

Executive Summary

During the first part of 2001 the Volusia County Metropolitan Planning Organization (MPO) began to investigate the assumptions used in its travel demand model. The reason for this investigation is that the MPO's travel demand model is a key planning tool used in helping the MPO Board set its long range transportation priorities for the next 20 years. As such the assumptions used in the MPO's travel demand model have important consequences for future transportation improvement projects. In an effort to rely less on statewide assumptions, the MPO undertook an extensive household travel survey. One of the major purposes of the Volusia County Travel Survey project was to collect information that will allow for a better understanding of the travel habits and patterns of residents within Volusia County. To understand the travel behavior characteristics of these trips a data collection program that consisted of gathering household travel data was implemented. The project was jointly funded by the Florida Department of Transportation, Volusia County and the Volusia County MPO.

Due to its size and location within the Central Florida area, Volusia County is unique in that it is a tourist destination as well as being attractive to the retiree population and seasonal residents. Volusia County is composed of two distinct geographical areas that present very different demographical characteristics. First is the coastal area, a region that attracts large amounts of recreational traffic because of its beaches and special events such as the races at the Daytona International Speedway. The coastal area experiences tremendous variations in seasonal traffic and has a high turnover of visitors throughout the year. The second area is the mainland, or West Volusia County, an area that houses the County Government offices, Stetson University and the District office of the Florida Department of Transportation (FDOT), which has characteristics of a typical urban area. These differences in trip making patterns within the distinct areas of the County present a challenge to the Florida Standard Urban Transportation Model Structure (FSUTMS) transportation model and their users in forecasting travel for Volusia County. The current transportation model does an adequate job of replicating travel within the urban areas of the County, but due to limitations of the standard model it has been artificially adjusted to replicate travel between these communities. The data from the household surveys collected under this study will allow transportation professionals to better understand the travel behaviors of trip makers and the travel patterns in Volusia County, and should help resolve any issues or deficiencies in the transportation model. The household survey was designed to produce data to estimate parameters for the Volusia County model's trip generation, distribution and mode split modules. Based on the findings resulting from the data collection effort, the Volusia County model structure should be completely revamped to accommodate the variables that are responsible for these unique travel patterns.

This research project used statistical methods to ensure the best use of resources for the development of accurate transportation models. Data was collected to characterize demographics of households as well as the travel patterns of the corresponding household members. The survey was designed to collect information to be used in calibrating travel demand forecasting models for:

- Home based trip productions;
- Trip distribution;

- Mode choice and auto occupancy; and,
- Peak Hour Factors.

COMMUNITY AWARENESS CAMPAIGN

An integral part of the Volusia County Travel Survey project was a public awareness campaign. The public awareness campaign's multi-faceted approach was developed to ensure the success of the data collection effort. The primary goal of the campaign was to get the selected survey participants to complete their surveys and to do so accurately. A secondary focus was mostly educational in nature; making folks aware that the survey was being conducted, why it was conducted, and how it was going to benefit the community.

In preparing the public awareness campaign one had to understand the different audiences that needed to be reached. The public awareness campaign involved 3 target groups the survey participants, the media, and the general public including public officials. Each group was targeted in different ways and received slightly different messages, but messages with the same general purpose, that encouraged the participation of the randomly selected survey participants.

