VCMPO Model Calibration
and
Home Based Travel Survey

Technical Memorandum
Number Six

Evaluation and Recommendations for Model Revalidation

Prepared for

Volusia County MPO
1190 Pelican Bay Drive
Daytona Beach, FL 32119-1381

Prepared by

TEI Engineers & Planners
300 Primera Boulevard
Suite 200
Lake Mary, FL 32746

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Introduction

The Volusia County Metropolitan Planning Organization is updating the Volusia County Urban Area Transportation Study (VCUATS) transportation model based on a major data collection activity that will allow the Florida Standard Urban Transportation Model Structure (FSUTMS) model to be calibrated more accurately. This data collection activity consisted of collecting travel surveys that described household demographics and travel patterns of household members over the age of 15. The purpose of the study was to better understand the travel habits and patterns of residents within Volusia County in order to both improve future project planning and evaluate the current market for transportation products and services. The survey was conducted over a two week period during the month of February, 2002. Following the data collection effort, the survey data was analyzed to calibrate the travel forecasting models and to estimate model coefficients for; Trip Generation (various trip production models), Trip Distribution (friction factors), Mode Choice and Auto Occupancy Rates and Traffic Assignment Factors (CONFAC: peak hour to daily ratios).

This Technical Memorandum provides an evaluation of the factors derived from the data collected as part of this study. The following provides an overview of the background of the 1997 model and the information presented as part of this Technical memorandum.

Background of the VCUATS Model

The framework of FSUTMS includes a series of standard procedures, program modules, datasets and definitions for use in travel demand forecasting. This section presents an introduction to the travel demand forecasting framework. As part of this discussion, information is presented on the typical travel demand forecasting process on which FSUTMS is based.

Travel Demand Forecasting Process

Traditional steps in the travel demand forecasting process are shown in Figure 6-1. Forecasts of urban activity and descriptions of transportation networks are the primary inputs to a sequential transportation demand computer model that normally consists of the following stages: generation, distribution, mode choice, and assignment. The urban activity forecasts in conjunction with this travel demand model sequence allow projected demand for travel to be predicted. Descriptions of highway and transit networks represent the supply of transportation services. Although this demand forecasting process works quite well in most cases, it has certain inherent drawbacks. Most theories of urban land use dynamics and transportation economics hold that the pattern of urban activities are influenced by the transportation system. If followed rigorously, the process illustrated in Figure 6-1 assures that this interaction occurs through regular updates of networks and land uses based on the results of assignment. In Florida, urban activity forecasts are generally the responsibility of the MPO staff. FDOT District staff is usually responsible for the initial definition of networks and maintaining the travel demand models. Evaluations of results and data modifications are joint responsibilities between MPO, FDOT, and Consultant staffs.

The VCUATS model includes the geographic area covered by Volusia County as shown in Figure 6-2. Both Highway and Transit networks, the basis for this model, have been coordinated with Geographic Information System (GIS) data using the Visual Planning Environment (VIPER) software.

Figure 6-1
Evaluation and Recommendations for Model Revalidation
Travel Demand Forecasting Process

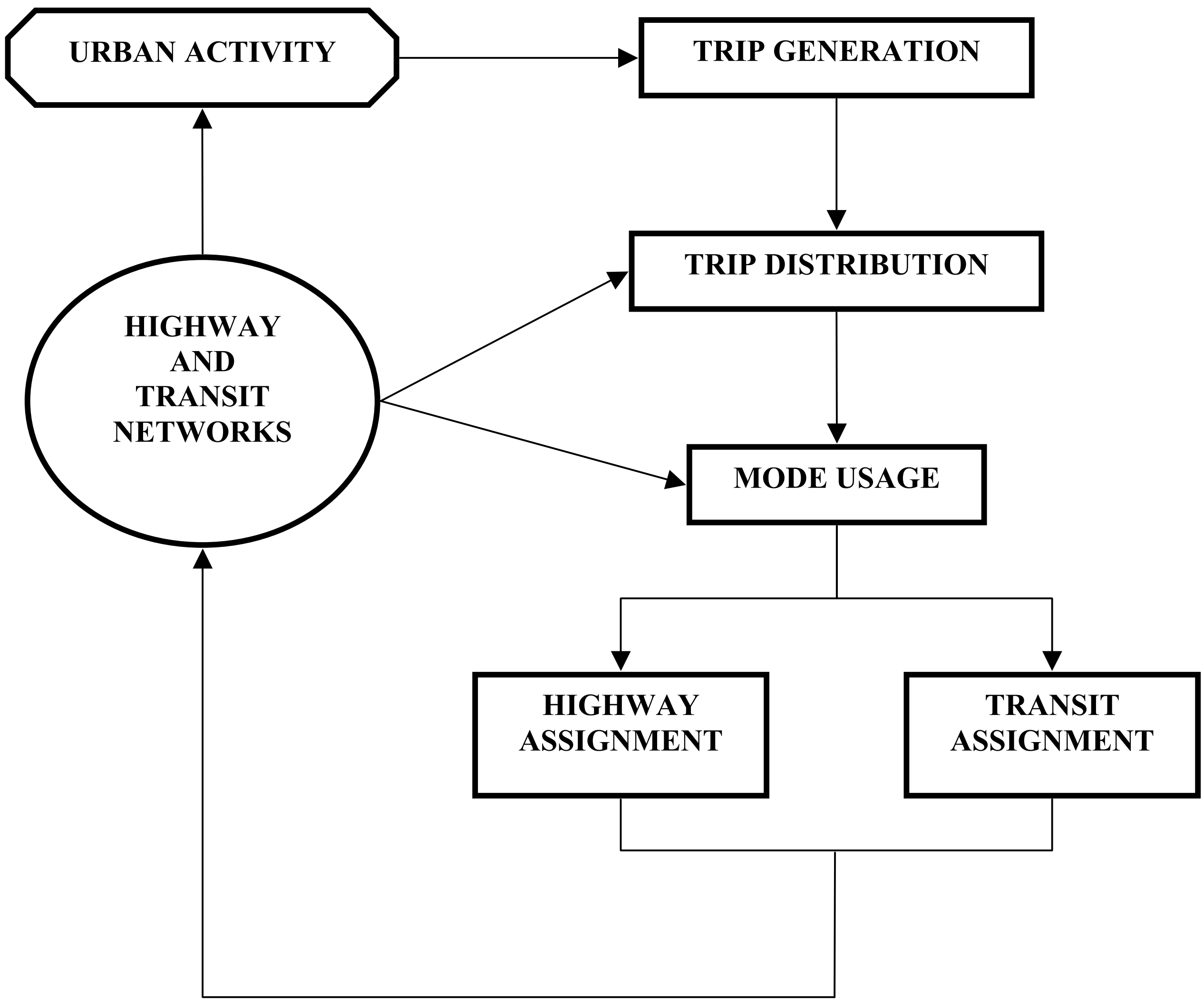


Figure 6-2
Evaluation and Recommendations for Model Revalidation
Geographic Area covered by VCUATS Model

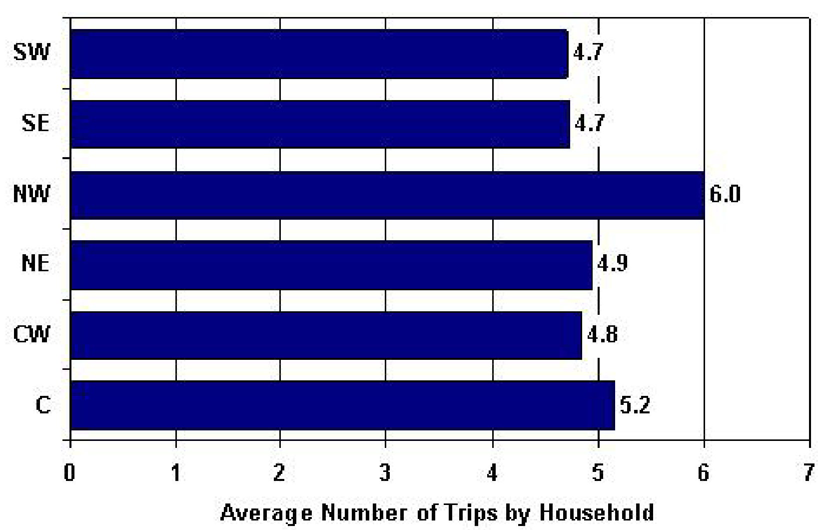
Overall Recommendation

The overall data collection effort and subsequent coding and analysis of the data allowed for an evaluation of travel characteristics by the six planning areas throughout Volusia County. This was done to determine if individual planning areas had distinct trip generation characteristics or travel patterns that would require additional development within the travel demand model structure. A review of Technical Memorandum #4, Household Travel Survey Findings shows that although there are slight differences in travel characteristics between the individual planning areas, these are not significant enough to warrant developing independent trip generation coefficients or friction factor curves.

