619.00	270.00	23924.00
40.00	616.00	284.00	197.00	1430.00	570.00	244.00	24208.00
41.00	575.00	249.00	178.00	1264.00	524.00	221.00	24496.00
42.00	537.00	219.00	161.00	1117.00	482.00	200.00	24788.00
43.00	501.00	193.00	146.00	987.00	443.00	180.00	25083.00
44.00	468.00	169.00	132.00	872.00	408.00	163.00	25381.00
45.00	437.00	149.00	119.00	771.00	375.00	147.00	25683.00
46.00	409.00	131.00	108.00	681.00	345.00	133.00	25989.00
47.00	382.00	115.00	97.00	602.00	318.00	120.00	26298.00
48.00	356.00	101.00	88.00	532.00	292.00	109.00	26611.00

49.00	333.00	89.00	80.00	470.00	269.00	98.00	26928.00
50.00	311.00	78.00	72.00	415.00	247.00	89.00	27248.00
51.00	290.00	69.00	65.00	367.00	227.00	80.00	27572.00
52.00	271.00	60.00	59.00	324.00	209.00	73.00	27900.00
53.00	253.00	53.00	53.00	287.00	192.00	66.00	28232.00
54.00	237.00	47.00	48.00	253.00	177.00	59.00	28568.00
55.00	221.00	41.00	43.00	224.00	163.00	54.00	28908.00
56.00	206.00	36.00	39.00	198.00	150.00	48.00	29252.00
57.00	193.00	32.00	35.00	175.00	138.00	44.00	29600.00
58.00	180.00	28.00	32.00	155.00	127.00	40.00	29952.00
59.00	168.00	25.00	29.00	137.00	117.00	36.00	30308.00
60.00	157.00	22.00	26.00	121.00	107.00	32.00	30669.00
61.00	147.00	19.00	24.00	107.00	99.00	29.00	31033.00
62.00	137.00	17.00	21.00	94.00	91.00	26.00	31403.00
63.00	128.00	15.00	19.00	83.00	84.00	24.00	31776.00
64.00	119.00	13.00	17.00	74.00	77.00	22.00	32154.00
65.00	112.00	11.00	16.00	65.00	71.00	19.00	32536.00
66.00	104.00	10.00	14.00	58.00	65.00	18.00	32923.00
67.00	97.00	9.00	13.00	51.00	60.00	16.00	33315.00
68.00	91.00	8.00	12.00	45.00	55.00	14.00	33711.00
69.00	85.00	7.00	11.00	40.00	51.00	13.00	34112.00
70.00	79.00	6.00	10.00	35.00	47.00	12.00	34517.00
71.00	74.00	5.00	9.00	31.00	43.00	11.00	34928.00
72.00	69.00	5.00	8.00	27.00	39.00	10.00	35343.00
73.00	65.00	4.00	7.00	24.00	36.00	9.00	35763.00
74.00	60.00	4.00	6.00	21.00	33.00	8.00	36188.00
75.00	56.00	3.00	6.00	19.00	31.00	7.00	36619.00
76.00	53.00	3.00	5.00	17.00	28.00	6.00	37054.00
77.00	49.00	2.00	5.00	15.00	26.00	6.00	37494.00
78.00	46.00	2.00	4.00	13.00	24.00	5.00	37940.00
79.00	43.00	2.00	4.00	12.00	22.00	5.00	38391.00
80.00	40.00	2.00	3.00	10.00	20.00	4.00	38847.00

Appendix C V Factors

10	0.66	0.1	0.15	6.5
11	0.66	0.1	0.15	6.5
12	0.66	0.1	0.15	6.5
13	0.66	0.1	0.15	6.5
14	0.66	0.1	0.15	6.5
15	0.66	0.1	0.15	6.5
16	0.66	0.1	0.15	6.5
17	0.66	0.1	0.15	6.5
18	0.66	0.1	0.15	6.5
19	0.66	0.1	0.15	6.5
20	0.9	0.1	0.15	5.5
21	0.7	0.1	0.15	5.5
22	0.7	0.1	0.15	5.5
23	0.93	0.1	0.15	5.5
24	0.91	0.1	0.15	5.5
25	0.8	0.1	0.15	5.5
26	0.9	0.1	0.15	5.5
27	0.9	0.1	0.15	5.5
28	0.9	0.1	0.15	5.5
29	0.9	0.1	0.15	5.5
30	0.9	0.1	0.15	4.5
31	0.7	0.1	0.15	4.5
32	0.93	0.1	0.15	4.5
33	0.91	0.1	0.15	4.5
34	0.8	0.1	0.15	4.5
35	0.7	0.1	0.15	4.5
36	0.93	0.1	0.15	4.5
37	0.91	0.1	0.15	4.5
38	0.8	0.1	0.15	4.5
39	0.9	0.1	0.15	4.5
40	0.85	0.1	0.15	4.5
41	0.76	0.1	0.15	4.5
42	0.76	0.1	0.15	4.5
43	0.76	0.1	0.15	4.5
44	0.89	0.1	0.15	4.5
45	0.89	0.1	0.15	4.5
46	0.89	0.1	0.15	4.5
47	0.89	0.1	0.15	4.5
48	0.89	0.1	0.15	4.5
49	0.85	0.1	0.15	4.5
50	1	0.1	0.15	4.5
51	1	0.1	0.15	4.5
52	1	0.1	0.15	4.5
53	1	0.1	0.15	4.5
54	1	0.1	0.15	4.5
55	1	0.1	0.15	4.5
56	1	0.1	0.15	4.5
57	1	0.1	0.15	4.5

58	1	0.1	0.15	4.5
59	1	0.1	0.15	4.5
60	0.9	0.1	0.15	4.5
61	0.7	0.1	0.15	4.5
62	0.93	0.1	0.15	4.5
63	0.91	0.1	0.15	4.5
64	0.8	0.1	0.15	4.5
65	0.7	0.1	0.15	4.5
66	0.93	0.1	0.15	4.5
67	0.91	0.1	0.15	4.5
68	0.8	0.1	0.15	4.5
69	0.9	0.1	0.15	4.5
70	0.66	0.1	0.15	6.5
71	0.57	0.1	0.15	6.5
72	0.85	0.1	0.15	6.5
73	0.57	0.1	0.15	6.5
74	0.85	0.1	0.15	6.5
75	0.57	0.1	0.15	6.5
76	0.85	0.1	0.15	6.5
77	0.57	0.1	0.15	6.5
78	0.85	0.1	0.15	6.5
79	0.66	0.1	0.15	6.5
80	0.66	0.1	0.3	8.5
81	0.66	0.1	0.3	8.5
82	0.66	0.1	0.3	8.5
83	0.66	0.1	0.3	8.5
84	0.66	0.1	0.3	8.5
85	0.66	0.1	0.3	8.5
86	0.66	0.1	0.3	8.5
87	0.66	0.1	0.3	8.5
88	0.66	0.1	0.3	8.5
89	0.66	0.1	0.3	8.5
90	0.66	0.1	0.15	6.5
91	0.66	0.1	0.15	6.5
92	0.66	0.1	0.15	6.5
93	0.66	0.1	0.15	6.5
94	0.93	0.1	0.15	5.5
95	0.93	0.1	0.15	4.5
96	0.66	0.1	0.15	6.5
97	0.57	0.1	0.15	6.5
98	0.57	0.1	0.15	6.5
99	1	0.1	0.15	6.5