- Media Release - A media information package was developed that included a brief description of the project and its importance to the people of Volusia County. The media release package included a project description, MPO and consultant contact information. Media releases were sent to all the print, radio and television outlets within Volusia County.
- Letters - Prior to receiving the survey, an introduction letter explaining what the survey was, why it is needed, how the results could affect the participants daily life and the rewards for participating in the program was sent to the participants.
- Local Leaders - The MPO board has a wealth of leadership available that assisted in getting the word out about the importance of citizen participation. The program tapped into this leadership pool and asked the board members take the message home to their city councils and the Volusia County Council.
- Web Site Development - A project web site was developed serving to educate and inform the public about the survey process and project timelines. The website also provided a link to an on-line version of the survey.
- School Mentoring Program - A school outreach program developed for 5th graders provided another mechanism for increasing survey participation and community awareness on transportation/mobility issues, along with ways to address those issues. This program consisted of speakers visiting individual schools and making a presentation regarding transportation planning in general and the travel survey in particular. Each class was then invited to participate in the two-day travel survey documenting where they went, how they got there (bike, foot, mom's taxi, etc) and what kind of stops they made (mall, soccer practice, friends house, fast food joint, etc). Their parents were asked to help their children and while doing so the parents, themselves also participated in the MPO travel survey program. This program served to supplement the overall survey response.
- Project Hot line - A toll free project hotline was established for the duration of the project, providing the public with access to a live person for direct communication

about the project. This was manned during normal business hours Monday through Friday, excluding holidays.

SURVEY DESIGN AND ADMINISTRATION

The household travel survey design reflected the practical experience that the Project Team has had collecting this type of survey data, using these data for model development, and using travel forecasting models to evaluate transportation policies.

The following were two key objectives in the approach that was used in designing this survey:

- 1) Minimize sampling and non-response bias – A survey sample provides good estimates of travel characteristics if and only if the sample of households who agree to complete the survey are representative of the full population. To ensure that this is the case means that the sample must be drawn such that all household types have an equal chance of being selected, and that those who choose to complete the questionnaire are representative of all households. The former can be accomplished reasonably well using a number of common random sampling approaches. The latter, getting responses from representative households requires significantly more effort. Some individuals and households simply did not respond to telephone solicitation. These individuals feel that they are too busy to spend time completing a lengthy questionnaire. However, these are most likely to be the households that also make the most trips. To combat this bias the survey team statistically weighted households that did respond to be reflective of the County in general by using data from the 2000 Census.
- 2) Ensure accuracy of data – There are at least two major challenges to collecting accurate travel/activity data. First, it is important that the household data contain a complete enumeration of household members and trips so that trip generation rates can be computed. Second, the trip information that is provided, including locations of trip ends must be accurately reported.

The survey design employed the general principles of the *Tailored Design Method*, an approach that has proven to maximize response rates in numerous past applications. An integral part of the design involves using a multi-method, multi-instrument approach that includes both telephone and mail recruitment, which allows for mailback, phone and Internet responses. This approach provides alternatives to those who have an aversion to being contacted by telephone and allows a convenient, extremely efficient option for Internet completion for those who have Internet access.

The administration plan allowed respondents to use any of three methods to report their travel activity:

- 1) By mail on printed forms,
- 2) By telephone, guided by an interviewer or
- 3) Over the Internet using a web instrument

Two instruments were designed to support these options: printed forms that served as complete travel diary instruments and a web instrument that served both phone interviewers as well as respondents who choose to respond directly over the Internet. Both were designed as two-stage instruments where Stage 1 collected household information and assigned an initial travel reporting day, while Stage 2 collected travel diary information.

The survey instruments were designed to gather household-level demographic information, individual member demographic information, and a travel diary for each household member. In addition, a short stated preference survey asked respondents to choose between rail service and car travel under various service conditions.

Printed Instrument

The printed Stage 1 instrument was designed in a booklet form, separate from the travel diary forms. The travel diary forms consisted of a set of letter-size sheets, each of which was sufficient for recording the travel activity of a single household member. The following figures are samples of the printed survey forms used in this study.

The left form, titled "HOUSEHOLD INFORMATION", includes sections for household size, age distribution, vehicle ownership, housing type, annual household income, and visitor frequency. It also includes a "PERSON INFORMATION" section for the first person in the household, asking for name, age, gender, and employment status.