Therefore, it is the recommendation of this study that the independent modules for the VCUATS travel demand model continue to be developed as a single county-wide model. The following figures present a summary of trip generation rates and average travel times by planning area which further validates this recommendation.

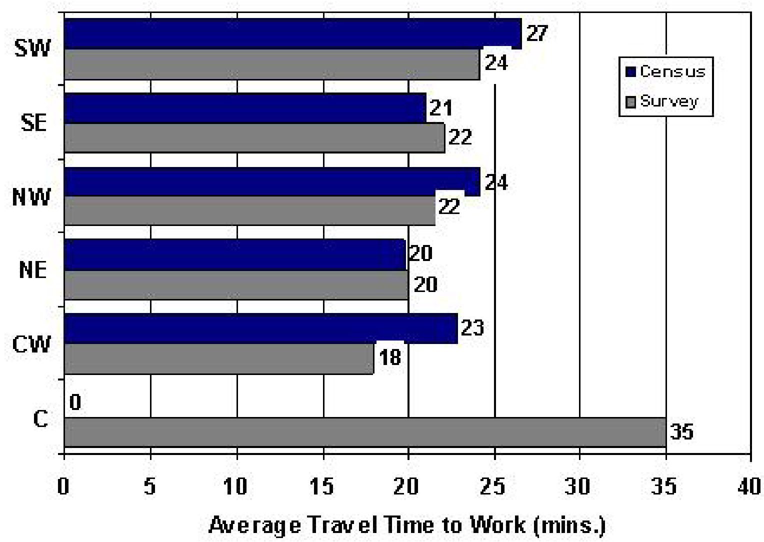
As can be seen below in Figure 6-3, the average number of daily trips made by households in Volusia County range from a low of 4.7 to a high of 6.0. This variation cannot be considered significant as 5 of the 6 planning regions demonstrate that household trip generation rates are within 10% of each other or ½ trip per day.

Figure 6-3
Evaluation and Recommendations for Model Revalidation
Average Daily Trips by Region



Similarly Figure 6-4 shows that the average travel time for work trips made in Volusia County ranges from a low of 20 to a high of 35 minutes. This variation cannot be considered significant as 5 of the 6 planning regions demonstrate average travel times that are within 7 minutes of each other. Considering the size of the County, a seven (7) minute difference would not warrant the development of separate models.

Figure 6-4
Evaluation and Recommendations for Model Revalidation
Average Travel Time to Work by Region



The household travel characteristics survey for Volusia County provided information on trip peaking characteristics to support the review of the peak hour to daily traffic factor (CONFAC) used in the highway assignment model. As a result, of this study it is recommended that the new CONFAC developed for this study be used as part of the validation for the next Long Range Transportation Plan update. Capacity restraint factors involve the conversion of daily traffic volumes to peak hour traffic volumes and the determination of volume to capacity ratios. The ratio of peak hour to daily traffic (CONFAC) of 10.0 % is used in the currently validated VCUATS Model as it reflects the peak hour to daily traffic characteristics of the Volusia County area. It is recommended that an average CONFAC value of 13% that was derived for all trip purposes be used as part of the validation for the next Long Range Transportation Plan update.

Trip Generation Model

Trip generation models predict urban trip making behavior by translating urban activity characteristics into numbers of person trips. Trip generation is the first, and in many respects, the most influential stage in simulating travel behavior. Thus, great care is necessary in preparing the socioeconomic data that serves as input into the trip generation simulation.

Trip generation models typically incorporate three attributes of land use: intensity, location, and character. Intensity determines the amount of activity in a given zone and is usually stated as number of households or number of employees. The location of land use suggests the spatial distribution of activities. Zonal maps show the relationship of location to zone numbers. Nonresidential land use is characterized by type of activity (e.g., industrial, commercial, and service employment). Residential land use characteristics are typically expressed in terms such as type of dwelling unit (e.g., single family, transient, multi-family).

Trip generation estimates the total number of trips made during an average day in the peak season using traffic analysis zone (TAZ) socioeconomic characteristics. Output from the trip generation analysis is divided into two tables of trip ends. One table identifies the number of trips "produced" by each zone. The other table identifies trips "attracted" by each zone. Trip productions generally identify where a trip begins while trip attractions identify where a trip ends. Trips are usually classified by purpose (e.g., "home-based work" and "home-based shopping"). Trips that neither begin nor end at home are considered non-home based trips. The process flow for the trip generation module is shown in Figure 6-5.

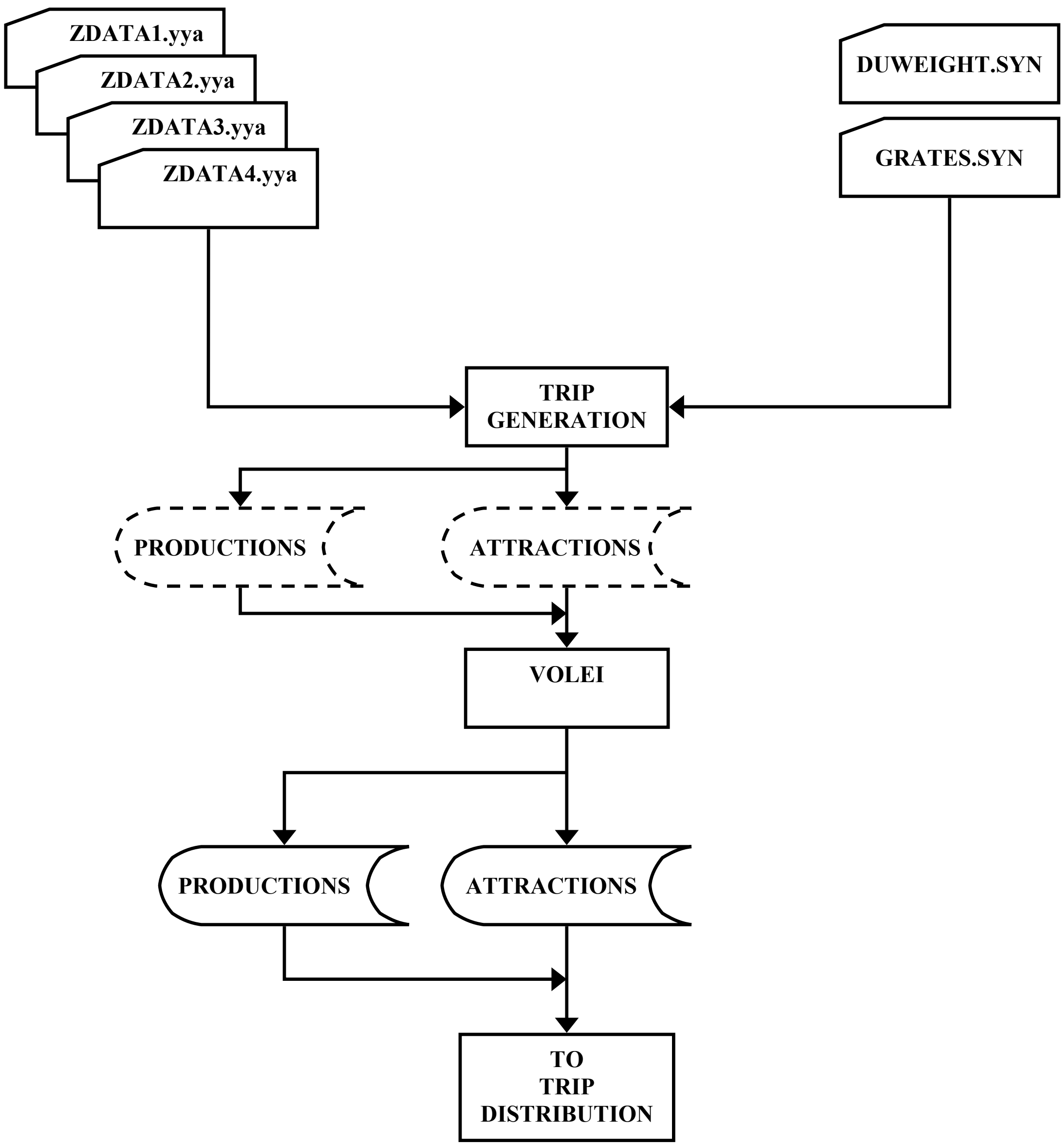
Productions and attractions are defined by trip purposes. The GEN program produces the following seven (7) trip purposes with variable production and attraction rates for each county:

1. Home Based Work (HBW)
2. Home Based Shopping (HBSH)
3. Home Based Social Recreation (HBSR)
4. Home Based Other (HBO)
5. Non-Home Based (NHB)
6. Truck and Taxi (TT)
7. Internal to External (IE)

Trip Generation Model Input Data And Parameters

This section describes the input data used for the Trip Generation Model as well as the input parameters used in the VCUATS model validation effort with the survey data for 1997. The first section summarizes the input socioeconomic data and the second section shows the input parameters and variables.

