TECHNICAL APPENDIX B CENTRAL FLORIDA REGIONAL PLANNING MODEL, VERSION 7 DRAFT MODEL VALIDATION REPORT



Central Florida Regional Planning Model, Version 7 - Draft Model Validation Report

This Technical Appendix consists of the working draft of the Model Validation Report for the Central Florida Regional Planning Model, Version 7 (CFRPM v7), developed by the Florida Department of Transportation, District Five. The 2015 base year and 2045 future year CFRPM v7 models provide MPOs/TPOs, FDOT, and other entities with a tool for forecasting travel demand in the District's nine counties.

The River to Sea TPO utilized CFRPM v7 to develop Connect 2045 by forecasting transportation demand within the metropolitan planning area for the year 2045 to identify a list of potential roadway needs. By utilizing CFRPM v7, Connect 2045 was developed based on the latest available estimates and assumptions for population, land use, travel, employment, congestion, and economic activity. In addition, CFRPM v7 was also used to develop alternative scenarios for automated, connected, electric, and shared mobility (ACES) to support Connect 2045's Technology Scenario.



Model Validation Report

WORKING DRAFT



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List of Acronyms

AADT Average Annual Daily Traffic

BPR Bureau of Public Roads

CFRPM Central Florida Regional Planning Model

DOT Department of Transportation

FDOT Florida Department of Transportation **FHWA** Federal Highway Administration

FSUTMS Florida Standard Urban Transportation Model Structure

GIS Geographic Information System

HBO Home-Based Other TripsHBW Home-Based Work TripsHBS Home-Based Shop Trips

HM Hotel/MotelLOS Level of Service

MPO Metropolitan Planning Organization

MUT Multi-Unit Trucks

NCHRP National Cooperative Highway Research Program

NHB Non-Home-Based Trips
NHO Non-Home Other Trips
NHW Non-Home Work Trips

NHTS National Household Travel Survey
PRMSE Percent Root Mean Square Error

RMSE Root Mean Squared Error

SUT Single-Unit Trucks
TAZ Traffic Analysis Zone

TOD Time-of-Day

TRB Transportation Research Board
 V/C Volume-to-Capacity Ratio
 VHT Vehicle Hours Traveled
 VMT Vehicle Miles Traveled



1 Introduction

The Florida Department of Transportation (FDOT), District 5 developed Central Florida Regional Planning Model, Version 7 (CFRPM 7). The 2015 base year and 2045 future year CFRPM 7 models provide the MPOs/TPOs, the FDOT and other entities with a dependable tool for forecasting travel demand in the District's nine counties.

CFRPM 7 includes a new roadway network and enhanced traffic analysis zone (TAZ) system across the entire District. It is a time-of-day model that is implemented in ArcGIS, Cube Voyager, and Federal Transit Administration's Simplified Trips on Project Software (STOPS) programs. It consists of three major components: a Geographic Information System (GIS)-based interface for editing, visualization and reporting of the roadway network and socio-economic data; a primary travel demand model that includes trip generation, distribution, mode choice and assignment steps; and a dedicated transit-only STOPS model that estimates public transportation ridership.

There are two companion documents. The model is fully described in the *CFRPM 7 Model Description Report*. Network editing and model running procedures can be found in the *CFRPM 7 User Guide*.

A travel model is designed by its nature to react and respond appropriately to reasonable changes in sociology-demographic variables and transportation systems. The purpose of the validation process is to assess the model's ability to reflect travel characteristics. CFRPM 7 has been validated at each major step of the model. The model outputs were also validated to the common performance measures used today, including congested travel times and person flows. Longitudinal tests were conducted so that errors in horizon year input data or model calibration can be addressed before the model is used in Long Range Transportation Plan (LRTP) applications. This *CFRPM 7 Model Validation Report* details the model validation procedures and results.

The process of model calibration and validation is vital to producing defensible travel demand forecasts. In calibration, parameters in the models were adjusted to assure that each model step is replicating known travel behavior. Validation primarily involved comparing model results to the known observed data but can also involve comparing results to independently-derived benchmarks.

Validation can help ensure that CFRPM 7 reasonably reflects existing the transportation network and demand so that it can be a useful tool for developing LRTPs and other studies. The validation results inform planners, policy and decision-makers of the model's strengths and weaknesses beyond its immediate intended purpose and identify future CFRPM adjustments to address those weaknesses or accentuate its strengths.



1.1 Validation Tests and Metrics

There are four categories of tests commonly used in the travel model validation. The descriptions of these tests are taken from FHWA's Reasonableness Manual.

Comparisons of base year model results to observation or benchmarks might be considered "traditional" validation. The comparisons might be of model results to disaggregate data such as data from a supplementary survey not used for model estimation or to aggregate data such as traffic counts or transit boardings. The practice of comparing the base year model to data that was used to estimate or calibrate a model is not as robust as comparing to independent data. However, this practice is unavoidable especially for the validation tests of trip generation and distribution sections, as the data used for model estimation or calibration are the only data available.

Reasonableness and logic checks include the comparison of estimated (or calibrated) model parameters against those estimated in other regions with similar models. Reasonableness and logic checks may also include "components of change" analyses or an evaluation of whether the model procedures "tell a coherent story" about the transportation system and how people use it (as recommended by the FTA for New Starts analysis).

Model sensitivity testing includes several important types of checks including both disaggregate and aggregate checks. Disaggregate checks, such as the determination of model elasticities, are performed during model estimation. Aggregate checks are tested from temporal validation. Sensitivity testing can also include model application using alternative demographic, socioeconomic, transportation supply, or policy assumptions to determine the reasonableness of the resulting travel forecasts.

Longitudinal tests are important aspects of model validation since, by definition, it implies comparing model results to data not used in model estimation. Both backcasts and forecasts may be used for model validation. For example, if a model is estimated using 2007 survey data, the model could be used to backcast to 2000 conditions and compared to the year 2000 traffic counts, transit boardings, CTPP data, or other historical data. Likewise, if a model is estimated or calibrated using the 2005 survey data, a forecast validation might be performed against 2008 data.

CFRPM 7 validation process included tests in three of the four categories:

- Comparisons of base year model results to observations or benchmarks,
- Reasonableness and logic checks, and
- Longitudinal tests.

The tests were applied to all components of CFRPM 7: socio-economic and roadway network data validation, trip generation, trip distribution, special area sub-models & non-motorized trips, highway assignment, longitude tests and transit assignment from STOPS.



It is important to note that models can be considered valid even if they do not replicate each observed value exactly, or meet every benchmark, reasonableness, or logic check. Sometimes there are errors or issues in the way the observed data was collected that make it challenging for a demand model to replicate. In other circumstances, the benchmarks and reasonableness checks reflect an "average" city and are not always directly relatable to Central Florida and its unique travel markets. In fact, models that "pass" every validation test are commonly found later to be over-calibrated. Over-calibrating occurs when the model is adjusted in a way – usually to achieve an improved validation result – that does not directly conform to a specific aspect of travel behavior. Over-calibration deprives the model of its ability to properly react to changed socio-demographic or transportation conditions, resulting in illogical or confusing results. Consequently, models that do not meet every benchmark can be considered valid, and sometimes more valid than those "passing" extensive lists of validation tests.

1.2 Validation Process

The validation process for each model component is:

- 1. Assemble the described observed data and benchmarks.
- 2. Determine the extent of how the observed data can be used for validation testing. For example, the observed data could have systemic biases or variability that make it untenable for validation purposes.
- 3. Assemble the appropriate CFRPM 7 model input data and outputs.
- 4. Compare CFRPM 7 model input data and outputs to the observed data and/or benchmarks.
- 5. Assess the model's performance given the quality of the observed data and identify significant differences.
- 6. Discuss the root cause of significant differences between model input data and outputs and observed data or benchmarks. Adjust the model if the adjustment conforms to well-studied aspects of travel behavior.
- 7. Summarize the model's performance, highlighting its strengths, weaknesses, and unknowns.

For CFRPM 7, the observations are from the various data resources such as American Community Survey (ACS), 2017 National Household Travel Survey (NHTS), Census Transportation Planning Products (CTPP), 2017 Transit On-Board Survey, etc. The benchmarks are from the Department's *Model Calibration and Validation Standards Report* produced in 2008 that is based on a variety of national sources, including Census data, household travel surveys, NHTS tabulations, and Federal and State guidelines on modeling practice. Travel time metrics related to performance-based planning are also used in model validation.



A travel model is designed by its nature to react and respond appropriately to reasonable changes in sociology-demographic variables and transportation systems. The purpose of the validation process is to assess the model's ability to reflect travel characteristics. Unfortunately, overcalibrating is readily instinctive to modeling analysts because of the inherent desire to have the model match observed values or benchmarks as closely as mathematically possible. This desire is misplaced and therefore needs to be tempered with the realization that over-calibrating both restricts the model's ability to provide helpful information for project-level analysis and mistakenly disregards the natural variability of the observed data. CFRPM 7 project team made every effort to adjust the model in a way to avoid over-calibrating. However, some of the validation results could not be improved without over-calibrating. In these situations, the team did not over-calibrate but instead let the results stand to allow users to make adjustments as necessary for their individual studies. These specific areas can be easily identified by comparing CFRPM 7 results to the benchmarks and metric thresholds. Please refer to *CFRPM 7 Model Description Report* for details of adjustments.

1.3 Report Outline

The purpose of this validation report is to summarize the validation results of CFRPM 7 and inform the reader which aspects of transportation CFRPM 7 knows well, knows somewhat, and does not know. A wide range of calibration adjustments were made to the modeling system to produce positive validation results in CFRPM 7. The validation results in this report demonstrate that CFRPM 7 does a reasonable job of replicating the transportation system and how people use the transportation system.

The report is organized as follows:

- Chapter 2 –Data Validation. This section summarizes the validation of various input data used in CFRPM 7 such as traffic analysis zone (TAZ) level household and demographic information as well as network information.
- Chapter 3 Trip Generation. This section summarizes the trip generation validation results for CFRPM 7. Comparisons with benchmarks and CFRPM 6.2 trip generation outputs are presented.
- Chapter 4 Trip Distribution. This section provides the trip distribution validation results. Three aspects are reviewed: county-to-county flows, average trip length by trip purposes, and percentage of trips that occur within a single TAZ.
- Chapter 5 Special Area Sub-Models & Non-Motorized Trips. This section compares the non-motorized, OIA, and transit trip results to observed values.
- Chapter 6 Highway Assignment. This section provides numerous comparisons of observed data (traffic counts and travel time observations) and the model estimates.



- Chapter 7 Longitudinal Tests. Good validation practice should include longitudinal tests for at least one year other than the base year for model estimation or calibration. This section presents the backcast results to 2010 and a forecast to 2045.
- Chapter 8 Summary. An overall review of all validation results is presented in this section.



2 Data Validation

This chapter summarizes the validation of socio-economic data and network data used in CFRPM7. The process of obtaining socio-economic data and network data is explained in Chapters 2 and 3, respectively, in the *CFRPM 7 Model Description Report*.

Socio-economic data are developed for each traffic analysis zone (TAZ). The TAZs are the specific geographic areas, with homogenous land use and activities, for a trip generation. The socio-economic data includes household, employment, hotel/motel, school enrollment, and other special generator data. This information is pooled from various data sources, which undergoes various corrections and adjustments before arriving at the final dataset. This dataset is called ZDATA.

2.1 Socio-Economic Data

Each of the seven MPO/TPOs in CFRPM region developed socio-economic data (household and employment), which is pooled and to develop CFRPM 7 ZDATA dataset. Table 2-1 presents the household data fields in the ZDATA.

Table 2-1 CFRPM 7 Household Data Elements

Data Element	Description
TAZ	TAZ Numbers
SF_DU	Number of Single Family Dwelling Units
OF DOT VAID	Percentage of Single Family are Vacation and Non-Permanent
SF_PCT_VNP	Resident Homes
SF_PCT_VAC	Percentage of Single Family are Vacation Homes
SF_POP	Permanent Single Family Population
SF_0AUTO	Single Family Percentage of 0 Auto-owning households
SF_1AUTO	Single Family Percentage of 1 Auto-owning households
SF_2AUTO	Single Family Percentage of 2+ Auto-owning households
MF_DU	Number of Multiple Family Dwelling Units
MF_PCT_VNP	Percentage of Multiple Family are Vacation and Non-Permanent
WIF_FCI_VINF	Resident Homes
MF_PCT_VAC	Percentage of Multiple Family are Vacation Homes
MF_POP	Permanent Multiple Family Population
MF_0AUTO	Multiple Family Percentage of 0 Auto-owning households
MF_1AUTO	Multiple Family Percentage of 1 Auto-owning households
MF_2AUTO	Multiple Family Percentage of 2+ Auto-owning households
HM_DU	Hotel/Motel Dwelling Units
HM_PCT_OCC	Hotel/Motel Occupancy Rate



Data Element	Description
HM_POP	Hotel/Motel Population

Source: CFRPM 7

Along with the household data, employment and school data are also developed to form socio-economic data by TAZ.