The right form, titled "Volusia County TRAVEL SURVEY FORM", includes a "DON'T FORGET!" section, a "CHECK HERE" section for trip reporting, and a table for recording trip details. The table has columns for trip number, start time, end time, location, mode of transport, and whether the trip was a round trip. A "TRIP CODES" section on the right lists various trip types with corresponding codes.

Sample Paper Survey Forms

Web Instrument

The instrument was designed in a way that first established the list of travel activities that each household member had undertaken and then requested details for each of the trips linking those activities. This approach is similar to the one used in the U.S. DOT National Household Travel Survey (NHTS) and has resulted in more accurate indications of total trip-making.

An advanced online geocoding system was integrated into the travel survey instrument. Respondents (or telephone operators, for telephone completions) could identify a trip end by entering a street address, identifying the nearest intersection, providing the name of a commercial establishment, using a point-and-click map or selecting a previously-identified location. The design included several features that reduced respondent burden. An advanced rostering system allowed respondents to simply indicate when family members traveled together (e.g., parent driving child), thereby avoiding the need to re-enter trip information for those other family members. The system also used extensive internal consistency checks to ensure that data was correctly entered. The following figures show sample screens used in the internet survey.

Volusia County
TRAVEL SURVEY

The survey day is 11/1/2001.

① Where did the day begin for AAS? For this survey, the day begins at 3:00 AM on 11/1/2001. ☐ Check here if AAS made no trips on this date, then click DONE.

② Indicate the reason AAS visited each place and the time she arrived there.

Place #	Why was this trip made?	What time did AAS arrive?
1	<input type="text" value="Drop off passenger"/>	7 : :30 <input type="radio"/> AM <input type="radio"/> PM
2	<input type="text" value="Go to work"/>	7 : :40 <input type="radio"/> AM <input type="radio"/> PM
3	<input type="text" value="Go home"/>	5 : :30 <input type="radio"/> AM <input type="radio"/> PM
4	<input type="text" value="Click arrow to select"/>	7 : :00 <input type="radio"/> AM <input type="radio"/> PM
5	<input type="text" value="Click arrow to select"/>	7 : :00 <input type="radio"/> AM <input type="radio"/> PM
6	<input type="text" value="Click arrow to select"/>	7 : :00 <input type="radio"/> AM <input type="radio"/> PM
7	<input type="text" value="Click arrow to select"/>	7 : :00 <input type="radio"/> AM <input type="radio"/> PM
8	<input type="text" value="Click arrow to select"/>	7 : :00 <input type="radio"/> AM <input type="radio"/> PM
9	<input type="text" value="Click arrow to select"/>	7 : :00 <input type="radio"/> AM <input type="radio"/> PM
10	<input type="text" value="Click arrow to select"/>	7 : :00 <input type="radio"/> AM <input type="radio"/> PM

Example Travel Day

Think of all places you visited that required traveling by car, bus, bicycle, or by walking 5 or more minutes. Stops along the way, such as for gas or to drop off a passenger should be listed as separate places.

ABC
Pick Up Passenger

Volusia County
TRAVEL SURVEY

AAS - Find start location (Home): Zoom in further by clicking on the map. Use the arrows around the map to move to another location.

Sample Internet Survey Forms

Survey Sampling Plan

The sampling frame for this survey included all resident households within the study area. There were several possible ways of selecting a sample from this frame. For this project, an address-based sampling approach was determined to be the most effective. This involved obtaining an address list that was augmented with telephone numbers.

The project required enough data to estimate trip generation for Volusia County with a maximum of 5% sampling error margin with a confidence level of 95%. In order to estimate the number of completed surveys necessary to meet these standards requires that the variability of the trip generation rates be known. Unfortunately the variation of the trip generation rates cannot be calculated until the survey has been completed. As a result travel surveys commonly rely on accepted values, based on previous travel surveys from other areas, as a proxy for the variation in trip generation rates. A number of past studies have shown that the coefficient of variation of trip generation rates at the zonal level is in the range of 0.8 to 1.0. For Volusia County this resulted in a required minimum sample size of approximately 1,540.