Figure 6-5
Evaluation and Recommendations for Model Revalidation
Trip Generation Module Flow Chart



Socioeconomic Data

Forecasts of urban activity estimate where people will live and where jobs and businesses will be at some target date. Such projections are generally developed for small geographic areas, called Traffic Analysis Zones (TAZs), into which urban areas are divided. Activity forecasts define the volume or intensity of activity within each zone in terms of socioeconomic, demographic and land use characteristics. Key urban activity forecast variables used in Florida include population, dwelling units, auto ownership, employment and school enrollment.

The socioeconomic data for the 1997 VCUATS model evaluation used with the updated Household Survey data was provided by the Volusia County MPO. This data is the same as the data used in the current VCUATS model validation and remained unchanged for the evaluation of the VCUATS model. The socioeconomic data summaries are shown in Tables 6-1 and 6-2.

Table 6-1
Evaluation and Recommendations for Model Revalidation
Year 1997 ZDATA1 Productions Summary

SINGLE FAMILY	
Total DUs	124,690
Occupied DUs	113,502
Population	288,317
Autos	194,347
MULTI FAMILY	
Total DUs	74,134
Occupied DUs	57,928
Population	123,501
Autos	87,098
TOTALS	
Total DUs	198,824
Occupied DUs	171,430
Population	411,818
Autos	281,445
HOTEL/MOTEL	
Units	17,232
Occupants	16,228

Table 6-2
Evaluation and Recommendations for Model Revalidation
Year 1997 ZDATA2 Attractions Summary

VOLUSIA COUNTY	
Industrial Employment	30,964
Commercial Employment	42,777
Service Employment	87,568
Employment Totals	161,309
School Enrollment	59,474

Standard Trip Generation Model

While there are several general alternative structures for specifying trip generation models, the procedure called Cross-Classification analysis is used in the VCUATS model. This procedure is based on household trip making as its level of analysis. Home-based trip productions are generated using a cross-classification model which stratifies dwelling units among five household size categories, three auto availability categories, and three dwelling unit types.

The household travel survey collected trip generation information for the household, therefore the following four home based trip generators are the only purposes affected by the results of the data collected during the survey.

- Home based Work (HBW),
- Home based Shopping (HBSH),
- Home based Social/Recreation (HBSR), and
- Home based Other (HBO).

Table 6-3 shows the standard cross-classification rates used in the existing validated VCUATS trip generation model.

As an analysis tool the travel survey data was analyzed using the existing cross-classification structure. Table 6-4 shows the resulting cross-classification trip production rates for single family dwelling units only.

An evaluation of the new cross-classification trip rates showed that the existing rates used in the VCUATS model are higher than what was determined from the survey data (when the existing cross-classification structure is used). Analyses of other models throughout the state have shown that the standard trip generation model over estimates the number of trips made by retired individuals. The survey data also showed that the number of persons per dwelling unit does not help explain trip making behavior for Volusia County. The trip generation rates shown in Table 6-4 are an improvement over the existing rates shown in Table 6-3. However, the standard FSUTMS trip generation cross-classification structure, as shown in Tables 6-3 and 6-4, can be improved upon. Therefore a Life Style trip generation model was evaluated to determine its applicability for the VCUATS model.

Table 6-3
Evaluation and Recommendations for Model Revalidation
Existing VCUATS Trip Production Rates

HOMEBASED WORK														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	0.52	0.65	1.37	PERS/DU	1	0.20	0.59	1.56	PERS/DU	1	0.33	0.33	0.33
	2	1.04	1.43	2.60		2	0.45	0.85	2.02		2	0.26	0.26	0.26
	3	1.49	1.95	3.19		3	0.72	1.17	2.41		3	0.20	0.20	0.20
	4	1.82	2.28	3.38		4	1.04	1.30	2.67		4	0.13	0.13	0.13
	5	2.02	2.47	3.45		5	1.30	1.43	2.80		5	0.13	0.13	0.13

HOMEBASED SHOPPING														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	0.39	1.04	1.17	PERS/DU	1	0.39	0.65	0.85	PERS/DU	1	0.39	0.39	0.39
	2	0.45	1.37	1.63		2	0.45	1.63	1.82		2	1.69	1.69	1.69
	3	0.52	1.56	1.89		3	0.52	1.95	2.15		3	2.60	2.60	2.60
	4	0.59	1.69	2.08		4	0.59	2.15	2.41		4	3.25	3.25	3.25
	5	0.59	1.69	2.21		5	0.59	2.21	2.54		5	3.77	3.77	3.77

HOMEBASED SOCIAL/RECREATION														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	0.26	0.85	1.11	PERS/DU	1	0.39	0.85	0.98	PERS/DU	1	0.78	0.78	0.78
	2	0.33	1.11	1.37		2	0.45	1.37	1.56		2	2.15	2.15	2.15
	3	0.39	1.43	1.69		3	0.52	1.89	2.15		3	3.51	3.51	3.51
	4	0.52	1.76	2.15		4	0.59	2.47	2.86		4	5.07	5.07	5.07
	5	0.59	2.21	2.73		5	0.72	3.45	3.97		5	7.67	7.67	7.67

HOMEBASED OTHER														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	0.26	0.78	0.91	PERS/DU	1	0.33	1.04	1.23	PERS/DU	1	0.65	0.65	0.65
	2	0.39	1.43	1.56		2	0.59	1.56	1.95		2	1.56	1.56	1.56
	3	0.72	2.41	2.86		3	0.91	2.08	2.99		3	2.73	2.73	2.73
	4	1.30	3.58	4.62		4	1.43	2.73	4.42		4	4.29	4.29	4.29
	5	2.08	5.14	6.96		5	2.21	3.90	6.05		5	5.72	5.72	5.72

Table 6-4
Evaluation and Recommendations for Model Revalidation
Survey Resulting Trip Production Rates for Single Family Dwelling Units

HOMEBASED WORK														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	***0.36***	***0.56***	***1.14***	PERS/DU	1	0.20	0.59	1.56	PERS/DU	1	0.33	0.33	0.33
	2	***0.57***	***0.91***	***1.67***		2	0.45	0.85	2.02		2	0.26	0.26	0.26
	3	***0.63***	***1.35***	***2.07***		3	0.72	1.17	2.41		3	0.20	0.20	0.20
	4	***1.26***	***1.81***	***2.64***		4	1.04	1.30	2.67		4	0.13	0.13	0.13
	5	***1.95***	***2.38***	***3.13***		5	1.30	1.43	2.80		5	0.13	0.13	0.13

HOMEBASED SHOPPING														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	***0.23***	***0.39***	***0.76***	PERS/DU	1	0.39	0.65	0.85	PERS/DU	1	0.39	0.39	0.39
	2	***0.51***	***0.62***	***1.45***		2	0.45	1.63	1.82		2	1.69	1.69	1.69
	3	***0.85***	***1.08***	***1.82***		3	0.52	1.95	2.15		3	2.60	2.60	2.60
	4	***1.05***	***1.56***	***2.24***		4	0.59	2.15	2.41		4	3.25	3.25	3.25
	5	***1.43***	***2.09***	***2.77***		5	0.59	2.21	2.54		5	3.77	3.77	3.77

HOMEBASED SOCIAL/RECREATION														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	***0.18***	***0.30***	***0.60***	PERS/DU	1	0.39	0.85	0.98	PERS/DU	1	0.78	0.78	0.78
	2	***0.36***	***0.49***	***1.14***		2	0.45	1.37	1.56		2	2.15	2.15	2.15
	3	***0.59***	***0.85***	***1.63***		3	0.52	1.89	2.15		3	3.51	3.51	3.51
	4	***0.73***	***1.23***	***1.76***		4	0.59	2.47	2.86		4	5.07	5.07	5.07
	5	***1.12***	***1.87***	***2.14***		5	0.72	3.45	3.97		5	7.67	7.67	7.67