Table 2-2 CFRPM 7 Employment and School Data Elements

Data Element	Description	
TAZ	TAZ Numbers	
IND_EMP	Industrial Employment* by Place-of-Work - All full-time and regular part-time employees, and self-employed persons by job location, whose job is in an industry classified in Standard Industrial Classification (SIC)¹ categories 01 to 39 (i.e., agriculture, forestry, fisheries, mining, contract construction, and manufacturing).	
COM_EMP	Commercial Employment* by Place-of-Work - All full-time and regular part-time employees, and self-employed persons, by job location, whose job is in an industry classified in SIC categories 50 to 59 (i.e., retail trade and wholesale trade since both are commonly located in areas zoned for commercial land use activities).	
SVC_EMP	Service Employment* by Place-of-Work - All full-time and regular part-time employees, and self-employed persons, by job location, whose job is in an industry classified in SIC categories 40 to 49 and 60 to 93 (i.e., transportation, communication and utilities services; finance, insurance and real estate services; selected personal services; tourism and recreational services, health and educational services; government services).	
TOT_EMP	Total Employment by Place-of-Work - The total of industrial, commercial and service employment.	
SCHL_K12	Kindergarten through 12 th grade (K-12) School Enrollment by School Location	
SCHL_POST	Post-secondary (College and above) Enrollment	

Source: CFRPM 7

¹ Standard Industrial Classification (SIC) is defined in the Standard Industrial Classification Manual: 1972, Office of Federal Statistical Policy and Standards, U.S. Department of Commerce, Washington, DC, GPO-SN 4101-0066 (1977 Supplement, SN 003-005-00176-0).



^{*}https://www.fsutmsonline.net/images/uploads/reports/TRGEN.PDF

The summary of the socio-economic data is provided in the next sections, followed by checks on the datasets and comparison of CFRPM data with some independent data sources.

2.1.1 Summary of Socio-Economic Data

The following table displays the total values of the household, employment, and school variables in CFRPM ZDATA. CFRPM region includes 4.6 million people, two million jobs and over one million students across its 11 counties.

Table 2-3 CFRPM 7 2015 Regionwide Totals

Metric	Regional Total
Number of Zones with HH/Emp data	7,102
Single Family Occupied DUs	1,375,365
Single Family Population	3,573,782
Multi Family Occupied DUs	456,248
Multi Family Population	1,023,361
Total Population	4,595,383
Total Households	1,998,681
Total Occupied DUs	1,831,613
Total Permanent DUs	1,674,263
Total Vacant DUs	167,068
Total Non-Permanent DUs	157,350
Hotel-Motel Occupied Units	164,267
Hotel-Motel Population	220,329
Total Autos	3,193,630
Occupied DUs with no automobile	101,218
Industrial Employment	236,453
Commercial Employment	388,762
Service Employment	1,427,744
Total Employment	2,052,959
K-12 School Enrollment	755,710
Post-secondary Enrollment	337,871

Source: CFRPM 7

Table 2-4 presents a selection of metrics of the ZDATA commonly used to compare across different regions.



Table 2-4 Selection of ZDATA Metrics

Derived Metrices	Regional Value
Population per Occupied DU	2.51
Employment to Population Ratio	0.45
Employment per Occupied DU	1.12
Autos per Occupied DU	1.74
Students per Occupied DU	0.60
Hotel-Motel Population per Occupied HM Units	1.34
Percent of Single Family DUs Relative to Total Occupied DUs	75%
Percent of vacant units Relative to Total Occupied DUs	9%
Percent of Seasonal Units Relative to Total Occupied DUs	9%
Percent of No Auto DUs Relative to Total Occupied DUs	6%
Percent of Industrial Employment Relative to Total Employment	12%
Percent of Commercial Employment Relative to Total Employment	19%
Percent of Service Employment Relative to Total Employment	70%

Source: CFRPM 7 Geodatabase

2.1.2 LUCHECK

The socio-economic data, developed from various sources, were checked for reasonableness of aggregated metrics. These checks are first level checks to identify and correct any obvious avoidable errors. The LUCHECK program (an abbreviated form of "Land Use Checks") was developed by Mike Brown many years ago to automatically conduct these checks. The LUCHECK program has a series of checks for errors (data-entry errors, typos, and mis-codings) and reasonableness tests (that may uncover deeper issues within the data). These checks are performed for each zone individually. These tests are not performed on "dummy zones", which are zones that do not have any socio-economic data since they are reserved for future applications. In the past, dummy zones were identified as zones with a zero sum of population, dwelling units, hotel/motel units, and employment. Today, dummy zones can be omitted entirely from the socio-economic file.

LUCHECK checks the number of autos and permanent resident DUs, which are not directly available in the household data. These variables are derived from the ZDATA information using the following equations:

(1) $NumAutos = (SF1CPct/100 \times SFDU) + (SF2CPct/100 \times SFDU \times 2.5) + (MF1CPct/100 \times MFDU) + (MF2CPct/100 \times MFDU \times 2.5)$



Where *NumAutos* is the number of autos in the TAZ, *SF1CPct* is the percentage of Single Family 1-car DUs, *SF2CPct* is the percentage of Single Family 2+-car DUs, *SFDU* is the number of Single Family permanent DUs, *MF1CPct* is the percentage of Multi-Family 1-car DUs, *MF2CPct* is the percentage of Multi-Family 2+-car DUs, and *MFDU* is the number of Multi-Family permanent DUs. The value of 2.5 is the assumed average number of auto owned by 2+ car households.

(2)
$$PermResDU = Trunc(TotalDU \times (100 - PercentVANP))$$

Where *PermResDU* is the total number of permanent resident DUs in TAZ, *TotalDU* is the number of total DUs of the zone, *PercentVANP* is the percent of vacant and non-permanent (i.e., seasonal) DUs in the zone, and *Trunc* is a function that truncates the result of the computation to an integer. Truncation is different from rounding; it only uses the whole number portion of the computation. For example, the truncated values of 235.9, 235.7, 235.5, 235.3, and 235.1 are all the same (235). A similar computation using the HM occupancy rate is performed to calculate occupied HMUs.

Table 2-5 presents the list of error checks performed on household data. A TAZ that achieves the conditions for an error check is found to have "failed" the error check and flagged for manual review.

Table 2-5 Error Checks on Household Data

#	Error Check
1	For single family HHs, both DU=0 and population (POP) >0
2	For single family HHs, both POP=0 and DU>0
3	For multi- family HHs, both DU=0 and POP>0
4	For multi- family HHs, both POP=0 and DU>0
5	For single family HHs, percent vacant DUs is greater than the percent
	vacant + non-permanent (seasonal) DUs
6	For multi- family HHs, percent vacant DUs is greater than the percent
U	vacant + non-permanent (seasonal) DUs
7	For single family HHs, the sum of the 0, 1 and 2+ auto percentages ≠ 100
8	For multi-family HHs, the sum of the 0, 1 and 2+ auto percentages ≠ 100
9	For single family HHs, DU > 0 and the sum of the 0, 1 and 2+ percent
9	autos is 0
10	For multifamily HHs, DU > 0 and the sum of the 0, 1 and 2+ percent
10	autos is 0
11	Single family HH DUs is less than 0
12	Multi-family HH DUs is less than 0
13	Single family HH population is less than 0



#	Error Check
14	Multi-family HH population is less than 0
15	Hotel/Motel units is less than 0
16	Hotel/Model occupancy rate < 0
17	For hotel/motels, both units>0 and occupancy rate =0
18	For hotel/motels, both units=0 and occupancy rate >0
19	For hotel/motels, both occupancy rate =100 and units >0
20	Total employment does not equal the sum of Industrial, Service and Commercial employment
21	Industrial employment is less than 0
22	Service employment is less than 0
23	Commercial employment is less than 0
24	Total employment is less than 0
25	Both hotel/motel units>0 and service employment =0
26	School enrollment is less than 0
27	School enrollment >0 and service employment =0
28	Single family HH non-permanent % > Multi-family non-permanent %
29	For single family HHs, DUs is greater than POP
30	For multi-family HHs, DUs is greater than POP
31	For hotel/motels, both units=0 and POP > 0
32	For hotel/motels, both POP=0 and units> 0
33	College enrollment < 0
34	College enrollment >0 and service employment =0

Source: LUCHECK program

Table 2-6 presents the list of reasonableness checks performed on household data. A TAZ that achieves the conditions for a reasonableness error check is found to have "failed" the check and flagged for manual review.

Table 2-6 Reasonableness check for Household Data

#	Reasonableness Check			
1	Hotel/motel units are between 1-11, inclusive			
2	Single family HH seasonal % > 50%			
3	Multi-family HH seasonal % > 50%			
4	Single family HH vacant % > 30%			
5	Multi-family HH vacant % > 30%			
6	Single family HH zero car % > 30%			
7	Multi-family HH zero car % > 30%			
8	Single family HH POP/permanent resident DU < 2.0 and 2+ auto % > 30%			



#	Reasonableness Check
9	Multi-family HH POP/permanent resident DU < 2.0 and 2+ auto % >
	30%
10	Single family HH POP per permanent resident DU < 1.00 or > 5.00
11	Single family HH autos per permanent resident DU < 1.00 or > 2.25
12	Multi-family HH POP per permanent resident DU < 1.00 or > 2.50
13	Multi-family HH autos per permanent resident DU < 1.00 or > 2.25
14	POP per permanent resident DU < 1.00 or > 3.50
15	Autos per permanent resident DU < 1.00 or > 2.20
16	Hotel/motel POP per occupied unit < 1.00 or > 2.50

Source: LUCHECK program

After performing these error and reasonableness checks on the zonal level household data, the modeling team investigated the zonal information of the zones that failed the tests. For reasonableness checks, any unique circumstances for such results were investigated. The results of the checks were then communicated with the MPO/TPOs for their reviews and clarifications. The MPO/TPOs reviewed the results and updated the dataset. Then the data was tested again. These communications continued till there are no errors and all the results were accepted by the parties (modeling team and the MPO/TPOs).

2.1.3 Socio-Economic Data Metrics

Additional socio-economic data metrics were inspected for reasonableness at the TAZ and county level. These are additional checks, separate from LUCHECK, to establish confidence in reasonableness of the data used for trip generation. Table 2-7 provides a list of these metrics. The county level results of these checks are presented later in this chapter, whereas any outliers at zonal level were investigated and discussed with the respective MPO/TPOs.

Table 2-7 Metrics for Household Data

	Benchmark	
Metric	Low	High
Visual inspection of population and employment and associated densities by TAZ and county	`	reasonable gment)
Regionwide persons/dwelling unit or persons/household	2.0	2.7
Regionwide employment/population ratio	0.35	0.75
Regionwide autos/dwelling unit or autos/household	1.75	2.10
Approximate population per TAZ	NA	3,000

Source: Department's Model Calibration and Validation Report



Household Data Comparisons

To further verify the ZDATA, the household data was compared with other published datasets. The data sources include Bureau of Economic and Business Research (BEBR, from the University of Florida), the United States Bureau of Economic Analysis (BEA), and 2015 American Community Survey (ACS) 2015 data. BEBR population projections are made for five year intervals, based on census survey. These projections estimate permanent residents only and do not include tourists and seasonal residents. BEA develops its forecasts by using data compiled by other federal agencies and conducting surveys to fill gaps. Its primary goal is to predict economic activity, not household data per se, so the estimates vary quite a bit compared to other sources. In the state of Florida, where seasonal residents are significant, BEA estimates tend to be higher than the actual estimates. ACS is a nationwide household survey that collects various demographic information of the household, and the survey is expanded using appropriate methods. These estimates will be closer to the actual estimates as the sampling is carefully designed.

The following sections compare the ZDATA to these datasets across five metrics at the county level. The positive sign under the columns "% change" reflects that CFRPM value is higher than the other sources and vice versa. Please note that, the Indian River County has not been considered in this comparison analysis as CFRPM 7 includes only a portion of this county.

2.1.3.1 Population

CFRPM 7 total population by county is compared with the population obtained from BEBR and BEA 2015 data. In BEBR, the total population of a geographic area is calculated as the number of occupied household unit times the average household size, plus the group quarter population and the homeless population.

Therefore, in Table 2-8 the BEBR column represents only the population obtained from *BEBR Projections Report*² published in January 2016. Also, please note that, in the following table the BEA column represents the population which includes the group quarter population. Please be aware CFRPM 7 population count does not include the group quarter population so CFRPM 7 data will usually be on the lower side to BEBR and BEA estimates.

² Rayer S, Wang Y. Projections of Florida population by county, 2020–2045, with estimates for 2016. Florida Population Studies. 2016;49:174.



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Table 2-8 Population Comparison by County

	Population			% Change (CFRPM7 –	% Change (CFRPM7 –
County	CFRPM7	BEBR	BEA	BEBR)	BEA)
Brevard	555,850	561,714	566,822	-1.0	-1.9
Flagler	101,289	101,353	104,739	-0.1	-3.3
Lake	318,365	316,569	325,699	0.6	-2.2
Marion	333,186	341,205	342,757	-2.4	-2.8
Orange	1,213,443	1,252,396	1,292,008	-3.1	-6.1
Osceola	313,899	308,327	324,189	1.8	-3.2
Polk	655,197	633,052	649,644	3.5	8.0
Seminole	449,141	442,903	449,132	1.4	0.0
Sumter	108,557	115,657	117,210	-6.1	-7.4
Volusia	503,615	510,494	517,512	-1.3	-2.7
Total	4,552,542	4,583,670	4,689,712	-0.7	-2.9

Source: CFRPM 7, BEBR, BEA

CFRPM's population estimates by county are all within 8% of the BEBR and BEA datasets, indicating that the population estimates match at county level between various sources. Generally, the BEBR and BEA population estimates are higher than CFRPM as expected except for Lake and Osceola county for BEBR while Polk and Seminole county for both BEBR and BEA. Currently, reasons for these differences are unknown. For future adjustment, user needs to be cautious about local condition that might cause these results.