Survey Administration Plan

The survey administration was divided into three phases:

- 1) Pre-contact – From the random sample list, pre-contact letters were sent to those selected in this sampling. Also, others were invited to participate through the Public Awareness Campaign.
- 2) Recruit – Phone calls were placed to those on the random sample list who had phone listings, requesting participation, collecting Stage 1 (household information) data and assigning an initial travel day. Packets were mailed to those on the list without phone numbers, including printed survey forms, Internet access information and assigning a travel day. Materials were also provided to those recruited through the Public Awareness Campaign.
- 3) Retrieval – Survey response by phone, mail and Internet was tracked. Follow-up reminders were also provided to all who agreed to participate. An acceptable retrieval window was set to ensure that the data collected involve recollections of reasonably recent trip-making.

For three two-day periods during November 2001 and February 2002, the Project Consultant team of TEI Engineers & Planners and Resource Systems Group conducted a household travel study in Volusia County, Florida with the purpose of reporting regional travel patterns and preferences to the Volusia County MPO. The breakdown of the overall response to the survey was:

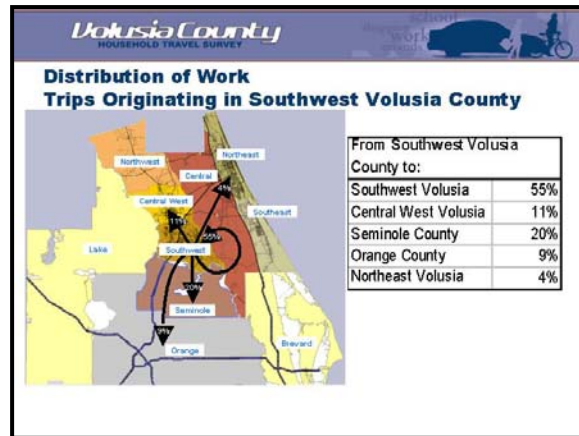
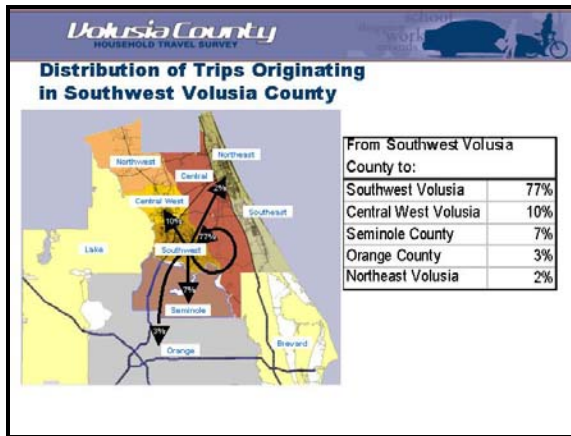
- Surveys mailed out to 6,300 households
 - Surveyed members 16+ years for 2 days
- Delivered: 5,759 (91.4%)
- Completed returns
 - 13,408 Trips Reported
 - 2,794 Travel Days
 - 1,397 Households (24% response rate)
 - 2,727 People Completed Travel Diaries