HOMEBASED OTHER														
Single Family					Multi-Family					Hotel/Motel				
	AUTOS/DU					AUTOS/DU					AUTOS/DU			
		0	1	2+			0	1	2+			0	1	2+
PERS/DU	1	***0.58***	***1.16***	***1.48***	PERS/DU	1	0.33	1.04	1.23	PERS/DU	1	0.65	0.65	0.65
	2	***1.04***	***2.07***	***2.58***		2	0.59	1.56	1.95		2	1.56	1.56	1.56
	3	***1.45***	***2.90***	***3.24***		3	0.91	2.08	2.99		3	2.73	2.73	2.73
	4	***1.72***	***3.44***	***4.24***		4	1.43	2.73	4.42		4	4.29	4.29	4.29
	5	***1.95***	***3.89***	***5.03***		5	2.21	3.90	6.05		5	5.72	5.72	5.72

Recommendation
Household travel characteristics survey data for Volusia County was compiled and analyzed to support the review of almost every aspect of the trip generation model. The household and member demographic sections of the survey yielded information regarding the general characteristics of the Volusia County population and enabled comparison to the 2000 Census data. As a result of this study it is recommended that as part of the validation for the next Long Range Transportation Plan update, a lifestyles trip generation model should be employed in the Volusia County travel demand model using the data collected and analyzed as part of this household survey study.

Users of the standard FSUTMS trip generation model throughout Florida have previously recognized that some of the characteristics of Florida, such as a large proportion of retired persons, are not sufficiently considered in the model. As a result, the standard trip generation model would often over-estimate the number of work trips for these households while under-estimating trips for other purposes. Therefore, we recommend that a Life Style trip generation model be implemented in place of the standard trip generation models. This proposed enhancement would better reflect the demographic character of Volusia County where there are a significant proportion of retired persons. As a result of this recommendation all occupied dwelling units will need to be classified into three categories based upon the lifestyle characteristics of their residents:

- **Retired Households:** Households that include at least one retired household member and no full-time employed household members.
- **Working Households with No Children:** Households, other than retired households, with no household members under the age of 16.
- **Working Households with Children:** Households, other than retired households, with at least one household member under the age of 16.

Using the information described above a life style model generates trips through cross classification tables that are based on the type of household and by the number of automobiles per dwelling unit.

The implementation of a Life Style Trip Generation model for the VCUATS model would require several revisions to the existing trip generation module. The trip generation program needs to be rewritten to take into account the new socioeconomic categories and the new recommended trip generation rates. Also script files used as instructions for the module would need to be adjusted to reflect the new program and input files. The format of the socioeconomic data input file would need to be revised to reflect the lifestyle characteristics of the household information. Life Style models are being used in other urban areas within the State of Florida that have similar population characteristics to Volusia County. Life Style Models currently in use throughout the state are:

- Tampa Bay (Citrus, Hernando, Pasco, Hillsborough, and Pinellas counties)
- Southeast Florida (Indian River, St. Lucie, Martin, Palm Beach, Broward, and Miami-Dade counties)

A trip generation life style model is currently being considered for the First Coast MPO which is a model that includes Duval and portions of Clay and St. Johns counties. Even though the trip generation rates listed in Table 6-4 are an improvement over the existing rates listed in Table 6-3, the data analysis shows that a Life Style model would explain the variation in trip making behavior more accurately than the standard FSUTMS trip generation model. Table 6-5 shows the new recommended cross-classification trip production rates for a lifestyle model.

Table 6-5
Evaluation and Recommendations for Model Revalidation
Recommended Life Style Model Trip Production Rates

Trip Purpose	Auto Ownership	Permanent Resident Households		
		Retired	Working with No Children	Working with Children
Home-Based Work	0	0.07	0.59	0.45
	1	0.14	1.34	1.32
	2	0.35	1.85	1.72
	3+	1.03	2.44	2.07
Home-Based Shopping	0	1.21	0.32	0.63
	1	1.67	0.57	1.11
	2	2.25	0.70	1.72
	3+	2.58	1.06	2.07
Home-Based Social/ Recreation	0	0.07	0.05	0.07
	1	1.08	0.31	0.44
	2	1.56	0.40	0.82
	3+	1.88	0.45	0.93
Home-Based Other	0	1.84	1.36	2.00
	1	2.35	1.43	3.51
	2	2.50	1.56	3.87
	3+	3.01	2.19	4.12

As mentioned previously in this section of the report the socioeconomic input data file ZDATA1 would need to be revised to address the lifestyle characteristics of the residents of Volusia County. The primary function of the ZDATA1 file is to provide the production demographic data by lifestyle for trip generation purposes. Table 6-6 presents the Input Data Format for the ZDATA1 file. The variables located in ZDATA1 are column specific. The column ranges and the associated variables are listed below in Table 6-6:

Table 6-6
Evaluation and Recommendations for Model Revalidation
Recommended ZDATA1 Format

ITEM	VARIABLE	COLUMN
1	Record Type	1
2	Planning Analysis District	2-4
3	Zone Number	5-10
4	Total Dwelling Units (DU's)	11-15
5	Percent Vacant & Non-Permanent DU's	16-18
6	Percent Vacant	19-21
7	Total Population	22-26
8	Percent 0 Autos DU's – Retiree	27-29
9	Percent 0 Autos DU's - Workers w/o Children	30-32
10	Percent 0 Autos DU's- Workers w/ Children	33-35
11	Percent 1 Autos DU's – Retiree	36-38
12	Percent 1 Autos DU's - Workers w/o Children	39-41
13	Percent 1 Autos DU's- Workers w/ Children	42-44
14	Percent 2 Autos DU's – Retiree	45-47
15	Percent 2 Autos DU's - Workers w/o Children	48-50
16	Percent 2 Autos DU's- Workers w/ Children	51-53
17	Percent 3 +Autos DU's – Retiree	54-56
18	Percent 3 +Autos DU's - Workers w/o Children	57-59
19	Percent 3 +Autos DU's- Workers w/ Children	60-62
20	Number of Hotel Rooms	63-67
21	% Occupied	68-70
22	Population in Hotel/Motel DUs	71-75

Highway Network

The highway network used for the VCUATS model consists of several files needed to adequately define the existing roadway network and its' associated attributes. These files are the coordinates (XY.yya), the link attributes (LINKS.yya), a turn prohibitor file (TCARDS.yya), a speed/capacity lookup table (SPDCAP.yya), and a variable UROAD factor file (VFACTORS.yya). The XY file contains information about the "X" and "Y" coordinates of all the nodes used in the VCUATS network. The LINKS file stores individual link information in the form of ANODE and BNODE pairs. Attribute data such as number of lanes, facility type, area type, and lane group are also defined in the LINKS file. The VFACTORS file consists of UROAD (the UROAD factor is used to convert roadway capacity to a "practical capacity" at which trip diversions occur) factors, CONFAC (peak to daily traffic) factors, BPR LOS (the BPR formula requires that the capacity be set at a level-of-service C) factors, and BPR Exponent factors. The BPR formula is a mathematical function that predicts changes in the travel time on a roadway segment represented by a link in a coded network as a function of changes in a link's volume to capacity ration. The exponent in the BPR formula is an example of a parameter value. The above factors change the loading procedure in FSUTMS. The SPDCAP file consists of two major elements: speeds and capacities, classified in categories according to number of lanes, facility type, and area type on each individual roadway link. The SPDCAP file is the standard recommended double digit-coding with minor adjustments made during the previous validation process. Finally, the TCARDS file contains information about the traffic movements that are either completely prohibited or assigned with an additional time penalty.

Ratio of Peak Hour to Daily Traffic (CONFAC)

Capacity restraint factors involve the conversion of daily traffic volumes to peak hour traffic volumes and the determination of volume to capacity ratios. The ratio of peak hour to daily traffic (CONFAC) of 10.0 % is used in the existing VCUATS Model as it reflects the peak hour to daily traffic characteristics of the Volusia County area. A new recommended CONFAC factor is based upon extensive analysis efforts from the Volusia County Home Based Travel Survey. The new factor reflects the most current peak hour to daily traffic characteristics of the Volusia County area. An average CONFAC value of 13% was derived for all trip purposes where as a CONFAC value of 10% is used in the existing VCUATS Model. A value of 13% means that 13% of the traffic in Volusia County occurs during the peak hour. An increase from 10% to 13% represents an increase of 3% of traffic in the peak hour from the existing VCUATS model compared to the values of the survey.