2.1.3.2 Average Household Size Comparison

CFRPM average household size by county was compared to estimates from the 2015 BEBR data. In BEBR data, households are defined as housing units occupied by the permanent residents only; no seasonally-occupied or vacant unit is included in the household. So, Table 2-9 presents the comparison of permanent population per permanently occupied household unit both for CFRPM and BEBR column. Please note CFRPM population count are expected to be lower than BEBR which indicate the expectation of higher household size for CFRPM than BEBR.

Table 2-9 Average Household Size Comparison

	HH Size		% Change
County	CFRPM 7	(CFRPM7 – BE BEBR	(CFRPM7 – BEBR)
Brevard	2.43	2.34	3.8
Flagler	2.97	2.43	22.2



•	HH Size		% Change
County	CFRPM 7	BEBR	(CFRPM7 – BEBR)
Lake	2.45	2.43	0.8
Marion	2.32	2.35	-1.3
Orange	3.15	2.66	18.4
Osceola	3.53	2.95	19.7
Polk	2.76	2.61	5.7
Seminole	3.05	2.55	19.6
Sumter	2.04	2.03	0.5
Volusia	2.43	2.32	4.7

Source: CFRPM 7, BEBR

Overall, household sizes for CFRPM are 5% higher than those from the BEBR data as expected. The differences are significant in Flagler (22%), Orange (18%), Osceola (20%) and Seminole (20%) Counties, but within 10% of all the other counties. Reasons for these differences are unknown at this time. Please note these results depends on all local condition. So, user needs to be cautious about these if they needed to be adjusted in the future. Overall, these estimates are acceptable for long-range planning use.

2.1.3.3 Total Permanently Occupied DUs Comparison

CFRPM total permanently occupied DUs was compared to the ACS 2015 data for each county. In ACS data, the occupied dwelling unit is classified as occupied if a person or group of people live in it permanently, or if the occupants are only temporarily absent from the residence for two months or less for vacation or a business trip. Any unit where people are staying for two months or less, is not considered to be in the occupied units. Therefore, only the permanent DUs from CFRPM 7 ZDATA has been reported in Table 2-10; vacant or seasonally occupied dwelling units are not considered in this comparison.

Table 2-10 Total Occupied DUs Comparison

	Total Occupied DUs		% Change
County	CFRPM7	ACS	(CFRPM7 – ACS)
Brevard	229,036	222,791	3
Flagler	34,071	36,950	-8
Lake	130,103	119,251	9
Marion	143,776	132,287	9
Orange	384,983	434,319	-11



	Total Occupied DUs		% Change	
County	CFRPM7	ACS	(CFRPM7 – ACS)	
Osceola	88,927	92,338	-4	
Polk	236,916	221,381	7	
Seminole	147,345	152,260	-3	
Sumter	53,257	48,039	11	
Volusia	207,592	200,180	4	
Total	1,656,014	1,659,796	0	

Source: CFRPM 7, ACS 2015

Across the region, the difference is less than 3,500 households or 0.2% which is within the ACS margin of error of 1%. The differences between CFRPM and ACS data is less than 11% for all counties. These results are acceptable because these values lie within ACS margin of error.

2.1.3.4 Seasonally Occupied and Vacant DUs Comparison

CFRPM's seasonally occupied and vacant DUs were compared to the ACS 2015 data by county. According to the ACS variable definition, the housing unit is classified as vacant if no one is living in it, or the unit is occupied entirely by persons who are staying for two months or less and who have a more permanent residence elsewhere at the time of interview. So, CFRPM 7 column represents the sum of vacant and the seasonal DUs in Table 2-11.

Table 2-11 Seasonally Occupied and Vacant DUs Comparison

	Seasonally Occupied and Vacant DUs		% Change
County	CFRPM 7	ACS	(CFRPM7 – ACS)
Brevard	46,727	48,863	-4
Flagler	8,621	12,323	-30
Lake	22,810	26,930	-15
Marion	21,562	31,400	-31
Orange	57,440	67,194	-15
Osceola	35,845	39,847	-10
Polk	44,816	60,867	-26
Seminole	29,870	32,114	-7
Sumter	16,305	13,132	24
Volusia	39,349	55,257	-29
Total	323,345	387,927	-17

Source: CFRPM 7, ACS 2015



The ACS data reports more seasonal and occupied DUs compared to CFRPM data. Relatively, the difference between CFRPM and ACS data is less than 30%. But these differences are relatively small in magnitude: the largest difference in the above table is 16,000 DUs in Polk County. This is less than 10% of the 237,000 occupied DUs in that county Across the region, the difference is less than 65,000 households or 17% which is more than the ACS margin of error of 4%. Not enough data for seasonally and vacant DUs for ACS survey data might be the reason. So, CFRPM data is acceptable for long-range planning use.

2.1.3.5 0-car-owning Occupied DUs

CFRPM zero-car owning occupied DUs was compared with the corresponding data from the ACS 2015 data by county in Table 2-12. Both datasets consider only the occupied housing units with no auto ownership.

Table 2-12 Comparison of Occupied DUs with Zero Autos

	DUs wit	th Zero Autos	% Change
County	CFRPM7	ACS	(CFRPM7 – ACS)
Brevard	14,959	12,350	21
Flagler	2,030	1,589	28
Lake	5,989	6,517	-8
Marion	8,416	8,076	4
Orange	24,073	28,320	-15
Osceola	5,160	5,568	-7
Polk	16,748	15,058	11
Seminole	4,391	5,303	-17
Sumter	1,409	1,672	-16
Volusia	16,852	13,741	23
Total	100,029	98,194	2

Source: CFRPM 7, ACS 2015

From the above table, the differences are relatively strong – as large as 28% – but in terms of magnitude the differences are small, less than 3,000 are the county level. Across the region, the difference is less than 2,000 households or 2% which is within the ACS margin of error of 5%. The county-level variability can be excused given the statistical noise of the survey sample of the ACS data, since all counties have household numbers within ACS margin of error. Therefore, this data is acceptable for long-range planning use.



2.1.4 Employment Data Comparisons

CFRPM employment was compared with the employment data obtained from the Bureau of Labor Statistics (BLS), American Community Survey (ACS), County Business Patterns (CBP), and Bureau of Economic Analysis (BEA) 2015 sources for each county. In CFRPM, employment is estimated as the average number of employees in peak season by the place of work location.

There are many subtle but important differences between these data sources:

- BLS employment data³ is data summarized by quarterly reports by employers to the
 United States Bureau of Labor Statistics. This is supplemented by various surveys
 conducted by BLS for other purposes. This dataset covers more than 95% of jobs in the
 United States but tends to under-report self-employed individuals. So, BLS data will
 usually be on the lower side to CFRPM estimates.
- The ACS is a nationwide survey that collects worker information, including residential and employment locations⁴. These estimates tend to be closer to actual estimates as the sampling is carefully designed and includes all types of jobs. Please be aware that no available employment data in the ACS 2015 Flagler and Sumter County datasets.
- The BEA data includes full-time and part-time jobs as well as self-employed workers⁵. A worker holding down two part-time jobs would be counted twice in this dataset. CFRPM defines employment as the average number of employees in the peak season, which should always be lower than BEA's accounting.
- The project team also compared the employment data with the Woods & Poole (W&P) employment database, which is mainly derived from data from the US Department of Commerce's Bureau of Economic Analysis. W&P data is similar to BEA data. Due to disclosure agreements, the W&P data is not presented in this report.
- The U.S. Census' CBP data excludes data on self-employed individuals, employees of private households, railroad employees, agricultural production employees, and most government employees⁶. Consequently, CDP employment data tends to be lower than CFRPM estimates.

Table 2-13 presents the comparison of total employment estimated for CFRPM with BLS, ACS, CBP and BEA 2015 sources for each county. Please note there are no benchmarks to compare the total employment; the comparison itself is the reasonableness check knowing the differences in the different datasets.

⁶ https://www.census.gov/programs-surveys/cbp/data.html. Accessed August 15, 2020.



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³ https://www.bls.gov/data/#employment. Accessed August 15, 2020.

⁴ https://www.census.gov/programs-surveys/acs. Accessed August 15, 2020.

⁵ https://www.bea.gov/data/employment. Accessed August 15, 2020.

Table 2-13 Employment Comparison

		Total Employment					% Change			
County	CFRPM7 (1)	BLS (2)	ACS (3)	CBP (4)	BEA (5)	(1)- (2)	(1)- (3)	(1)- (4)	(1)- (5)	
Brevard	252,418	194,456	241,881	169,860	272,836	30	4	49	-7	
Flagler	25,805	21,175	NA	17,815	36,271	22	NA	45	-29	
Lake	129,709	89,592	129,511	77,497	132,044	45	0	67	-2	
Marion	111,501	96,719	111,085	80,011	141,954	15	0	39	-21	
Orange	809,428	762,674	655,717	678,721	997,734	6	23	19	-19	
Osceola	93,859	84,340	143,825	71,586	127,787	11	-35	31	-27	
Polk	193,464	203,802	258,761	174,572	281,016	-5	-25	11	-31	
Seminole	186,966	174,086	218,095	163,565	247,353	7	-14	14.	-24	
Sumter	30,189	26,134	NA	19,010	40,351	16	NA	59	-25	
Volusia	204,694	160,541	209,562	140,144	232,742	28	-2	46	-12	
Total	2,038,033	1,813,519	1,968,437	1,592,781	2,510,088	12	4	28	-19	

Source: CFRPM 7, BLS, ACS 2015, CBP, BEA

The comparisons are consistent with the differences in the datasets discussed above. CFRPM employment data is slightly higher than BLS and CBP data. It is generally similar to ACS data except for Orange, Osceola, Polk and Seminole Counties. For the Orange and Osceola Counties, the employment estimates from ACS might have some issues since they are either the lowest or highest in all data sources. The BEA employment data is predictably higher than CFRPM data as expected. So, CFRPM data is acceptable for long-range planning use.

The following sections will make similar comparisons by FSUTMS' standard three classifications: industrial, commercial and service.

2.1.4.1 Industrial Employment Comparison

Industrial employment includes employment in forestry, fishing and related activities, mining, quarrying and oil and gas extraction, utilities, construction and manufacturing. In this section, CFRPM industrial employment by county was compared with the industrial employment data obtained from ACS, CBP, BEA and W&P 2015 data sources for each county, and is presented in Table 2-14. The W&P data is not presented due to disclosure agreements. Please be aware that ACS employment data was not available in the 2015 Flagler and Sumter County datasets. In



addition, BLS data is not available to download for industrial employment from the BLS data finder portal⁷.

Table 2-14 Comparison of Industrial Employment

		% Change					
County	CFRPM7 (1)	ACS (3)	CBP (4)	BEA (5)	(1)-(3)	(1)-(4)	(1)- (5)
Brevard	37,354	37,283	27,897	38,994	0	34	-4
Flagler	2,174	NA	1,987	3,689	NA	9	-41
Lake	14,415	18,377	10,005	18,523	-22	44	-22
Marion	16,695	21,524	11,678	24,002	-22	43	-30
Orange	75,670	99,245	53,827	81,164	-24	41	-7
Osceola	5,637	25,824	6,704	11,071	-78	-16	-49
Polk	28,105	47,416	26,429	43,467	-41	6	-35
Seminole	27,203	30,423	19,870	28,292	-11	37	-4
Sumter	3,902	NA	3,862	7,129	NA	1	-45
Volusia	23,093	32,234	16,848	28,612	-28	37	-19
Total	234,248	312,326	179,107	284,943	-25	31	-18

Source: CFRPM 7, ACS 2015, CBP, BEA

The comparisons are consistent with the differences in the datasets discussed above. CFRPM employment data is slightly higher than the CBP data. It is generally similar to ACS data except for Orange, Osceola, and Polk Counties. The reasons for these strong differences are unknown at this time. The BEA employment data is predictably higher than CFRPM data that indicate the acceptance of CFRPM data for long-range planning use.

2.1.4.2 Commercial Employment Comparison

Wholesale and retail trade are defined as commercial employment. In this section, CFRPM commercial employment by county was compared with the corresponding employment data obtained from ACS, CBP, BEA and W&P 2015 data sources for each county, and is presented in Table 2-15. The W&P data is not presented due to disclosure agreements. Please be aware that no available employment data in the ACS 2015 Flagler and Sumter County datasets. BLS data is not available for commercial employment from the BLS data finder portal.

⁷ https://www.bls.gov/data/#employment. Accessed August 15, 2020.



Table 2-15 Commercial Employment Comparison

	Commercial Employment				% Change			
County	CFRPM7 (1)	ACS (3)	CBP (4)	BEA (5)	(1)-(3)	(1)-(4)	(1)- (5)	
Brevard	44,711	39,680	32,784	39,714	13	36	13	
Flagler	5,584	NA	4,013	4,974	NA	39	12	
Lake	25,444	18,588	16,716	21,245	37	52	20	
Marion	23,393	17,853	20,181	23,446	31	16	0	
Orange	128,935	72,482	109,277	131,333	78	18	-2	
Osceola	17,233	15,228	17,130	19,941	13	1	-14	
Polk	54,217	37,683	34,889	43,886	46	55	24	
Seminole	39,914	23,832	34,199	43,080	67	17	-7	
Sumter	5,117	NA	3,926	5,648	NA	30	-9	
Volusia	38,934	30,513	29,679	36,395	28	31	7	
Total	383,482	255,859	302,794	369,662	50	27	4	

Source: CFRPM 7, ACS 2015, CBP, BEA

The comparisons are consistent with the differences in the datasets discussed above. CFRPM employment data is slightly higher than the CBP data. It is generally similar to ACS data except for Orange, Polk and Seminole Counties. The BEA employment data is usually higher than CFRPM data, but for commercial employment it is lower. The reasons for these strong differences are unknown at this time.