Key Results

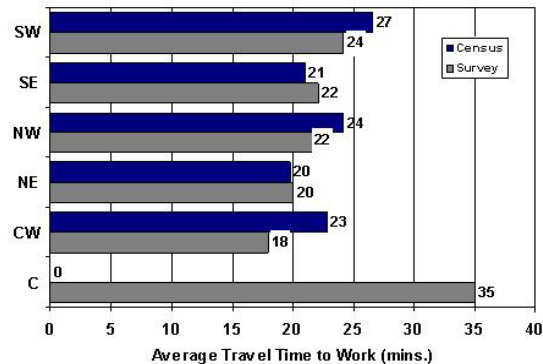
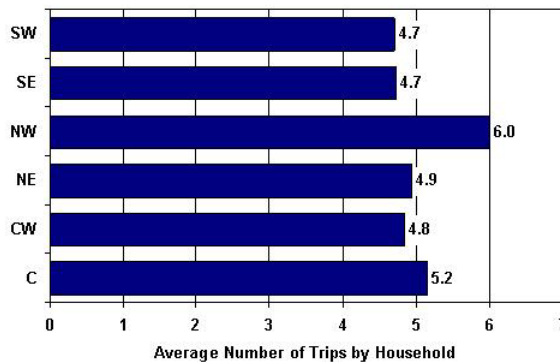
The household and member demographic sections of the survey yielded information regarding the general characteristics of the Volusia County population and enabled comparisons to the 2000 Census data. Given this comparison, a weight was applied to the household, member, trip and stated preference data so that an accurate extrapolation could be made from our sample population to the entire population of Volusia County to ensure appropriate model results. The resulting overall respondent profile is summarized as follows:

- 70%—households with one to two people
- 72%—no one under the age of 16 living at home
- 78%—live in a single-family home
- 88%—homeowners
- 37%—at least one retired household member
- 93%—live in Volusia County 10+ months per year
- 74%—own one to two vehicles
- 83%—never use public transit

The travel diaries yielded overall information on trips and travel patterns within Volusia County and the surrounding regions. The overwhelming majority of all trips reported were made by car, approximately two-thirds of which were single-occupant vehicles. One third of trips reported were for the purpose of going home, and the majority of the rest was divided among the categories of Shopping, Personal Business and Go to Work. As an example of how the survey data can be used to understand the travel patterns within Volusia, the two figures below depict travel patterns for trips originating from the Southwest Volusia planning area on a daily basis. The first figure shows travel patterns for all types of trips combined, while the second figure presents information for work trips only.



The following two bar charts present a summary of trip generation rates and average travel times by the six planning areas. As can be seen below in the first chart, 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 is not 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.



Similarly the second chart 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 also 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.

The stated preference section of the survey yielded information which showed that Volusia residents value trips to the Orlando International Airport most highly, at \$17.40 per hour for the main travel segment and \$30.13 per hour for the access and egress portions of those trips. The monetary value of these trips is consistent with studies from other regions around the country. The application of the stated preference model indicates reasonably high rail shares under very favorable service conditions and that residents of Volusia County are receptive to this transportation alternative. However, region-wide rail shares would be lowered by less favorable service conditions than those used in this modeling process.

MODEL RESULTS

The data collected through the 2000 Volusia County Household Travel Characteristics Survey was analyzed to formulate and calibrate the future enhancement of the Volusia County MPO's travel demand model (VCUATS). As such, the analysis used a statistical method to ensure the best use of limited resources to develop accurate models. Utilizing the Volusia County travel characteristics data, model coefficients were estimated and trip factors were developed.

Trip Generation Rates

Volusia County household travel characteristics survey data were compiled and analyzed to support the review of almost every aspect of the trip generation model. The Volusia County Household Travel Survey strongly indicates that other variables may be more statistically significant in determining trip production rates by purpose than are currently used in the traditional FSUTMS (dwelling unit type, household size and number of available vehicles) model.

Users of the standard FSUTMS trip generation model previously recognized that some of the characteristics of Florida, such as a large proportion of retired persons, were not 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. An extensive investigation was conducted to determine which independent variables were most important for predicting trip productions in Volusia County.

The investigation examined such variables as employment status, age of householders, income, traditional dwelling unit type, household size and number of available vehicles. The survey particularly indicated that household "lifestyles" were an important factor. This investigation revealed that trip production in the Volusia County could best be predicted using a cross classification model based on two variables: lifestyle and the number of vehicles available. The lifestyle model better reflects the demographic character of Volusia County where there is a significant proportion of retired households. These variables, which, can be estimated using available Census data would be designated as follows:

- Retired Households: Households in which the householder is age 65 or over.
- Working with Children Households: Households in which the householder is under age 65 and at least one household member is age 17 or under.
- Working with No Children Households: Households in which the householder is under age 65 and no member of the household is age 17 or under.