Highway Network Building

The Year 1997 VCUATS model network was rectified to the latest county roadway GIS files using the VIPER program. Network changes were based on coordinated efforts with the Volusia County MPO and the Florida Department of Transportation (FDOT). Figure 6-6 presents the existing VCUATS model network.

Highway Assignment

Highway assignment represents the allocation of highway trips resulting from the mode split step onto the predicted congested path of the highway network. The inputs for the highway assignment model are dependent on results produced by previous modeling steps, such as

Figure 6-6
Evaluation and Recommendations for Model Revalidation
Current Model Highway Network

external trips at the Volusia County border, trip generation, highway network coding, highway path building, trip distribution, mode choice, and auto occupancy models.

Recommendations

The household travel characteristics survey for Volusia County provided information on traffic peaking characteristics to support the review of the peak hour to daily traffic factor (CONFAC) used in the existing highway assignment model. As a result of this study it is recommended that the new CONFAC developed for this study be used as part of the validation of the next Long Range Transportation Plan update. Capacity restraint factors involve the conversion of daily traffic volumes to peak hour traffic volumes and the determination of volume to capacity ratios. The ratio of peak hour to daily traffic (CONFAC) of 10.0 % is used in the currently validated VCUATS Model as this was what was assumed as the peak hour to daily traffic characteristics for the Volusia County area. However, based on an analysis of the Volusia County travel survey data it is recommended that an average CONFAC value of 13% for all trip purposes be used in the validation of the next Long Range Transportation Plan Update.

Trip Distribution Model

The trip generation phase of travel demand modeling uses socioeconomic data to forecast the number of trips that will be generated in each zone. Trip distribution is the process by which the travel demand model determines where the generated trips will go. A trip distribution model simulates the attraction zones for trips produced in a particular area. The result is a table showing trips among all possible production and attraction zones.

In deciding how many trips will go from one zone to another, the trip distribution model uses two factors: relative attractiveness of, and accessibility to, all possible attraction zones. The number of attraction trip ends in a zone measures attractiveness for each trip purpose analyzed. Accessibility is measured by highway travel times between zones. These variables assign the greatest proportion of trips from a zone to those nearby zones with many attraction trip ends.

Although various simulation models are available for trip distribution, Florida's urban area transportation models use the gravity model. The gravity model is the most widely used technique by transportation models to distribute trips. Gravity models vary between urban areas based on the values of friction factors used in the distribution of trips.

Gravity Model Methodology and Operation

The crucial part of this model is the gravity model. The gravity model accepts zonal trip end productions and attractions stratified by class of trip (purpose, geography, time of day, etc.), travel impedance factors, zone-to-zone travel indices, and generates a zone-to-zone trip table file from the Gravity Model distribution formula. The model also checks the acceptability of computed attractions, and if necessary, adjusts the calculated attractions to each zone to equal the input attractions.

The Gravity Model originally paralleled Newton's gravitational law, i.e., the assumption that all trips starting from a given zone are attracted by various traffic generators in other zones and that this attraction is directly proportional to the relative attraction of the zone and inversely proportional to the separation (i.e. distance) between zones in the gravity model. The measure of separation is generally accepted as the zone-to-zone travel time via the specified transportation network. However, because people as social beings do not order their lives according to exact physical laws, an adjustment is necessary to adjust the gravitational concept to fit the travel characteristics of the urban area being studied.

The classical gravitational formula is:

$$f = \frac{-m1 * m2}{d^2} g$$

where:

f = force
$m1,m2$ = mass of bodies
d = distance separating 1 and 2
g = gravitational constant

The classical gravitational formula has been restructured for computer use as follows:

- First, the separation (distance) is generalized to allow inclusion of any travel index. In FSUTMS, time, distance, cost or a combination of them may be used. In the VCUATS model, time is selected as the indicator of separation (distance).
- Second, the effect of separation for each minute time increment is represented by a table of "friction factors"; this replaces the squared quantity in the denominator. The travel separation function is then more easily represented. Friction factors may be input as explicit values by travel time, by purpose, or by a deterrence coefficient in the formulation $F(t) = e^{-ut}$, where t is the travel time in minutes and ut is the deterrence coefficient for a particular purpose.
- Third, a modification in the basic gravitational formulation is made to combine all these effects with the constant of proportionality.

The resultant formula has evolved to resemble Bayes' Theorem of conditional probability and is as follows:

$$T_{(ij)} = \frac{P_i A_j F_{t(i,j)} K_{(i,j)}}{\sum_{x=1}^{n} A_x F_{t(i,j)} K_{(i,j)}}$$

where:

$T_{(i,j)}$ = trips produced in zone i and attracted to zone j
P_i = trips produced in zone i
A_j = trips attracted zone j
$t_{(i,j)}$ = travel time in minutes between zone i and zone j
$F_{t(i,j)}$ = empirically derived travel time factor that expresses the average area-wide effect of spatial separation on trip interchange between zones that are *t(i,j)* apart.
$K_{(i,j)}$ = specific zone-to-zone adjustment factor to allow for the incorporation of the effect on travel patterns of defined social or economic linkages not otherwise accounted for in the gravity model formulation.

Therefore, in the VCUATS FSUTMS gravity model, to balance the attractions the number of iterations and the convergence criteria are specified by the analyst so the model iterate until either convergence or the number of iterations specified by the user is met. In the actual gravity model the trip attractions parameter gives way to a term called the "attraction factor". This factor is a product of a balancing procedure to ensure that the number of trips sent to a zone by the gravity model is equivalent to its trip attractions estimated by the trip generation procedure.

Gravity Model Inputs and Variables
There are four essential inputs to the Distribution module:

- A zone-to-zone travel impedance matrix (travel times)
- Terminal times
- Trip productions and trip attractions, and
- Friction factors

The following describes each of these inputs in detail.

Terminal Times

The gravity model includes terminal times to accurately represent travel behavior. Terminal times account for time spent on things not calculated during path building. For example, time spent looking for parking and the out-of-vehicle travel time spent to complete a trip, such as walking to one's destination. Terminal times are added to the impedance travel time values in the zone-to-zone skim tables. The standard FSUTMS terminal times are shown in Table 6-7. The survey data does not indicate a need to modify the standard FSUTMS terminal times.

Table 6-7
Evaluation and Recommendations for Model Revalidation
Terminal Times

AREA TYPE	TIME (IN MINUTES)
CBD	5
Fringe	3
Residential	1
Outlying Business District	1
Rural	1

Friction Factors

Friction factors reflect the propensity to make trips with differing travel times. Friction factors are determined from origin-destination data that was collected during the household survey. The friction factors reflect the areawide effect of traveltime on drivers' willingness to drive to various destinations. The friction factors represent accessibility, with higher values being greater accessibility. The longer the travel time, the less probability that a trip exchange will occur. A specific friction factor is used for each unique trip purpose and trip length.

Recommendations

The household travel characteristics survey for Volusia County collected information for trip lengths to support the review of the friction factors used in the trip distribution model. Because of this study it is recommended that new friction factor curves developed for this study be used as part of the validation for the next Long Range Transportation Plan update. Based on these friction factors, new trip lengths resulting from survey information were developed. These average trip lengths developed from survey data are longer than the trip lengths currently being used in the 1997 VCUATS model.

The reasonableness of the new trip lengths by trip purposes was evaluated by comparing the survey results with the results from the 1997 VCUATS model, other validated models in Florida, and the travel characteristic survey results from other urban areas in Florida. Table 6-8 shows the comparison of trip length in minutes by trip purpose from the survey data, the existing Volusia County MPO model and other surveys and models throughout Florida. The existing 1997 VCUATS model average trip lengths are significantly less than the lengths used in other urban area models or those found in travel surveys throughout Florida. The proposed trip lengths are more consistent with trip lengths used throughout the state. Therefore this study recommends that the average trip lengths be modified to reflect the travel survey data summarized in Table 6-8.