2.1.4.3 Service Employment Comparison

Service employment includes employment in transportation and warehousing, information, finance and insurance, real estate, rental and leasing, professional, scientific and technical services, management of companies and enterprises, administrative services, waste management and remediation services, educational services, health care and social assistance, arts, entertainment and recreational services, accommodation and food services, government and government enterprises and other services. In this section, CFRPM service employment by county was compared with the corresponding employment data obtained from ACS, CBP, BEA and W&P 2015 data sources for each county, and is presented in Table 2-16. The W&P data is not presented due to disclosure agreements. Please be aware that ACS employment data was available in the 2015 Flagler and Sumter County datasets. BLS data is not available for service employment from the BLS data finder portal.



Table 2-16 Comparison of Service Employment

	Service Employment				% Change		
County	CFRPM7 (1)	ACS (3)	CBP (4)	BEA (5)	(1)-(3)	(1)-(4)	(1)- (5)
Brevard	170,353	164,918	109,179	194,128	3	56	-12
Flagler	18,047	NA	11,815	26,227	NA	53	-31
Lake	89,850	92,546	50,776	92,276	-3	77	-3
Marion	71,413	71,708	48,152	94,506	0	48	-24
Orange	604,823	483,990	515,617	785,237	25	17	-23
Osceola	70,989	102,773	47,752	96,775	-31	49	-27
Polk	111,142	173,662	113,254	193,663	-36	-2	-43
Seminole	119,849	163,840	109,496	175,430	-27	9	-32
Sumter	21,170	NA	11,222	25,338	NA	89	-16
Volusia	142,667	146,815	93,617	167,735	-3	52	-15
Total	1,420,303	1,400,252	1,110,880	1,851,315	1	28	-23

Source: CFRPM 7, ACS 2015, CBP, BEA

The comparisons are consistent with the differences in the datasets discussed above. CFRPM employment data is slightly higher than the CBP data. It is generally similar to ACS data except for Orange, Osceola, Polk and Seminole Counties. The reasons for these strong differences are unknown at this time. The BEA employment data is predictably higher than CFRPM data.

2.1.5 Enrollment Comparison

Table 2-17 compares the elementary, middle and high school (K-12) enrollment from the ZDATA with the ACS 2015 school enrollment by county. The ACS data, a sampled dataset and therefore not a definitive source, is the only data available that includes public, private and charter school K-12 enrollment by county.

Table 2-17 Comparison of School (K-12) Enrollment

	K-12	Enrollment	% Difference
County	CFRPM7	ACS	// Direction
Brevard	84,553	78,793	6
Flagler	15,145	14,544	4
Lake	48,608	47,095	3
Marion	47,104	47,612	-1
Orange	217,899	204,069	7
Osceola	72,466	58,368	24



	K-12	Enrollment	% Difference
County	CFRPM7	ACS	70 Difference
Polk	108,389	107,145	1
Seminole	76,387	73,195	4
Sumter	8,650	6,815	27
Volusia	70,010	68,124	3
Total	748,503	705,760	6

Source: CFRPM 7, ACS 2015

CFRPM data is higher than the ACS data in all counties. The differences are less than 10% or 10,000 students in 8 of the counties. There are significant differences in Osceola and Seminole Counties. The reasons for these significant differences are unknown at this time, but they correspond to similar differences in the employment data comparisons.

Comparisons for college enrollment are not included here because a reliable data source is not available at this time. Some enrollment data does exist, but currently it does not include both public and private university enrollment and the enrollment is not stratified by campus.

2.2 Roadway Network Data

Verifying the roadway network data is extremely important, as they are the key elements in the trip distribution and traffic assignment steps of CFRPM. Broadly speaking, the roadway network consists of:

- Nodes, elements that describe the position of intersections or shape points on roadway networks.
- Links, network model elements that connect the nodes and have attributes including direction, speed, capacity, and highway functional classification.
- Centroid Connectors connect the zones to the network. They represent the distance and time to be covered between a zone's center of gravity (the center of trip generating and attracting activity) and the model links serving that zone.

Each node and link have data fields that provide information on posted speed limits, number of lanes, free flow speeds, capacity of the roadway, tolls, turn restrictions and other descriptive information.



2.2.1 Posted Speed Limits

The project team reviewed the posted speed limits for accuracy. The team obtained the Roadway Characteristics Inventory (RCI) Geographic Information Systems (GIS) file with posted speed limits from FDOT Central Office. Other roadway files related to posted speed limits were collected from FDOT's GIS online database and other resources including Navteq data, Highway Performance Monitoring System (HPMS) data, Bing and Waze.

The project team reviewed the posted speeds – specifically the POST_SPEED data field – slightly differently for SHS (State Highway System) and Off SHS roadways because speed information is readily-available in GIS for SHS roadways.

For SHS roadways, the posted speed limits in CFRPM network were compared the corresponding data in the Transportation Data and Analytics (TDA) RCI file. If they did not agree, the network was changed to reflect the TDA value.

For Off-SHS roadways, the network posted speeds were compared against corresponding data from a variety of sources, including posted speed signs in Google Maps' Street View, NavTeq data, Bing maps and Waze. If the network speed did not agree with the sources, the best representative posted speed from all the sources was used to update the network values. Table 2-18 presents the number of updated segments of posted speed limits by county.

Table 2-18 Posted Speed Adjustments Summary

County	Number of Segments	Number of Adjusted Segments	Percentage of Adjusted Segments
Brevard	8,937	319	4%
Flagler	1,732	0	0%
Indian river	943	0	0%
Lake	5,864	309	5%
Marion	7,358	295	4%
Orange	16,430	503	3%
Osceola	4,255	205	5%
Polk	9,806	1,486	15%
Seminole	5,361	304	6%
Sumter	2,117	84	4%
Volusia	10,094	0	0%
Total	72,897	3,505	5%

Source: CFRPM 7



2.2.2 Estimated Free-Flow Speeds

Travel models require estimates of free-flow speeds; that is, the speeds that occur during daylight hours with minimal traffic congestion. Free-flow speeds are typically higher than posted speed limits on limited-access roadways, and lower than posted speeds on arterials and signalized roadways. Equations to estimate free-flow speeds⁸ were developed using the observed free-flow speed data (using speeds observed on Sundays between 7 and 8 AM). These equations are applied at an aggregate level. Then, the resulting free-flow speeds were compared for each link to the observed free-flow speed data.

To simplify the comparison, a ratio of estimated to observed free-flow speed was computed on the 20,130 links with observed free-flow speeds. A ratio of 1.0 means the estimated and observed values match exactly. Ratios less than 1.0 indicate the estimated speed is less than the observed speed. Ratios greater than 1.0 indicate the estimated speed is greater than the observed speed. The ratio was reviewed by county, facility type and both county and facility type. Table 2-19 presents the comparison between estimated free flow speed and observed free flow speeds.

Table 2-19 Estimated/Observed Free Flow Speed by County

	Percentag	Number of		
County	< 0.9 (less than -10%)	Between 0.9-1.1 (within 10%)	> 1.1 (greater than 10%)	Links
Brevard	12.7	73.0	14.3	3,487
Flagler	15.2	69.1	15.7	362
Indian River	23.3	65.4	11.3	335
Lake	22.7	74.0	3.3	1,157
Marion	15.8	73.6	10.6	1,857
Orange	8.4	60.9	30.6	4,274
Osceola	11.8	65.8	22.5	842
Polk	26.5	53.7	19.7	3,321
Seminole	7.3	77.8	14.9	1,252
Sumter	33.5	64.6	1.9	418
Volusia	16.5	67.8	15.7	2,825
Region	15.7	66.2	18.0	20,130

Source: CFRPM 7

⁸ Please see Section 3.1.6.3 of *CFRPM 7 Model Description Report* for more details



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Regionally, almost two-thirds of all links are within 10% of the observed values, with the remaining links evenly divided between differences of less than -10% and greater than +10%.

Table 2-20 presents the comparison between estimated free flow speed and observed free flow speeds by facility type.

Table 2-20 Estimated/Observed Free Flow Speed by Facility Type

Facility Type	Facility Type	Percen Estin Obs	Total No. of		
Code		< 0.9	Between 0.9-1.1	> 1.1	Links
11	Freeway Non-Toll	13.2	84.5	2.3	523
21	Divided Arterial Unsignalized (Speed 55 & above mph)	11.5	74.1	14.4	1,090
22	Divided Arterial Unsignalized (Speed 45 & 50 mph)	26.4	55.7	17.9	106
23	Divided Arterial Class I	11.6	66.4	22.0	5,227
24	Divided Arterial Class II	11.3	71.5	17.1	3,138
31	Undivided Arterial Unsignalized with Turn Bays	18.7	73.3	8.0	573
32	Undivided Arterial Class I with Turn Bays	16.0	65.5	18.5	2,643
33	Undivided Arterial Class II with Turn Bays	19.2	62.0	18.8	1,690
34	Undivided Arterial Class III/IV with Turn Bays	9.4	76.9	13.8	320
35	Undivided Arterial Unsignalized without Turn Bays	16.2	83.8	0.0	74
36	Undivided Arterial Class I without Turn Bays	0.0	100.0	0.0	8
37	Undivided Arterial Class II without Turn Bays	50.0	50.0	0.0	6
38	Undivided Arterial Class III/IV without Turn Bays	100.0	0.0	0.0	1
41	Major Local Divided Roadway	18.5	66.8	14.8	298
42	Major Local Undivided Roadway with Turn Bays	18.2	61.1	20.7	1,708
43	Major Local Undivided Roadway without Turn Bays	28.3	62.7	9.1	431
44	Other Local Divided Roadway	33.3	7.4	59.3	27
45	Other Local Undivided Roadway with Turn Bays	27.7	63.1	9.2	130
46	Other Local Undivided Roadway without Turn Bays	19.5	68.3	12.2	82
47	Low Speed Collector	33.7	44.8	21.5	1,085
52	External Station Connector	35.0	65.0	0.0	20



All	All Facility Type	15.8	66.3	18.0	20,130
98	Toll Off Ramp	68.8	31.3	0.0	16
97	Toll On Ramp	70.6	23.5	5.9	17
92	Toll Facility - Arterial	0.0	31.3	68.8	16
91	Toll Facility - Freeway	1.2	91.6	7.3	510
76	Freeway-Collector/Distributor Ramp	71.4	21.4	7.1	14
75	Freeway-to-Freeway Ramp-System Interchange	28.6	61.4	10.0	70
74	Other On/Off Loop Ramp-Urban Interchange	50.0	50.0	0.0	2
73	Other On/Off Ramp-Urban Interchange	42.9	35.7	21.4	14
72	Freeway On/Off Loop Ramp-Service Interchange	41.7	8.3	50.0	24
71	Freeway On/Off Ramp-Service Interchange	59.2	23.7	17.1	76
68	Frontage Road Class III/IV	100.0	0.0	0.0	2
64	One-Way Facilities Class III/IV	0.0	27.6	72.4	58
63	One-Way Facilities Class II	33.3	57.7	9.0	78
62	One-Way Facilities Class I	34.0	56.6	9.4	53

Source: CFRPM 7

Appendix C presents the comparison of estimated and observed free flow speed by county and facility type.

There is significant variation in the results by facility type. One reason for this variation is that the estimated free-flow speed equations were developed at an aggregate level, using only 7 facility types (freeways [both toll and non-toll], unsignalized arterials, Class I arterials, Class II/III/IV arterials, local roads, freeway and other on/off ramps, and freeway-to-freeway and freeway-collector/distributor ramps) due to significant noise in the observed dataset. When comparing the results across 35 facility types, variation is to be expected. Another reason is that, due to schedule constraints, the free-flow speed equations had to be developed before the roadway posted speeds could be verified.

Since this is the first time that estimated free-flow speeds are being validated for CFRPM, it is difficult to fairly evaluate these results. The significant noise in the observed dataset, which appears even at the county level, implies that a modest level of accuracy is to be expected. The estimated speeds are very accurate for limited-access facilities, less so for arterials and not accurate for ramps. The observed data for ramp speeds was particularly noisy, so the inaccurate results are expected.

Generally, the project team concludes that the estimated free-flow speeds, at a regional level, are reasonable for long-range planning use. In subsequent updates, the observed free-flow speed data



 especially for ramps – should be reviewed thoroughly before use and updates to the equations should be made after posted speeds are verified.

2.2.3 Number of Lanes

The project team reviewed and updated the number of lanes, using the similar methods used to revise the posted speed limits presented in 2.2.1. The project team reviewed the NUM_LANES data field differently for SHS (State Highway System) and Off SHS roadways because the information is readily-available in GIS for SHS roadways.

For SHS roadways, the number of lanes in CFRPM network were compared the corresponding data in the HPMS and the Transportation Data and Analytics (TDA) RCI file. If they did not agree, the network was updated based on aerial imagery.

For Off-SHS roadways, the network was compared against corresponding data from a variety of sources, including aerial imagery from Google Maps, HPMS data, NavTeq data, Bing maps and Waze. If the number of lanes did not agree, the network was updated based on aerial imagery.

Table 2-21 presents the number of updated segments with number of segments by county.