Other urban areas in the State of Florida are currently employing different versions of the Life Style Model. This trip generation model is currently in use in the following areas:

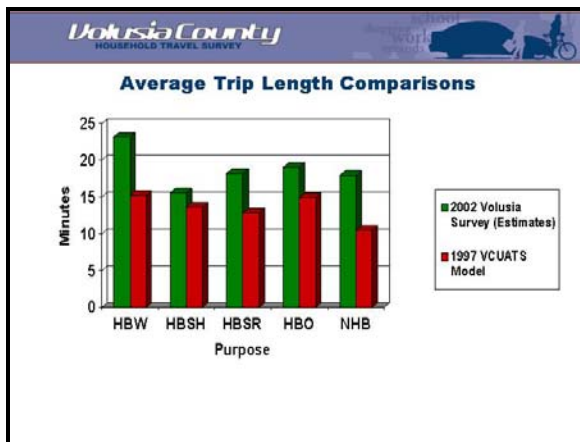
- Tampa Bay (Citrus, Hernando, Pasco, Hillsborough, and Pinellas counties)
- Southeast Florida (Indian River, St. Lucie, Martin, Palm Beach, Broward, and Miami-Dade Counties)
- Potential Future Life Style Models
 - First Coast MPO (model includes Duval and portions of Clay and St. Johns counties)

Trip Distribution Friction Factors

The distribution of home-based work trips a key component to the transportation modeling process. It is the home based work trips that usually determine peak-hour usage, and is often the trip for which roadway facilities are designed. For work trips, the estimated average travel time based on data from the survey (mean congested travel time) for home-based work trips is 23 minutes. This compares favorably with reported average trip lengths from the 2000 U.S. Census, which is 25 minutes for the Volusia County. This indicated that the estimated average travel time from the survey perform much better than the average travel time from the existing 1997 VCUATS model, which uses a travel time of only 15 minutes, much shorter than 2000 Census average home-based work travel times.

For the five different trip purposes, it is expected that home-based shopping trips are shorter in duration than home-based work trips. Additionally, these trips usually have a much smaller variance, or deviation than work trips. The estimated average travel time from the survey data for home-based shopping trips was 16 minutes, an average that is much shorter than the 23 minutes 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 data for home-based other trips was 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 was 18 minutes. As expected, these travel times were shorter than that for work trips. The figures presented below provide a comparison of average trip lengths resulting from the survey and the trip lengths from the existing 1997 VCUATS model. The second figure compares the trip length results from the survey with those of other urban areas in Florida.