Table 6-8
Evaluation and Recommendations for Model Revalidation
Average Trip Length Comparisons (Minutes)

Survey//Model	HBW	HBSH	HBSR	HBO	NHB
2002 Volusia Survey (Estimates)	23.20	15.60	18.19	19.05	17.95
1997 VCUATS Model	15.25	13.65	12.86	14.95	10.48
2000 Tampa Bay Survey	28.46	22.62	23.95	25.95	24.15
1996 Tampa Bay Survey	26.20	20.40	20.90	19.75	22.35
1999 TBRPM Model	21.32	15.70	16.50	16.05	15.69
Other FL Surveys	14-23	11-18	14-21	13-18	13-17
Other FL Models	14-24	12-19	13-18	12-19	11-15

As urban development patterns and transportation infrastructure are unique to each urban area, trip length frequency distributions are unique to each urbanized area, as well. Usually, it is expected that, like home-based shopping trips, home-based social/recreation trips are shorter in duration than home-based work trips. However, they should be longer than general shopping trips. Additionally, these trips should have a much smaller variance or deviation than work trips. The estimated average travel time from the survey for home- based social/recreation trips is 18 minutes. As expected, the mean trip length for these trips is shorter than that for work trips.

The home-based other trip purpose represents a significant number of trips in the survey trip logs. The estimated average travel time from the survey for home-based other trips is 19 minutes. Non-home-based trips represent the largest number of trips in the survey trip logs. The estimated average travel time from the survey for non-home-based trips is 18 minutes. As expected, this travel time is shorter than that for work trips.

The determination of the correct friction factors is key in the validation of a transportation computer model. One of the most powerful methods for adjusting traffic volumes on highway links is through the trip distribution process. Shortening or increasing the average trip lengths through the trip distribution process will raise or lower the traffic volumes on roadway links. Trip lengths resulting from a gravity model, similar to the one used in the VCUATS model, are controlled by changing or adjusting the friction factor curves. Table 6-9 shows the relationship between model parameters and model products.

Table 6-9
Evaluation and Recommendations for Model Revalidation
Gravity Model Relationships

IF Friction Factor	THEN Trip Length	AND Link Volumes	AND Intrazonal Volumes
↓	↑	↑	↓
↑	↓	↓	↑

New recommended friction factors for each person trip purpose for use in the VCUATS trip distribution model are provided in Table 6-10. Typically the values in the friction factor table decrease as travel times increase. As can be seen in Table 6-10 this is not the case. As part of the validation process for the 2025 Long Range Transportation Plan Update, the friction factors presented in Table 6-10 will need to be calibrated. This process involves adjusting the friction factor parameters until the model adequately reproduces the trip distribution as represented by the results of the survey data collection effort. It is an iterative trial and adjustment process, that is complete when the output trip table balances with the input table.

Table 6-10
Evaluation and Recommendations for Model Revalidation
Recommended Initial Friction Factors

Travel Time	HBW	HBSH	HBSR	HBO	NHB
1	1	1	1	1	1
2	1	1	1	1	1
3	107	99	77	70	222
4	173	192	137	128	413
5	245	301	203	195	636
6	319	414	271	266	871
7	392	520	334	334	1099
8	461	611	391	397	1304
9	524	682	438	452	1479
10	581	731	474	496	1617
11	630	758	501	531	1717
12	672	766	516	554	1779
13	706	756	523	567	1807
14	733	733	521	572	1803
15	752	698	512	568	1773
16	765	656	497	557	1720
17	772	608	478	541	1651
18	773	558	455	520	1568
19	770	506	430	495	1476
20	761	456	403	469	1378
21	749	407	375	440	1277
22	734	360	347	411	1176
23	716	317	319	381	1076
24	696	277	292	352	979
25	673	241	266	323	887
26	649	209	242	296	799
27	625	180	218	269	717
28	603	154	197	244	641
29	573	132	176	221	571
30	546	112	158	199	507
31	490	95	141	179	448
32	460	80	125	160	395
33	438	67	111	143	347
34	413	57	98	127	305
35	388	47	87	113	267
36	364	40	76	100	233

Travel Time	HBW	HBSH	HBSR	HBO	NHB
37	351	33	67	89	203
38	329	27	59	79	176
39	287	23	52	69	153
40	279	19	45	61	132
41	263	15	39	53	114
42	254	13	34	47	98
43	240	10	30	41	85
44	205	9	26	36	73
45	173	7	22	31	62
46	158	6	19	27	54
47	143	5	17	24	46
48	128	4	15	21	39
49	102	3	13	18	33
50	67	3	11	16	29
51	52	2	9	18	34
52	40	2	8	18	34
53	22	1	7	12	18
54	10	1	6	12	15
55	9	1	5	8	13
56	8	1	4	6	11
57	5	1	4	6	9
58	3	0	3	5	8
59	3	0	3	4	6
60	3	0	2	4	2

Mode Choice Model

In previous sections of this report we have discussed trip generation, the number of trips that will be made, and trip distribution where trips will go. This section discusses the modes of transportation chosen for making trips. The purpose of the modal choice model is to estimate the number of person trips by travel mode as a function of the levels of service between origins and destinations. The mode usage analysis, also known as mode choice or mode split analysis, is the process by which the travel demand model determines the amount of travel that will be made by using each available mode of transportation in the urban area.

In urban areas where transit is modeled, as is done in VCUATS, the mode choice model is used to factor person trips to vehicle trips (using auto occupancy factors). This is done by combining all trip purposes, and then balancing trip productions and attractions on a zone-by-zone basis, and splitting person trips into various auto and transit components.

The mode choice model produces estimates of how many person trips will travel by each available mode. The mode choice model does this by determining the probability of using each available mode for traveling between each pair of zones, then using those probabilities to stratify trips among available modes.

In the MODE modeling step, the person trip tables for home based work (HBW), home based non-work (HBNW), and non-home based (NHB) trip purposes from the trip distribution step are multiplied by auto occupancy factors (AOFAC in the PROFILE.MAS) to convert person trips into vehicle trips. The HBNW trip purpose includes home based shopping (HBSH), home based social/recreation (HBSR) and home based other (HBO) trip purposes.

During this process, person trip tables are subdivided by the mode choice model into the following modes:

- single-occupant auto (low occupant vehicle, or LOV)
- two or more occupant auto (high occupant vehicle, or HOV)
- local bus
- premium transit (commuter rail, light rail, fixed guide way, express bus, etc.)

For the purposes of the Volusia County Urban Area Transportation Study, the mode choice model was divided into three (3) parts: a work mode choice model, a non-work mode choice model, and a special purpose model for the airport. The special purpose model includes resident and tourist purposes for the airport. Each pair is treated the same way as the HBNW/NHB application of the model, with the resident purpose using the same logic as HBNW and the tourist purpose using the NHB logic.

The mode choice model assumes that work trips occur in the peak period and are subject to congested travel conditions, while non-work trips occur in the off-peak period and are subject to uncongested travel conditions. Therefore, the work mode choice model uses the congested impedance skims (travel times) where the non-work mode choice model uses the free-flow impedance skims.

Congested travel times are estimated by a default mode choice parameter during the initial highway assignment in the Trip Distribution Step of the model chain. The default mode choice model is a simplified version of the final mode choice model. It uses reasonable, accurate assumptions of estimated modal shifts. The vehicle trip tables created by the default mode choice model are assigned to the highway network. The loaded network is then "skimmed" to create a congested travel time matrix used by the mode choice model.

Although the 1997 VCUATS model network has no high occupancy vehicle (HOV) facilities, the model is structured so that the estimation of highway trips by auto occupancy category is sensitive to different impedances from low occupancy vehicle (LOV) and HOV networks. Thus, the model is capable of responding to relative differences in LOV and HOV network performances, and has the ability to shift trips from one mode to another. HOV skims are developed by the model, but because there are no coded HOV facilities in the 1997 network, the HOV skims are equal to non-HOV skims.