Table 2-21 QC Segments with the Updated Number of Lanes by County

County	Number of Segments	Number of Adjusted Segments	Length in Miles
Brevard	8,937	71	0.8%
Flagler	1,732	0	0.0%
Indian river	943	0	0.0%
Lake	5,864	25	0.4%
Marion	7,358	8	0.1%
Orange	1,6430	165	1.0%
Osceola	4,255	20	0.5%
Polk	9,806	36	0.4%
Seminole	5,361	33	0.6%
Sumter	2,117	6	0.3%
Volusia	10,094	0	0.0%
Total	72,897	364	0.5%

Source: CFRPM 7

Only a modest number of adjustments were made, indicating the original data was highly accurate.



2.2.4 Visual Inspections

Many of the other aspects of the roadway network are best verified through visual inspection. The project team manually reviewed the following information throughout the development of CFRPM: area types, facility types, and turn prohibitors.

Figure 2-1 to Figure 2-4 present the final figures with these visualizations. Area type and facility type codes are shown in Table 2-22 and Table 2-23.

Table 2-22 Area Type

Area Type Code	Area Type
11	Urbanized area (500,000+) primary city CBD
12	Urbanized area (<500,000) primary city CBD
13	Other urbanized area CBD & small city downtown
14	Non-urbanized area small city downtown
21	All CBD fringe areas
31	Residential area of urbanized areas
32	Undeveloped portions of urbanized areas
33	Transitioning areas/urban areas over 5,000 population
34	Beach residential
41	High density outlying business district (OBD)
42	Other OBD
43	Beach OBD
51	Developed rural areas/small cities <5,000 population
52	Undeveloped rural areas

Source: CFRPM 7

Table 2-23 Facility Type

Facility Type Code	Facility Type
10-19	Freeway Non-Toll
20-29	Divided Arterial
30-39	Undivided Arterial
40-49	Local Roadway
50-59	Centroid Connector
60-69	One-Way Facilities



70-79	Ramp-Service Interchange
90-99	Toll Facility

Source: CFRPM 7



Figure 2-1 CFRPM Area Types

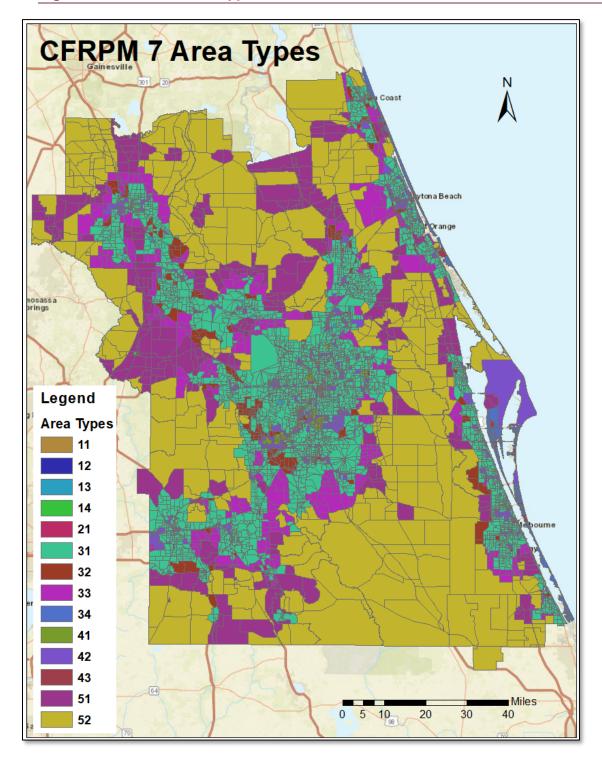




Figure 2-2 CFRPM Facility Types

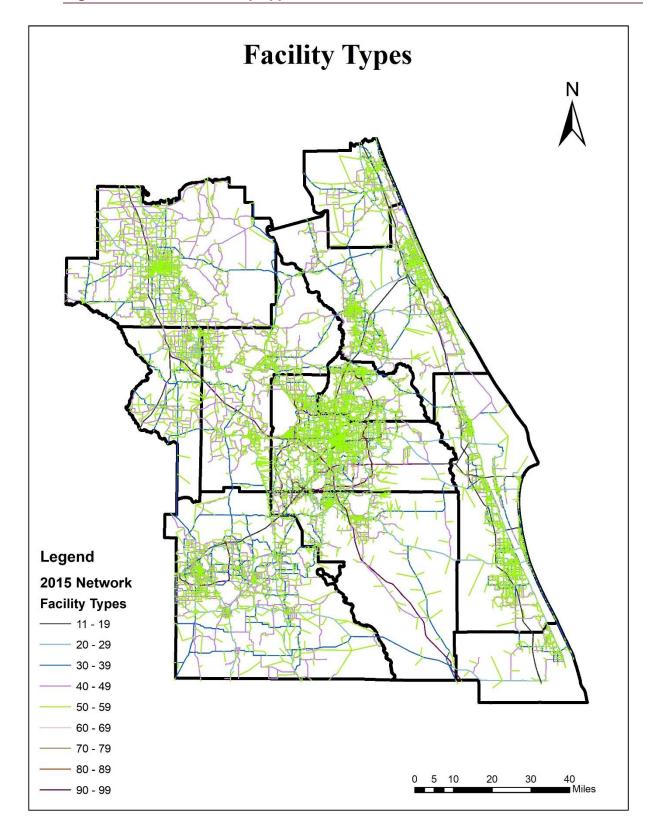




Figure 2-3 CFRPM Number of Lanes

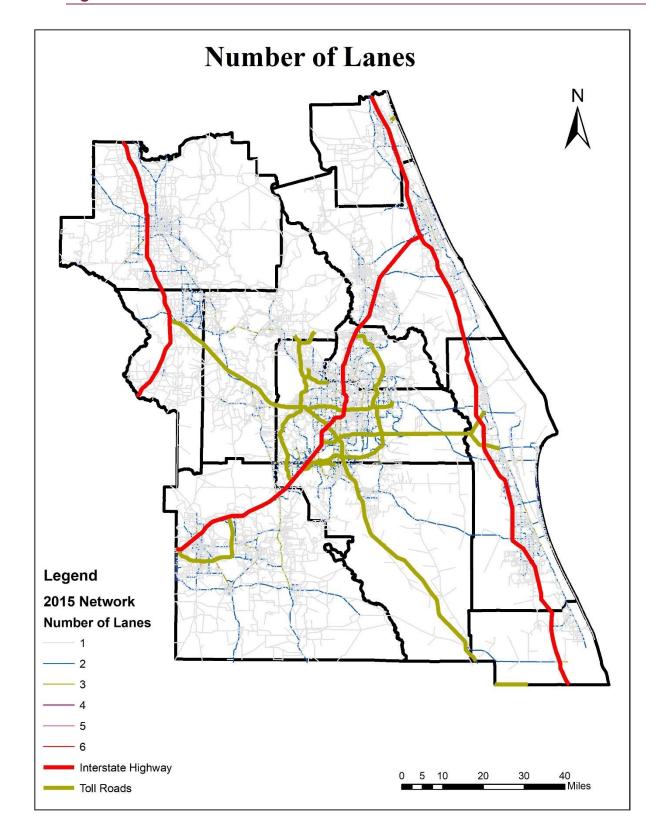
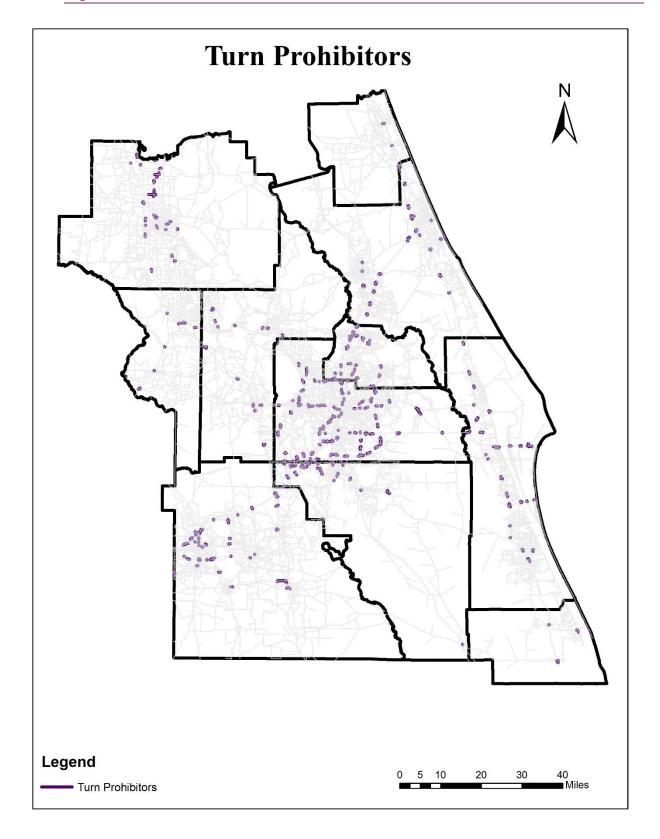




Figure 2-4 Turn Prohibitors





2.2.5 Centerline Miles

It is very important to compare the newly-developed network with an independent data source to validate the fact that CFRPM 7 represents a sufficient amount of the roads by facility type within each county. To validate the coverage, a centerline miles comparison between CFRPM 7 and an independent source, 2015 Road Mileage and Travel (DVMT) report, was prepared. The centerline miles in Table 2-24 are taken from the 2015 Road Mileage and Travel (DVMT) Report. The comparison of centerline miles from the DVMT report and CFRPM 7 are presented in Table 2-26 while Table 2-26 presents the percentage change of these comparison. Please note percent change or percent Delta is defined by the relative difference between CFRPM 7 with DVMT report values. CFRPM 7 has accurate coverage of centerline miles for major road categories including inter-state/freeway/turnpike, principal/divided arterials, and minor/undivided arterials. CFRPM 7 has just 28% of all local roadways in the region. The reason behind this is the lowest level of geography considered in CFRPM 7 is the traffic analysis zone (TAZ). Individual local roads that begin and end within a TAZ cannot be modeled. These local roads are represented as centroid connectors within CFRPM 7 highway network, but centroid connectors will have substantially lower number of centerline miles.

Table 2-24 Centerline Miles from 2015 DVMT Report

Centerline Miles	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
Brevard	98	244	160	318	2,727	3,548
Flagler	19	61	62	107	736	986
Lake	24	139	74	478	1,640	2,355
Marion	38	183	131	595	3,030	3,977
Orange	178	195	287	588	3,363	4,610
Osceola	78	165	84	223	975	1,526
Polk	56	244	141	568	3,407	4,416
Seminole	32	89	73	175	1,264	1,633
Sumter	40	60	62	175	712	1,048
Volusia	74	266	146	422	2,492	3,400
Total	636	1,647	1,220	3,649	20,346	27,498

Source: 2015 DVMT Report

Table 2-25 Centerline Miles from CFRPM 7

Centerline Miles	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
Brevard	101	222	166	363	577	1,429
Flagler	19	42	75	133	223	492



Centerline Miles	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
Lake	24	101	127	525	585	1,362
Marion	38	170	149	787	768	1,912
Orange	188	446	122	626	950	2,332
Osceola	86	119	124	280	392	1,001
Polk	56	264	370	760	834	2,284
Seminole	33	121	45	252	362	813
Sumter	40	53	99	186	262	640
Volusia	73	225	185	559	645	1,687
Total	658	1,763	1,462	4,471	5,598	13,952

Source: CFRPM 7

Table 2-26 Centerline Miles Delta Between DVMT and CFRPM 7

Centerline Miles	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
Brevard	3	(22)	6	45	(2,150)	(2,119)
Flagler	0	(19)	13	26	(513)	(494)
Lake	0	(38)	53	47	(1,055)	(993)
Marion	(0)	(13)	18	192	(2,262)	(2,065)
Orange	10	251	(165)	38	(2,413)	(2,278)
Osceola	8	(46)	40	57	(583)	(525)
Polk	(0)	20	229	192	(2,573)	(2,132)
Seminole	1	32	(28)	77	(902)	(820)
Sumter	0	(7)	37	11	(450)	(408)
Volusia	(1)	(41)	39	137	(1,847)	(1,713)
Total	22	116	242	822	(14,748)	(13,546)

Source: CFRPM 7, 2015 DVMT Report

Table 2-27 Centerline Miles %Delta Between DVMT and CFRPM 7

Centerline Miles	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
Brevard	3%	-9%	4%	14%	-79%	-60%
Flagler	0%	-31%	21%	24%	-70%	-50%
Lake	0%	-27%	72%	10%	-64%	-42%
Marion	0%	-7%	14%	32%	-75%	-52%
Orange	6%	129%	-57%	6%	-72%	-49%
Osceola	10%	-28%	48%	26%	-60%	-34%



Polk	0%	8%	162%	34%	-76%	-48%
Seminole	3%	36%	-38%	44%	-71%	-50%
Sumter	0%	-12%	60%	6%	-63%	-39%
Volusia	-1%	-15%	27%	32%	-74%	-50%
Total	3%	7%	20%	23%	-72%	-49%

Source: CFRPM 7, 2015 DVMT Report



3 Trip Generation

This chapter summarizes CFRPM 7 trip generation validation results. CFRPM 7 trip generation results were compared to both nationally accepted benchmarks and CFRPM 6.2 trip generation outputs.

The trip generation benchmarks were developed from the Department's *Model Calibration and Validation Standards Report* produced in 2008. They were based on a variety of national sources, including Census data, household travel surveys, NHTS tabulations, and Federal and State guidelines on modeling practice. The trip generation benchmarks were mainly based on historical demographic and socio-economic trends and well-recognized in the social science fields. It is important that these benchmarks are general guideline and any value out of these ranges do not necessarily indicate any potential error in the model.