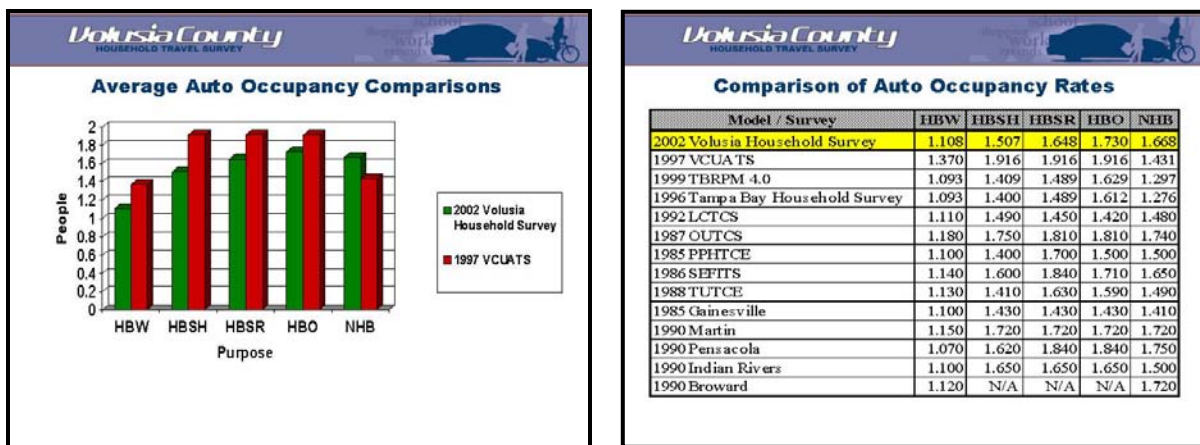
Average Trip Length Comparisons					
Survey/Model	HBW	HBSH	HBSR	HBO	NHB
2002 Volusia Survey (Estimates)	23.20	15.60	18.19	19.05	17.95
1997 VCUATS Model	15.25	13.65	12.86	14.95	10.48
2000 Tampa Bay Survey	28.46	22.62	23.95	25.95	24.15
1996 Tampa Bay Survey	26.20	20.40	20.90	19.75	22.35
1999 TBRPM Model	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 can be seen from these exhibits the resulting trip lengths estimated from the survey data are longer than those used in the 1997 existing VCUATS model. The second figure provides a comparison between trip length in minutes by trip purpose from the survey data, the existing Volusia County MPO model, and other surveys and models throughout Florida. As can be seen from this figure the trip lengths developed from the survey data compare favorably with trip lengths from other surveys and models used in other urban areas in Florida. The percent changes of average trip length from 1997 VCUATS model to 2002 Volusia County travel survey data are 52.1% for HBW, 14.3% for HBSH, 41.4% for HBSR, 27.4% for HBO, and 71.28% for NHB.

As a result the longer trip lengths will increase VHT (Vehicle Hours Traveled) in Volusia County. The model assigned volumes multiplied by travel times equals VHT. However, the validity and reasonableness of a travel demand model needs to be checked not only by the trip distribution model (trip length) alone, but other model components as well. An example would be the trip generation rates in the trip generation model and the auto occupancy rates in the mode choice model.

Mode Choice and Auto Occupancy Rates

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 in order to factor the person trips into vehicle trips for each trip purpose. The new recommended auto occupancy factors (AOFAC) are shown in the following exhibits.



The first figure shows that the values used in the 1997 VCUATS model assumed a higher number of occupants per vehicle in Volusia County than have been estimated from the results of the survey. This means that there are more people driving alone in a vehicle than originally assumed by the 1997 VCUATS model. The auto occupancy rates derived from the Volusia County household travel survey were compared with those auto occupancy rates used in other Florida models and other Florida travel characteristics surveys.

The percent changes of average trip length from 1997 VCUATS model to 2002 Volusia County travel survey are -19.1% for HBW, -21.4% for HBSH, -14.0% for HBSR, -9.7% for HBO, and 16.6% for NHB. As a result, the lower auto occupancy rates would increase the model vehicle volumes loaded onto the network in Volusia County. However, the validity and reasonableness of a travel demand model need to be checked not only by mode choice model (auto occupancy) alone but other model components as well. An example would be the trip generation rates in the trip generation model and the trip length in the trip distribution model.

Traffic Assignment Factors

The new recommended CONFAC factor is based upon extensive analysis efforts on the Volusia County Home Based Travel Survey. This 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 purpose where as CONFAC value of 10% was used in the 1997 VCUATS

Model. A larger CONFAC reduces the daily roadway capacity, which in turn reduces loaded volumes onto the network since the reduced capacity may cause more delays and more congestion. In order to evaluate reasonableness of the new recommended ratios of peak hour to daily traffic (CONFAC), it is necessary to perform a model validation.

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 final conclusions of this study are:

- 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 per 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 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 sample variations will be reviewed and critiqued allowing the most appropriate values to be selected during the calibration/validation process.