Calibration Of Nested-Logit Mode-Choice Models For Florida

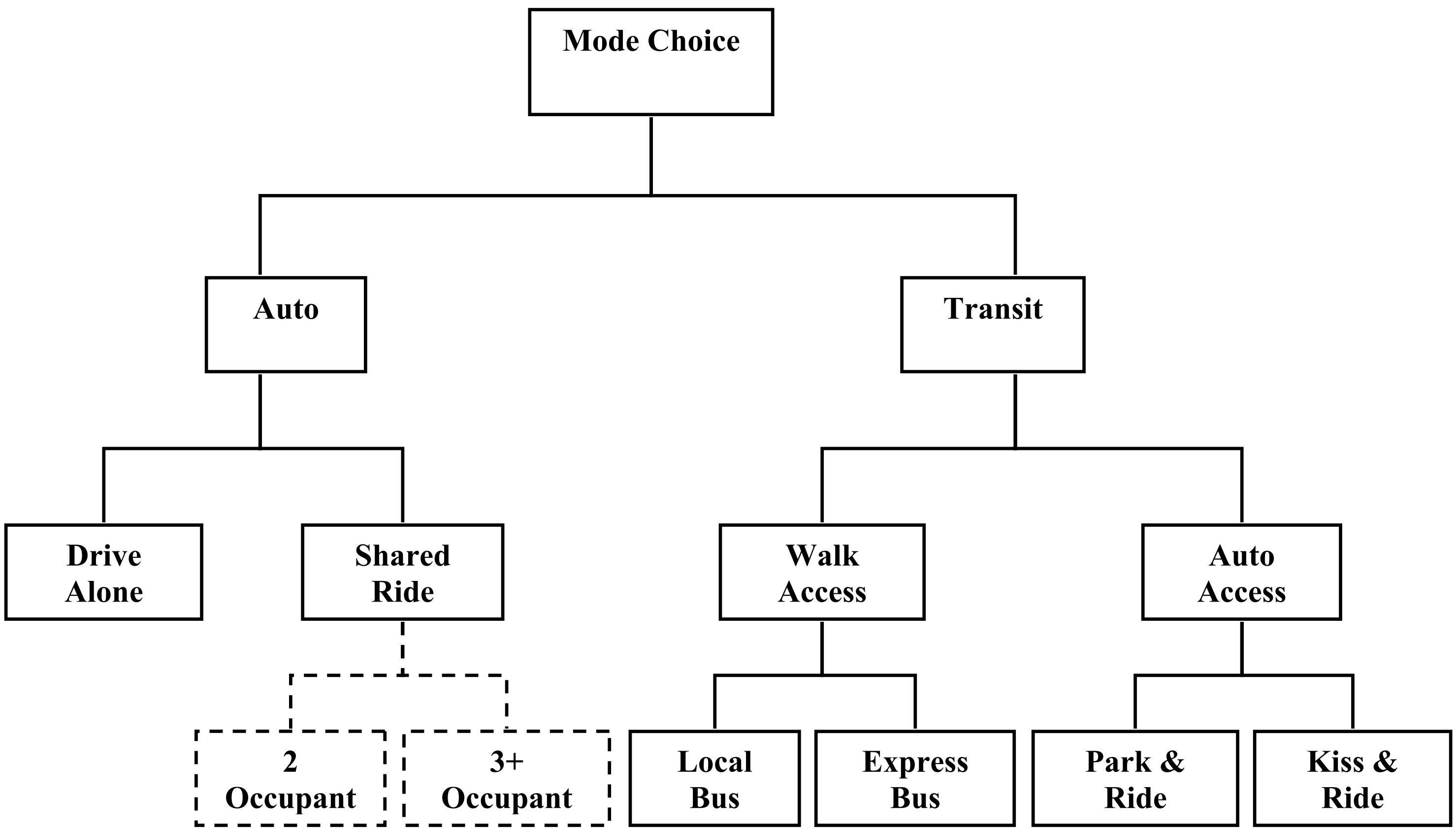
A nested logit mode choice model recognizes and accounts for non-equal competition among differing transportation modes. This model assumes that all modes, sub-modes, and access modes are distinctly different types of alternatives that present distinct choices and attract different travelers. It departs from the multinomial mode choice models by permitting lower level choices to be more elastic than in multinomial models. As a result, an improvement in walk access to transit would alter mostly the existing allocations between walk and drive to transit.

This same improvement in walk access would also apply to a shift of travelers from auto to transit, but with elasticities that are equal to the elasticities found in multinomial models. In other words, because of the improvement in, for example, access, the elasticities for access choice are higher. This increased sensitivity is reasonable if the modes included within a single level of the nest are logically related. Intuitively, a person who had already chosen to utilize transit would be more sensitive with respect to accessing the transit system, than to a change in transit travel time or cost than would be a person who would be deciding between transit and auto modes.

The nested logit mode choice model used in the VCUATS model is a multi-path structure that builds on the single-path structure by accommodating more than one type of transit service. The transit portion of the tree is subdivided into walk and auto access for each type of transit service, both local and express bus service, as shown below in This is shown in Figure 6-7.

The Florida Department of Transportation commissioned Dr. Mohamed Abdel-Aty, Ph.D., P.E., from the University of Central Florida, to complete a research project to develop a universal nested-logit mode-choice model for the State of Florida. In recent years, urban policymakers, faced with the growing and complex problems of air pollution and traffic congestion, have begun to ask for more sophisticated decision-making tools, including models to forecast travel demand

Figure 6-7
Evaluation and Recommendations for Model Revalidation
Generalized Nested Logit Multi-Path Structure



and its effect under various circumstances. The art of finding the appropriate model for a particular application requires from the analyst both a close familiarity with the reality under interest, and a strong understanding of the methodological and theoretical background of the model.

Typically, a nested-logit mode-choice model is applied by a set of three model parameters: nesting coefficients, mode-specific constants, and level-of-service coefficients. The common practice in developing mode-choice models for urban areas in Florida is to borrow coefficients from other urban areas, then to implement a model by (1) adjusting the modal bias coefficients (constants in the utility equation) to replicate transit ridership data and (2) examining the validation results to identify any additional adjustments to coefficients or other parameters, where appropriate. The validity of this approach has been questioned, such as with the Miami model, which borrowed coefficients from Minneapolis. In order to better model mode-choice in Florida, it was decided that it was necessary to develop a new Florida model based on Florida travel data .

Research and evaluation of the available nested-logit model indicated that new models based on actual Florida travel data were warranted and developable based on a recently completed major survey in Southeast Florida. The research team participating in this study decided to calibrate nested-logit mode-choice models based on Florida travel data for different trip purposes, and to use those models to replace the ones currently used in the state.

The selection of the proper universal nesting structure is critical to the development of a nested-logit mode-choice model for Florida. The nesting structure must address the existing transit service, as well as provide suitable flexibility to permit the addition of future modes. The selection of a nesting structure must also consider the data that are available for estimating the model. Several alternative nesting structures were investigated.

Ultimately, the mode-choice model developed as part of Dr. Aty's research was estimated as a three-level nested-logit structure. All of the models included seven transit mode/access combinations and two highway modes. The transit mode/access combinations were local bus, walk to express bus, walk to metro rail, walk access to tri rail, auto access to express bus, auto-access to metro rail, and auto-access to tri-rail. The highway modes were drive alone and share riding. Also, different models were calibrated for three different trip purposes: home based work trips (HBW), home-based non-work trips (HBNW), and non-home-based trips (NHB).

The results of Dr. Aty's research study recommended that the model his Team developed should replace the current models used in Miami, Orlando, Tampa, Jacksonville, and Volusia, and that these models should be re-validated based upon the new model. The value of this research is that it significantly enhanced the state of transportation modeling in Florida. In the 1980s, nearly all of Florida's 25 MPO transportation models were highway-only models. Over the past fifteen years, more emphasis has been placed on the transit component of urban travel. Many more urban areas have adopted transit models, and since the mid 1990s, nested-logit mode-choice modeling has become the adopted method for metropolitan areas served by multiple transit travel modes. This research provides Florida modelers with a nested-logit model that is estimated using travel survey data specific to Florida. The developed model provides a much improved and more accurate foundation upon which to base other Florida nested-logit mode-choice models.

The results of the Volusia County household survey data show that less than 1% of all person trips made within Volusia County are made using the transit system. When comparing this information to the results of the existing VCUATS model, the results of the survey data collection effort were consistent with the output generated from the existing mode choice model. Table 6-11 presents the comparison of the mode split between the existing VCUATS model and the data obtained from the household survey.

Table 6-11
Evaluation and Recommendations for Model Revalidation
Mode Split Comparison

Mode	Existing Coefficients	2002 Survey Coefficients
Transit	0.42%	0.30%
Highway	99.58%	99.70%
Total	100.00%	100.00%

Mode Choice Model Outputs

The output data from the VCUATS mode choice model consists of two (2) components, highway trips and transit trips. The highway trips consist of three (3) components:

- Drive Alone
- One Passenger
- Two+ Passengers

The transit trips consist of four (4) components:

- Walk to local
- Walk to express
- Park and Ride
- Kiss and Ride

The mode choice program determines all seven (7) of these components for the following three (3) trip purposes:

- Home Based Work (HBWRK)
- Home Based Non-Work (HBNWK)
- Non-Home Based (NHB)

Recommendations

Mode choice determinations specify which trips between zones use the various transportation modes (e.g, car, car pool, bus, etc). In the VCUATS model, this decision is made following trip distribution and is called “post-distribution mode usage”. The split of trips among modes depends on three general categories of factors: characteristics of the trip maker, characteristics of the trip, and characteristics of the transportation system.