Table 3-1 Trip Generation Benchmarks (applied to each county)

Metric		Benchmark
Metric	Low	High
Relative comparison of trip rates by county	None ((reasonableness and logic check)
Person trips per TAZ	n/a	15,000
Person trips per person	3.3	4.0
Person trips per dwelling unit or household	8.0	10.0
HBW person trips/employee	1.20	1.55
Relative difference between unbalanced attractions to productions (all purposes)	0-10%	50% under certain conditions
Percent of HBW trips relative to all other trips	12%	24%
Percent of HBSH trips relative to all other trips	10%	20%
Percent of HBSR trips relative to all other trips	9%	12%
Percent of HBSC trips relative to all other trips	5%	8%
Percent of HBO trips relative to all other trips	14%	28%
Percent of HBNW trips relative to all other trips	45%	60%
Percent of NHB trips relative to all other trips	20%	33%
Percent of EE trips relative to all other trips	4%	21%

Source: Florida Department of Transportation. *Model Calibration and Validation Standards*. 2008.

Comparisons between CFRPM 6.2 and CFRPM 7 trip generation outputs are also presented. The aim of this comparison exercise is to identify potential methodological differences or errors in CFRPM 7 trip generation outputs. For example, CFRPM 7 used the new 2017 NHTS survey data for updated production and attraction rates. The comparison may provide insights on the reasonableness of CFRPM 7 rates.



3.1 Trip Rate Level Comparison

Trip generation estimates the magnitude of person trips for each TAZ. It is derived based on the socio-economic land use data and travel rates. Travel generation is computed in terms of **productions**, the number of trips being "created" by a TAZ, and **attractions**, the number of trips enticed to a TAZ.

The trip generation benchmarks compare the trip rates with ranges experienced in other models around the country. CFRPM 7 results should fall within these ranges. Should the results fall outside these ranges, it may not necessarily mean there was an error or technical issue. There may be localized reasons that justify the results. For example, retirement communities usually produce less work trips than other areas. Counties comprised of significant retirement communities can expect to have a lower amount of work trips compared to other models around the country.

Trip rates were examined across a variety of categories and the relative proportion of different trip purposes. The trip production and attraction rates by different socio-economic category are described in Section 4.2 and Section 4.3, respectively, in CFRPM 7 *Model Description Report*. This section contains the comparison of trip generation benchmarks in Table 3-1 with the trip generation results from CFRPM 6.2 and CFRPM 7. Please note the purpose of this comparison exercise is to check the compatibility between CFRPM 6.2 and CFRPM 7 trip generation outputs to find and analyze any inconsistencies. The values obtained from both models were compared against these benchmark ranges. The tables in the following sections are color-coded in such a way to identify which counties in CFRPM 6.2 and CFRPM 7 meet the standard and the paragraph following each table describes how well CFRPM 7 performs against the benchmark. Please note percent change or percent Delta⁹ is defined by the relative difference between CFRPM 7 and CFRPM 6.2 values.

3.1.1 Person Trips Per Person By County

The following table shows the person trips per person by the counties. This value was obtained by dividing the total number of trips produced in a county (i.e. HBW, HBSH, HBSR, HBSC, HBCU, HBO, and NHB) by the total population of that county. The values from this analysis indicate how many trips a person generally takes daily by the county. The trip generation benchmarks show that a person is expected to take **3.3 to 4.0** person trips daily.

 $^{^{9}}$ %Delta = $\frac{CFRPM 7 - CFRPM 6.2}{CFRPM 6.2} * 100\%$



Table 3-2 Person Trips Per Person By County

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	2.51	3.63	1.12	44%
Flagler	2.26	3.10	0.84	37%
Indian River	2.68	3.22	0.54	20%
Lake	2.52	3.51	0.99	39%
Marion	2.39	3.36	0.97	41%
Orange	3.50	3.25	-0.26	-7%
Osceola	3.00	3.65	0.64	21%
Polk	2.02	3.15	1.13	56%
Seminole	2.96	3.41	0.46	15%
Sumter	2.13	3.47	1.35	63%
Volusia	2.62	3.50	0.88	34%
Region	2.77	3.38	0.61	22%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN UBPANDA DBF', CFRPM 7 'PANDA.DBF'

Person trip rates per person for seven of 11 counties in CFRPM 7 meet the trip generation benchmarks. For the remaining four of 11 counties, person trip rates per person in CFRPM 7 are within 10% of the lower bound (3.3 person trips daily). The 2015 overall regional trip rate (person trips per household) in CFRPM 7 is 3.38, which matches well with the trip generation benchmarks of 3.3 to 4.0 person trips daily. The comparisons made in Table 3-2 show that the person trip rates per person are consistent with the trip generation benchmarks.

3.1.2 Person Trips Per Occupied Dwelling Unit By County

This analysis depicts the average person trips generated per occupied dwelling units (DU) by county and the overall person trip generation pattern per occupied DU. The table below represents the average number of person trips generated per occupied dwelling unit (DU) by county. The total number of trips includes HBW, HBSH, HBSR, HBSC, HBCU, HBO, and NHB trips and the occupied DU refers to the living unit where family lives.

The trip generation benchmarks suggest that an occupied DU is expected to generate **8.0 to 10.0** person trips per day.

Table 3-3 Person Trips Per Occupied Dwelling Unit By County

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	5.37	7.72	2.35	44%
Flagler	5.44	8.14	2.70	50%
Indian River	6.10	7.90	1.80	30%



County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Lake	5.69	7.70	2.01	35%
Marion	5.14	7.44	2.30	45%
Orange	8.68	9.79	1.11	13%
Osceola	7.63	9.95	2.32	30%
Polk	4.86	8.13	3.27	67%
Seminole	7.15	10.15	3.00	42%
Sumter	3.99	5.61	1.62	41%
Volusia	5.41	7.68	2.27	42%
Region	6.39	8.48	2.09	33%

*Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN_UBPANDA DBF', CFRPM 7 'PANDA.DBF'

Person trip rates per occupied DU for four of 11 counties in CFRPM 7 meet the trip generation benchmarks of 8.0 to 10.0. For the other five of 11 counties, person trip rates per occupied DU in CFRPM 7 are within 10% of the lower bound (8 person trips daily per occupied DU). The low rate in Sumter County may be due to the small household size (2.04 persons per household in Sumter County) in Sumter County. The rate in Seminole County is within 10% of the upper bound probably due to the local travel behavior. The regional person trips per occupied DU is 8.48 in CFRPM 7, which matches well with the trip generation benchmark. The comparisons made in Table 3-3 show that the person trip rates per occupied DU from CFRPM 7 are generally consistent with the benchmarks.

3.1.3 HBW Attractions Per Job

The HBW trips per job metric measure the number of HBW person trips generated by each job. Typically, this value is between 1.20 and 1.55, meaning that 100 jobs generate on average between 120 and 155 HBW person trips. The following table demonstrates the number of Home Based Work (HBW) attractions per job in each county. The job includes industrial, commercial, and service employment categories. This table evaluates how the HBW attractions behave in the mixture of industrial, commercial, and service employment categories. The value of HBW attractions per job is expected to stay between **1.20 to 1.55** based on the trip generation benchmarks. The last row of the table contains the regional level information. HBW attractions per job for all counties in CFRPM 7 meet the trip generation benchmarks. The comparisons made in Table 3-4 show that the HBW attractions per job from CFRPM 7 are consistent with the benchmarks.



Table 3-4 HBW Attractions Per Job By County

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	1.11	1.33	0.22	20%
Flagler	1.78	1.34	-0.44	-25%
Indian River	1.19	1.42	0.23	19%
Lake	1.07	1.33	0.26	24%
Marion	1.12	1.35	0.23	21%
Orange	0.73	1.31	0.58	79%
Osceola	1.49	1.32	-0.17	-11%
Polk	0.96	1.38	0.42	44%
Seminole	0.94	1.35	0.41	44%
Sumter	1.02	1.32	0.30	29%
Volusia	1.16	1.33	0.17	15%
Region	0.96	1.33	0.37	39%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN UBPANDA DBF', CFRPM 7 'PANDA.DBF'

3.1.4 Relative Difference of Unbalanced Attractions to Productions

Travel demand models balance the total number of home-based trip attractions to the total number of home-based productions by each purpose. It is valuable to review the ratio between unbalanced attractions and productions. A large difference might indicate problems with population or employment estimates, and production and attraction calculations. The table below depicts the relative difference between unbalanced attractions to productions by each trip purpose in the entire region. The attractions and productions were estimated based on different perspectives. For example, employment opportunities, including industry, retail or office activities, generally influence attractions. On the other hand, productions are influenced by mainly socio-demographic factors (household size, number of autos per HH, etc.). Therefore, this comparison analysis was done to evaluate the consistency between the attractions and productions in the region. The relative difference was calculated by dividing the difference between unbalanced productions and attractions by the productions and taking the absolute value. The relative difference between unbalanced attractions to productions is expected to stay between 5% to 50% based on the trip generation benchmarks.

Table 3-5 Relative Difference Between Attractions (A) to Productions (P)

Trip Purpose	Production (P)	Attraction (A)	Ratio (A/P)	Delta P-A	Relative Difference*
HBW	2,731,123	2,328,505	0.85	402,618	15%
HBSH	2,176,458	5,092,743	2.34	2,916,285	134%
HBSR	1,764,257	2,762,253	1.57	994,996	57%
HBO	3,865,873	5,224,071	1.35	1,358,198	35%



Trip Purpose	Production (P)	Attraction (A)	Ratio (A/P)	Delta P-A	Relative Difference*
HBSC	1,148,096	1,002,071	0.87	146,025	13%
HBCU	113,215	185,491	1.64	72,276	64%
NHB	3,988,397	4,535,476	1.14	547,079	14%
Total	15,787,419	21,130,612	1.34	5,343,193	34%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 7 'PANDA.DBF'

The relative difference between unbalanced attractions to productions for four of the seven trip purposes meets the trip generation benchmarks. For HBSH trips, the high relative difference value is the result of the attractions being run twice for HBSH trips: once for permanent residents and again for seasonal residents. The trip attraction equations do not have distinct variables for permanent and seasonal residents, so the process must be run twice which more than doubles the HBSH relative difference.

3.1.5 Percent of HBW Trips Relative to All Other Trips

The percent trips by purpose is a way to measure whether some trip production or attraction purposes are disproportionate when compared to other similar models. A Home Based Work (HBW) trip is that either the origin or destination of the trip is at the home or work location. The following table presents the percentage of HBW trips in each county. This value was calculated as HBW trips divided by the total number of trips (i.e., the sum of HBW, HBSH, HBSR, HBSC, HBCU, HBO, and NHB). The percentage of HBW trips produced in a county can be used to understand the overall HBW travel pattern and economic activity. The value of the percentage of HBW trips relative to all other trips is expected to be between 12% and 24% based on the trip generation benchmarks.

The comparisons made in Table 3-6 show that percentages of HBW trips relative to all other trips for 10 of 11 counties in CFRPM 7 meet the trip generation benchmarks. The low value in Sumter County may be due to an exceptionally large retirement community in the county.

Table 3-6 Percent of HBW Trips Realtive to All Other Trips

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	18.93	17.82	-1.17	-6%
Flagler	18.83	16.37	-2.46	-13%
Indian River	18.73	18.05	-0.68	-4%
Lake	17.08	18.04	0.96	6%
Marion	18.06	16.85	-1.21	-7%
Orange	14.59	17.05	2.46	17%



County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Osceola	16.97	19.87	2.90	17%
Polk	20.52	17.75	-2.77	-14%
Seminole	17.92	20.86	2.94	16%
Sumter	15.66	10.22	-5.44	-35%
Volusia	17.90	16.06	-1.84	-10%
Region	17.06	17.59	0.53	0%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN_UBPANDA DBF', CFRPM 7 'PANDA.DBF'

3.1.6 Percent of HBSH Trips Relative to All Other Trips

A Home Based Shopping (HBSH) trip is that either the origin or destination of the trip is at the home or shop location. The following table presents the percentage of HBSH trips in each county. This value was calculated as HBSH trips divided by the total number of trips. The percentage of HBSH trips produced in a county can be used to understand the overall HBSH travel pattern and economic activity. The value of the percentage of HBSH trips relative to all other trips is expected to stay between 10% to 20% based on the trip generation benchmarks.

The comparisons made in Table 3-7 show that the percentages of HBSH trips relative to all other trips are all within the benchmarks.

Table 3-7 Percent of HBSH Trips Realtive to All Other Trips

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	11.02	14.17	3.15	29%
Flagler	13.67	14.36	0.69	5%
Indian River	11.79	14.02	2.23	19%
Lake	11.54	14.09	2.55	22%
Marion	11.56	14.35	2.79	24%
Orange	12.10	13.98	1.88	16%
Osceola	12.31	13.29	0.98	8%
Polk	13.47	13.77	0.30	2%
Seminole	9.85	12.79	2.94	30%
Sumter	13.48	17.39	3.91	29%
Volusia	10.72	14.72	4.00	37777%
Region	11.75	14.02	2.27	0%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN UBPANDA DBF', CFRPM 7 'PANDA.DBF'



3.1.7 Percent of HBSR Trips Relative to All Other Trips

A Home Based Social Recreational (HBSR) trip is that either the origin or destination of the trip is at the home or social/recreation location. The following table presents the percentage of HBSR trips in each county. This value was calculated as HBSR trips divided by the total number of trips. The value of the percentage of HBSR trips relative to all other trips is expected to stay between **9% to 12%** based on the trip generation benchmarks.

The comparisons made in Table 3-8 show that percentages of HBSR trips relative to all other trips meet the trip generation benchmark for 10 of the 11 counties. The high value in Sumter County may be due to its large number of households with retirees.

Table 3-8 Percent of HBSR Trips Realtive to All Other Trips

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	6.77	10.43	3.66	54%
Flagler	10.20	11.08	0.88	9%
Indian River	8.84	10.78	1.94	22%
Lake	9.04	10.66	1.62	18%
Marion	8.10	11.09	2.99	37%
Orange	8.77	10.68	1.91	22%
Osceola	16.83	10.45	-6.38	-38%
Polk	10.73	10.44	-0.29	-3%
Seminole	7.84	9.68	1.84	23%
Sumter	8.62	12.89	4.27	50%
Volusia	11.57	11.77	0.20	2%
Region	9.58	10.71	1.13	0%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN_UBPANDA DBF', CFRPM 7 'PANDA.DBF'

3.1.8 Percent of HBSC Trips Relative to All Other Trips

A Home Based School (HBSC) trip is that either the origin or destination of the trip is at the home or school location. The following table presents the percentage of HBSC trips in each county. The school trips were generated based on the school enrollment from kindergarten to 12th grade. This percentage value was calculated as HBSC trips divided by the total number of trips. The value of the percentage of HBSC trips relative to all other trips is expected to stay between 5% to 8% based on the trip generation benchmarks.

CFRPM 6.2 did not estimate any HBSC trips. According to Table 3-9, the percentages of HBSC trips meet the trip generation benchmark for eight of 11 counties. The low value in Sumter County may be due to a large proportion of retired households. The two other counties are within



10% of the upper bound (8.4% for Osceola and 8.01% for Seminole). Overall, the percentages of HBSR trips are consistent with the benchmark.

Table 3-9 Percent of HBSC Trips Realtive to All Other Trips

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	0	5.51	5.51	Inf
Flagler	0	6.39	6.39	Inf
Indian River	0	6.26	6.26	Inf
Lake	0	5.78	5.78	Inf
Marion	0	5.58	5.58	Inf
Orange	0	7.34	7.34	Inf
Osceola	0	8.40	8.40	Inf
Polk	0	7.01	7.01	Inf
Seminole	0	6.61	6.61	Inf
Sumter	0	3.04	3.04	Inf
Volusia	0	5.27	5.27	Inf
Region	0	6.45	6.45	Inf

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN_UBPANDA DBF', CFRPM 7 'PANDA.DBF'

3.1.9 Percent of HBO Trips Relative to All Other Trips

A Home Based Social Other (HBO) trip is that either the origin or destination of the trip is at the home or the other location not shown in other home based trip purposes. The following table presents the HBO trips in each county. This value was calculated as HBO trips divided by the total number of trips. The value of the percentage of HBO trips relative to all other trips is expected to be between 14% to 28%.

The comparisons made in Table 3-10 show that percentages of HBO trips meet the benchmark for 10 of 11 counties. Again, the high value in Sumter County may be due to a large proportion of retirement households.

Table 3-10 Percent of HBO Trips Realtive to All Other Trips

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	29.26	26.60	-2.66	-9%
Flagler	33.89	25.98	-7.91	-23%
Indian River	30.49	23.88	-6.61	-22%
Lake	30.01	24.96	-5.05	-17%
Marion	30.29	24.95	-5.34	-18%
Orange	25.03	27.31	2.28	9%
Osceola	29.78	27.24	-2.54	-9%
Polk	37.39	24.53	-12.86	-34%



County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Seminole	26.60	23.04	-3.56	-13%
Sumter	32.35	32.31	-0.04	0%
Volusia	27.05	26.87	-0.18	-1%
Region	28.51	26.1	-2.41	0%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN_UBPANDA DBF', CFRPM 7 'PANDA.DBF'

3.1.10 Percent of HBNW Trips Relative to All Other Trips

A Home Based Non-Work (HBNW) trip is that either the origin or destination of the trip is at the home or non-work location. The following table presents the percentage of HBNW trips in each county. The HBNW value includes HBSH, HBSR, HBSC, HBCU and HBO trips. This value was calculated as HBNW trips divided by the total number of trips. The value of the percentage of HBO trips relative to all other trips is expected to stay between **45% to 60%** based on the trip generation benchmarks.

The comparisons made in Table 3-11 show that percentages of HBNW trips relative meet the benchmark for 10 of 11 counties. Again, the high value in Sumter County may be due to a large proportion of retired households.

Table 3-11 Percent of HBNW Trips Realtive to All Other Trips

County	CFRPM 6.2*	CFRPM 7*	Delta	% Change
Brevard	47.05	56.72	9.67	20%
Flagler	57.76	57.81	0.05	0%
Indian River	51.12	54.94	3.82	7%
Lake	50.60	55.49	4.89	10%
Marion	49.96	55.96	6.00	12%
Orange	45.90	59.31	13.41	29%
Osceola	58.92	59.38	0.46	1%
Polk	61.59	55.75	-5.84	-9%
Seminole	44.29	52.12	7.83	18%
Sumter	54.45	65.64	11.19	21%
Volusia	49.33	58.62	9.29	19%
Region	49.84	57.28	7.44	0%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN_UBPANDA DBF', CFRPM 7 'PANDA.DBF'

3.1.11 Percent of NHB Trips Relative to All Other Trips

A Non-Home Based (NHB) trip is that either the origin or destination of the trip is both at non home location. The following table presents the percentage of NHB trips in each county. This



value was calculated as NHB trips divided by the total number of trips. The value of the percentage of NHB trips relative to all other trips is expected to stay between 20% to 30% based on the trip generation benchmarks.

The comparisons made in Table 3-12 show that percentages of NHB trips meet the trip generation benchmarks for all counties, so the percentages of NHB trips are consistent with the benchmark.

Table 3-12 Percent of NHB Trips Realtive to All Other Trips

County	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
Brevard	34.02	25.53	-8.49	-25%
Flagler	23.41	25.82	2.41	10%
Indian River	30.15	27.01	-3.14	-10%
Lake	32.33	26.48	-5.85	-18%
Marion	31.98	27.18	-5.80	-15%
Orange	39.51	23.64	-15.87	-40%
Osceola	24.12	20.75	-3.37	-14%
Polk	17.89	26.49	8.60	48%
Seminole	37.80	27.02	-10.78	-29%
Sumter	29.89	24.14	-5.75	-19%
Volusia	32.76	25.32	-7.44	-23%
Region	33.10	25.12	-7.98	0%

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 6.2 'GEN_UBPANDA DBF', CFRPM 7 'PANDA.DBF'

3.2 Trip Purpose Comparison

The balanced productions and attractions obtained in the trip generation step were compared to CFRPM 6.2 results at a county and regional level. The special visitor, resident and external trips were also compared. These comparisons are made for informational purposes only. Please note that the base year for CFRPM 6.2 is 2010, and 2015 for CFRPM 7 and also HBCU trips is included within HBO.

Table 3-13 presents the number of trips produced in the entire region by trip purpose.

Table 3-13 Trips Productions in the Region

Trip Purpose	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
HBW	2,267,581	2,731,128	463,547	20%
HBSH	1,562,055	2,176,451	614,396	39%
HBSR	1,274,017	1,663,191	389,174	31%
HBSC	0	1,002,086	1,002,086	Inf
HBO	3,789,948	4,051,347	261,399	7%



Trip Purpose	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
NHB	4,400,537	3,900,328	-500,209	-11%
Total	13,294,138	15,524,531	2,230,393	17%

Source: CFRPM 6.2 'GEN UBPANDA DBF', CFRPM 7 'PANDA.DBF'

Table 3-14 presents the number of balanced attractions by trip purpose.

Table 3-14 Trips Attractions in the Region

Trip Purpose	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
HBW	2,277,077	2,731,090	454,013	20%
HBSH	1,576,891	2,176,528	599,637	38%
HBSR	1,286,116	1,759,500	473,384	37%
HBSC	0	1,002,070	1,002,070	Inf
HBO*	3,793,142	4,051,368	258,226	7%
NHB	4,521,074	3,974,397	-546,677	-12%
Total	13,454,300	15,694,953	2,240,653	17%

Source: CFRPM 6.2 'GEN UBPANDA DBF', CFRPM 7 'PANDA.DBF'

The special purpose trips include visitor, resident and external trips to the Orlando International Airport (OIA), Orange County Convention Center (OCC), Universal Orlando (UNI), Sea World (SEA), Disney World (DIS), Kennedy Space Center (KSC) and Port Canaveral (PC). Visitor and resident trips were updated to reflect 2015 attendance. The external trips were updated based on 2015 traffic counts. During this update, an error was identified and corrected in how external trips were produced in earlier versions of CFRPM. Table 3-15 presents the number of special purpose trips.

Table 3-15 Special Trips in the Region

Special Trip Type	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
OIA Visitor	72,166	74,981	2,815	4%
OIA Resident	27,679	36,568	8,889	32%
OIA External	3,397	2,300	-1,097	-32%
OCC Visitor	4,375	5,991	1,616	37%
OCC Resident	4,848	6,463	1,615	33%
OCC External	3,378	148	-3,230	-96%
UNI Visitor	81,130	84,423	3,293	4%
UNI Resident	10,996	14,289	3,293	30%
UNI External	8,569	1,984	-6,585	-77%
SEA Visitor	26,516	28,612	2,096	8%
SEA Resident	6,375	8,470	2,095	33%



^{*}HBCU trips is included within HBO

Special Trip Type	CFRPM 6.2*	CFRPM 7*	Delta	% Delta
SEA External	4,651	458	-4,193	-90%
DIS Visitor	310,120	313,794	3,674	1%
DIS Resident	18,546	22,218	3,672	20%
DIS External	10,997	3,669	-7,328	-67%
KSC Visitor	3,952	7,694	3,742	95%
KSC Resident	587	1,536	949	162%
KSC External	551	85	-466	-85%
PC Visitor	5,654	11,431	5,777	102%
PC Resident	5,723	11,535	5,812	102%
PC External	3,958	211	-3,747	-95%

Source: CFRPM 6.2, CFRPM 7



4 Trip Distribution

This chapter summarizes the trip distribution results. Trip distribution is the process of linking trip productions to attractions across the region. The distribution results were compared to observed values and benchmarks across four aspects: (1) average trip lengths, and (2) the percentage of trips that occur within a single TAZ (i.e., intrazonal trips), (3) county-to-county flows for the main trip purposes, and (4) county-to-attraction flows for each of the special purposes.

CFRPM 7 uses a gravity model to distribute trips between production and attraction zones for all purposes except for External to External (EE) trips. The gravity model includes friction factors (representing travel impedance between zones) and K-factors (often referred as socioeconomic adjustment factors). The gravity model was calibrated to trip length frequency distributions. Issues raised by initial distribution results were then resolved by investigating issues with the roadway network, production equations or attraction equations. Finally, K-factors were used to fine-tune county-to-county movements.

4.1 Average Trip Lengths

Benchmarks for average trip length were used to assess the model's ability to reflect Central Florida travel patterns. The benchmarks in Table 4-1 were taken from the Department's *Model Calibration and Validation Standards Report* produced in 2008. They are based on Census data and household travel surveys from other cities. These benchmarks are general guidelines and values outside of these ranges do not necessarily indicate errors. The results from both the peak period and off-peak period distributions were compared to the benchmarks.

Table 4-1 Average Trip Length Benchmarks

Metric	Benchmark (%)	
Wethe	Low	High
HBW average trip length (minutes)	12	35
HBSH average trip length (minutes)	9	19
HBSR average trip length (minutes)	11	19
HBSC average trip length (minutes)	7	16
HBO average trip length (minutes)	8	20
NHB average trip length (minutes)	6	19
IE average trip length (minutes)	26	58

Source: Department's Model Calibration and Validation Standards Report

The following table depicts the average trip length statistics summarized in minutes by trip purposes for peak period. Please note terminal time/intrazonal travel time is included within



these trip lengths and for more details please see section 5.3 of *CFRPM 7 Model Description Report*. The HBW and NHB average trip lengths are within the benchmark values. The average trip length in minutes for HBSH, HBSR, HBO trips are slightly longer (less than ~10%) than the upper benchmark value. Overall, these results indicate that in CFRPM the average lengths consistent with models around the country.

Table 4-2 Average Trip Length by Trip Purpose (Peak Period)

Trip Purpose	Avg. Trip Longth (minutes)	Bench	mark (%)
Trip Fulpose	Avg. Trip Length (minutes)	Low	High
HBW	28.40	12	35
HBSH	20.28	9	19
HBSR	20.91	11	19
НВО	20.41	8	20
NHB	17.31	6	19

*Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 7

For the off-peak period, the average trip length for HBW, HBSH, HBO, and NHB are within the benchmark values. The average trip length for HBSR is slightly higher (less than 5%) than the high-end benchmark.

Table 4-3 Average Trip Length by Trip Purposes (Off-Peak Period)

Trip Purpose	Avg. Trip Length (minutes)	Bench	mark (%)
Trip i dipose	Avg. Trip Length (minutes)	Low	High
HBW	18.20	9	19
HBSH	19.41	11	19
HBSR	16.63	8	20
НВО	17.43	6	19
NHB	18.20	9	19

*Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 7

Overall, these results indicate that CFRPM has the average length consistent with models around the country. This is an incredibly positive result since the gravity model was calibrated to Tampa Bay Regional Planning Model (TBRPM) trip lengths (locally observed data was not available). However, the non-work average trip lengths are near or exceed the high-end benchmarks. One possible explanation is that CFRPM may have too many trips being assigned to the network, and not enough intrazonal trips (see next section).