Trip maker factors often considered are income and auto availability. Common characteristics affecting mode choice are time of day and trip purpose. Important characteristics of the transportation system are travel times for modes, quality of public transportation service, and the costs of parking, operating an auto, and riding transit. A simulation model using known characteristics of trip makers, trips, and the transportation system was developed to replicate current mode use. When these factors were applied to forecasts of changes in these variables, prediction of mode choice became possible.

The research study conducted by Dr.Mohamed Abdel-Aty, Ph.D., P.E. on Calibration of Nested-Logit Mode-Choice Models for Florida recommended that the VCUATS model, along with all other nested logit models in Florida, be re-validated using new Florida specific coefficients. The household travel characteristics survey for Volusia County collected information to support the review of the mode choice model. As a result of these studies, it is recommended that the mode choice model be updated with information provided by the research study completed by Dr. Aty as part of the validation for the next Long Range Transportation Plan update.

It is also recommended to use the data collected by VOTRAN as part of their on-board transit survey to assist in the validation of the 2025 Long Range Transportation Plan Update. The results of the VOTRAN data collection effort will need to be compared with ridership estimates produced by the model to ensure the transportation model adequately represents transit ridership.

Auto Occupancy Factors (AOFAC)

The Auto Occupancy factors are used to convert person trips into vehicle trips for each trip purpose. The auto occupancy factor is the inverse, or reciprocal, of the auto occupancy rate, which is the average number of occupants in a vehicle for each trip purpose.

Changes in auto occupancy rates can result in significant changes in the amount of vehicle trips. By adjusting auto occupancy rates, vehicle trips can be adjusted up or down. A comparison between the new recommended auto occupancy factors (AOFAC) and the auto occupancy factors used in the existing model is shown in Table 6-12. This table shows that the values used for this variable in the 1997 VCUATS model assumes a higher number of occupants per vehicle in Volusia County than the results of the survey show. This means that there are more people driving alone in a vehicle than originally assumed by the 1997 VCUATS model.

Table 6-12
Evaluation and Recommendations for Model Revalidation
Auto Occupancy Factors (AOFAC)

	Auto Occupancy Rates		Auto Occupancy Factors	
Trip Purpose	**Existing**	**New Survey Recommended**	**Existing**	**New Survey Recommended**
Home based Work (HBW)	1.370	1.108	0.730	0.903
Home based Shopping (HBSH)	1.916	1.507	0.522	0.664
Home based Social/Recreation (HBSR)	1.916	1.648	0.522	0.607
Home based Other (HBO)	1.916	1.730	0.522	0.578
Non-Home based (NHB)	1.431	1.668	0.699	0.600

Recommendations
The study team for the household travel characteristics survey for Volusia County collected information regarding passengers per vehicle to support the review of the auto occupancy factors used in the mode choice model. As a result of this study, it is recommended that the new auto occupancy factors developed for this study be used as part of the validation for the next Long Range Transportation Plan update.

The new recommended auto occupancy factors (AOFAC) are shown in Table 6-12. The auto occupancy rate is the average number of occupants in a vehicle for each trip purpose. The auto occupancy factor is the inverse, or reciprocal, of the auto occupancy rate. The auto occupancy factors are applied to factor the person trips into vehicle trips for each trip purpose.

The introduction of the new auto occupancy factors implies that in Volusia County there are a higher number of single occupant vehicles on the road, rather than people ride-sharing, than what was previously being forecasted by the existing VCUATS model. The auto occupancy rates derived from the Volusia County household travel survey were compared for reasonableness with those auto occupancy rates used in other Florida models and other Florida travel characteristics surveys, as is shown in Table 6-13. As shown in Table 6-13, the new factors obtained from the household survey data collection effort are more in line with the factors used in other areas of the state. The existing 1997 VCUATS model auto occupancy rates are significantly higher than the rates used in other urban models or those found in travel surveys throughout Florida. The proposed auto occupancy rates are more consistent with auto occupancy rates used throughout Florida. Therefore, this study recommends that the auto occupancy rates be modified to reflect the travel survey data summarized in Table 6-13.

Table 6-13
Model Coefficients and Trip Factors
Comparison of Auto Occupancy Rates

Model / Survey	HBW	HBSH	HBSR	HBO	NHB
2002 Volusia Household Survey	1.108	1.507	1.648	1.730	1.668
1997 VCUATS	1.370	1.916	1.916	1.916	1.431
1999 TBRPM 4.0	1.093	1.409	1.489	1.629	1.297
1996 Tampa Bay Household Survey	1.093	1.400	1.489	1.612	1.276
1992 LCTCS	1.110	1.490	1.450	1.420	1.480
1987 OUTCS	1.180	1.750	1.810	1.810	1.740
1985 PPHTCE	1.100	1.400	1.700	1.500	1.500
1986 SEFITS	1.140	1.600	1.840	1.710	1.650
1988 TUTCE	1.130	1.410	1.630	1.590	1.490
1985 Gainesville	1.100	1.430	1.430	1.430	1.410
1990 Martin	1.150	1.720	1.720	1.720	1.720
1990 Pensacola	1.070	1.620	1.840	1.840	1.750
1990 Indian Rivers	1.100	1.650	1.650	1.650	1.500
1990 Broward	1.120	N/A	N/A	N/A	1.720

Notes:
TBRPM: Tampa Bay Regional Planning Model
LCTCS: Lee County Urban Travel Characteristics Study
TUTCE: Tallahassee Urban Travel Characteristics Evaluation Study
OUTCS: Orlando Urban Travel Characteristics Study
SEFITS: Southeast Florida Internal Travel Study
PPHTCE: Pasco, Pinellas, and Hillsborough Travel Characteristics Evaluation Study

Conclusions

As part of the 2025 Long Range Transportation Plan Update the Volusia County MPO Model needs to be validated using the new information collected as part of the household survey effort.

- The introduction of the survey findings into the current VCUATS model should be one of the first efforts in the development of the upcoming 2025 Long Range Transportation Plan Update. It is during this time that findings from the survey will be reviewed and decisions will be made about how to best implement the survey findings. Decisions will be based on the strength of the survey conclusions, current data availability, and the ability to forecast variables found to be statistically significant, staff or consultant time requirements, as well as financial constraints.
- The survey and the results from the analysis provide valuable insights into the characteristics and behavior of travelers in Volusia County.
- In many ways, the survey was able to confirm that (1) the way we estimate trips in Volusia County can be improved, and (2) the demographic characteristics of the region are somewhat atypical for the nation as a whole. For example, the survey was able to confirm that retirees occupy a significant proportion of households. Statistical analysis of the survey indicates that, while the current Volusia County FSUTMS default trip generation model considers dwelling unit structure type, auto availability and persons / household as key variables, other lifestyle characteristics, such as retirement or the presence/absence of children may better help explain household trip making potential.
- The survey confirmed that the trip rates, trip length and mode choice characteristics of Volusia County can be better represented in the current FSUTMS model to produce even more accurate estimates of future demand. The refined model will provide a stronger foundation to help the MPO to make wise choices about where to invest limited resources.
- The survey is a sample of a much larger population. Statistics and conclusions drawn from the survey were carefully evaluated during the data validation process. Survey data was compared with outside data sources, such as the U.S. Census and other local sources (including anecdotal experiences) to identify and calibrate the range of parameters best suited to the model.
- Use the data collected by VOTRAN as part of their on-board transit survey to assist in the validation of the process for the 2025 Long Range Transportation Plan Update. The results of the VOTRAN data collection effort will be compared with ridership estimates produced by the model to ensure the transportation model adequately represents that transit ridership.
- Ultimately, the results of the model will be compared against ground counts of transit patrons and vehicular traffic. Model parameters will need to be adjusted during the validation process as part of the 2025 LRTP Update based on the findings of the survey. Averages, confidence intervals, sampling error and simple variations will be reviewed and critiqued allowing the most appropriate values to be selected during this calibration/validation process.