4.2 Percent of Intrazonal Trips

Intrazonal trips are extremely short trips that have production and attraction located in the same zone. The intrazonal trips do not appear in traffic volumes, but they are important to correctly estimate vehicle-miles of travel and emissions. Intrazonal travel times are computed in CFRPM using 50% of the minimum non-zero time from the origin zone to any other (non-external) zone. The benchmarks in Table 4-1 were developed from the Department's *Model Calibration and Validation Standards Report* produced in 2008.

Table 4-4 Intrazonal Benchmarks

Metric	Benchma	rk (%)
Metric	Low	High
Percent of intrazonal HBW trips relative to all HBW trips	1	4
Percent of intrazonal HBSH trips relative to all HBSH trips	3	9
Percent of intrazonal HBSR trips relative to all HBSR trips	4	10
Percent of intrazonal HBSC trips relative to all HBSC trips	10	12
Percent of intrazonal HBO trips relative to all HBO trips	3	7
Percent of intrazonal NHB trips relative to all NHB trips	5	9

Source: Department's Model Calibration and Validation Standards Report

The following table displays the percentage of intrazonal trips and the corresponding benchmark. For the peak period, only the percentage of intrazonal HBSH trips fall within the benchmark range. The percentages of intrazonal trips for other purposes are much lower than benchmark ranges, confirming that the observation in 4.2: that CFRPM 7 generally has too few intrazonal trips and is assigning too many interzonal trips.

Table 4-5 Intrazonal Trips (Peak Period)

Trip Purpose	Percent of Intrazonal Trips	Bench	mark (%)
Trip Purpose	reicent of intrazonal rrips	Low	High
HBW	0.43	1	4
HBSH	1.94	1	9
HBSR	3.22	4	10
НВО	2.26	3	7
NHB	2.15	5	9
Total	1.87	3	5

*Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 7



The following table displays the percentage of intrazonal trips related to all trips on the same trip purpose in off-peak period. The results are similar to the peak results.

Combined, these results might be partially explained by the result of CFRPM 7's new zone system, which created smaller zones in most of the model area. Smaller TAZ sizes would naturally decrease the percentage of intrazonal trips. Using the TBRPM trip lengths may have also contributed to this result.

Table 4-6 Intrazonal Trips (Off-Peak Period)

Trip Purpose	Percent of Intrazonal Trips	Bench	mark (%)
mp Fulpose	reicent of intrazonal mps	Low	High
HBW	0.35	1	4
HBSH	1.78	1	9
HBSR	3.52	4	10
HBO	3.07	3	7
NHB	1.53	5	9
Total	2.10	3	5

^{*}Blue = Less than low benchmark; Red = Greater than high benchmark; Green = OK

Source: CFRPM 7

4.3 Average Trip Length and Percent of Intrazonal Trips

This section compares the observed and estimated Trip Length Frequency Distribution (TLFD) curves for person and vehicle trips. The estimated TLFD curves are calibrated using friction factor adjustments, so in many situations the observed and estimated curves will match closely. Significant differences may indicate issues with the production and attraction equations or the ZDATA.

The 2017 NHTS dataset did not have enough records or location data needed for developing the observed Trip Length Frequency Distribution (TLFD) curves. Consequently, Friction Factors (FFs) were calibrated using Trip Length Frequency Distribution (TLFD) from the Tampa Bay Regional Planning Model (TBRPM) as an observed TLFD. After running CFRPM with the calibrated FFs, an estimated TLFD ("Est") from CFRPM 7 and observed TLFD ("Obs") from the TBRPM were compared as shown in Figure 4-1.

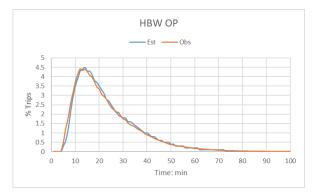
The estimated TLFD curves have a good fit with the observed curves for HBW, HBSR, HBSH, HBSC, HBCU, HBO, and NHB trip purposes. Since CFRPM used separate FFs for the medium truck and heavy truck, they were not compared. Figure 4-1 (o) and (p) show discrepancies in TLFD for Internal to External (IE) trips due to differences in geography and land-use between Tampa Bay and Central Florida.



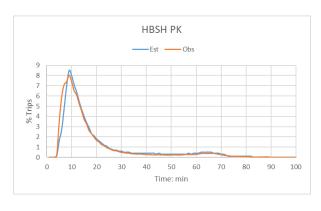
Figure 4-1: Comparison of Estimated and Observed TLFD

(a) HBW peak

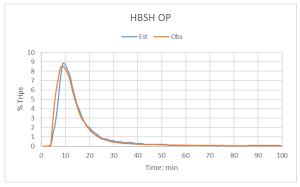
(b) HBW off-peak



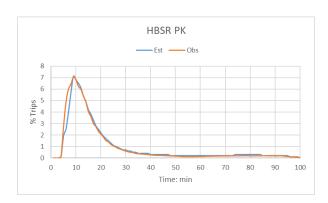
(c) HBSH peak



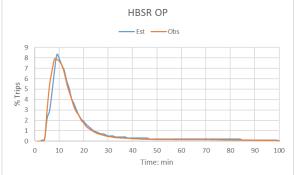
(d) HBSH off-peak



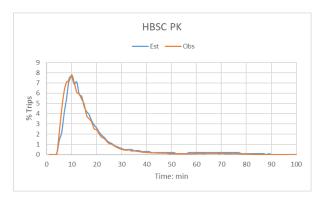
(e) HBSR peak



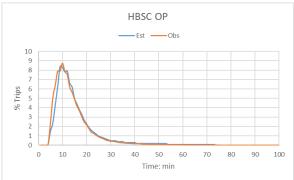
(f) HBSR off-peak



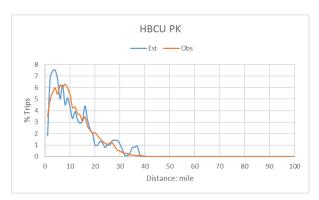
(g) HBSC peak



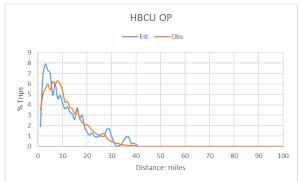
(h) HBSC off-peak



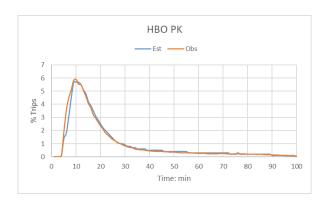
(i) HBCU peak



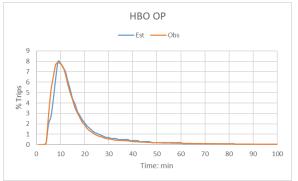
(j) HBCU off-peak



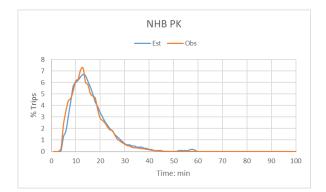
(k) HBO peak



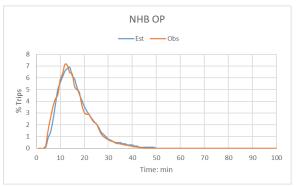
(l) HBO off-peak



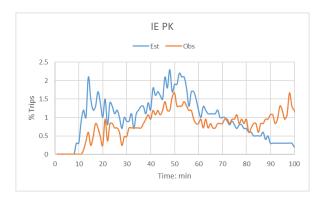
(m) NHB peak



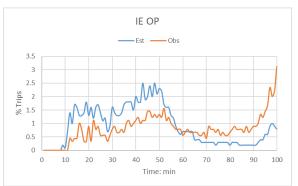
(n) NHB off-peak



(o) IE peak



(p) IE off-peak



4.4 County-to-County Flows

County-to-county travel patterns, or flows, strongly influence the amount of traffic on major arterials and limited-access roadways. In this section, the estimated flows are compared to observed data from the 2015 American Community Survey (ACS) and 2009 National Household Travel Survey (NHTS) data and used to evaluate the estimated county-to-county flows for different trip purposes. The ACS data was used to verify the HBW county-to-county flows, while the NHTS data was used to verify the HBSH, HBSR, HBO, and NHB flows. The 2009 NHTS data was used since it has many times more records than the 2017 NHTS data and contains the trip start- and end- location data. For each trip purpose, the observed county-to-county trip table was adjusted using an arithmetic procedure called Iterative Proportional Fitting (IPF) to match the total productions and attractions for each county. All data compared in this report is in the Production/Attraction (P/A) format.

Unfortunately, there are no standard benchmarks for these comparisons. The estimated flows should reasonably reflect the observed values, although admittedly this is subjective. 4.4.1 through 4.4.6 provide the county-to-county person trip flow comparisons. Sections 4.4.7 through



4.4.9 provide alternate travel pattern comparisons for person trips. 4.4.10 through 4.4.12 provide information on the vehicle trip flow comparisons.

4.4.1 County-to-County Flow Comparison for HBW Trips

The following tables compare the county-to-county flows for HBW trips between the ACS 2015 data and CFRPM 7 results. In Table 4-10 cell values between 10-30% are colored in olive and cell values greater than 30% are colored in red. Table 4-11 summarizes the number of cells and observed trips by error rate.

Table 4-7 HBW Trips from ACS

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	325,818	148	907	125	12	22,174	1,162	174	2,212	0	2,464	355,196
Flagler	96	31,473	0	78	29	441	61	0	421	0	18,362	50,961
Indian River	4,985	0	20,316	0	0	1,630	48	26	164	0	99	27,268
Lake	154	161	0	121,746	947	57,823	3,751	723	6,191	5,126	2,807	199,429
Marion	0	169	0	22,883	147,503	4,124	351	120	599	9,972	1,060	186,781
Orange	1,522	67	6	7,364	161	604,014	11,842	876	38,855	184	2,613	667,504
Osceola	763	6	19	1,953	120	131,526	84,386	2,751	4,226	0	204	225,954
Polk	267	0	15	3,673	71	75,511	18,960	261,459	1,003	132	241	361,332
Seminole	680	58	3	1,409	34	137,227	941	179	171,928	229	5,463	318,151
Sumter	26	0	0	10,687	962	1,538	120	125	362	23,976	21	37,817
Volusia	846	1,850	0	1,258	105	17,475	232	147	23,714	16	234,966	280,609
Total	335,157	33,932	21,266	171,176	149,944	1,053,483	121,854	266,580	249,675	39,635	268,300	2,711,002

Source: ACS 2015

Table 4-8 HBW Trips from CFRPM 7 Estimated Results

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	320,783	137	858	53	0	22,887	2,662	1	4,516	0	3,299	355,197
Flagler	80	29,964	0	101	4	312	0	0	511	2	19,988	50,963
Indian River	6,052	2	20,298	2	0	504	253	7	39	0	113	27,268
Lake	38	147	0	114,160	2,179	57,825	3,991	1,435	9,320	6,607	3,729	199,430
Marion	2	102	0	22,827	144,927	4,579	84	4	433	11,186	2,636	186,780
Orange	3,027	11	2	9,054	35	598,053	13,190	777	39,688	216	3,450	667,504
Osceola	1,948	0	30	2,521	2	127,759	81,320	8,099	4,077	31	169	225,955
Polk	108	0	77	7,355	20	76,953	19,051	256,197	1,238	289	44	361,332
Seminole	1,246	69	0	2,712	2	139,907	1,118	11	166,341	20	6,726	318,151
Sumter	0	0	0	10,036	2,735	3,436	92	51	159	21,259	48	37,816
Volusia	1,873	3,501	0	2,355	39	21,269	94	0	23,355	23	228,098	280,608
Total	335,157	33,933	21,264	171,177	149,944	1,053,484	121,855	266,581	249,676	39,634	268,298	2,711,004

Source: CFRPM 7



Table 4-9 Delta Trips for HBW

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	-5,035	-11	-49	-72	-12	713	1,500	-173	2,304	0	835	1
Flagler	-16	-1,509	0	23	-25	-129	-61	0	90	2	1,626	2
Indian River	1,067	2	-18	2	0	-1,126	205	-19	-125	0	14	0
Lake	-116	-14	0	-7,586	1,232	2	240	712	3,129	1,481	922	1
Marion	2	-67	0	-56	-2,576	455	-267	-116	-166	1,214	1,576	-1
Orange	1,505	-56	-4	1,690	-126	-5,961	1,348	-99	833	32	837	0
Osceola	1,185	-6	11	568	-118	-3,767	-3,066	5,348	-149	31	-35	1
Polk	-159	0	62	3,682	-51	1,442	91	-5,262	235	157	-197	0
Seminole	566	11	-3	1,303	-32	2,680	177	-168	-5,587	-209	1,263	0
Sumter	-26	0	0	-651	1,773	1,898	-28	-74	-203	-2,717	27	-1
Volusia	1,027	1,651	0	1,097	-66	3,794	-138	-147	-359	7	-6,868	-1
Total	0	1	-2	1	0	1	1	1	1	-1	-2	2

Source: CFRPM 7, ACS 2015

Table 4-10 Percent of Delta Trips for HBW

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia
Brevard	-2%	-7%	-5%	-58%	-100%	3%	129%	-100%	104%	100%	34%
Flagler	-17%	-5%	100%	30%	-85%	-29%	-100%	100%	21%	100%	9%
Indian River	21%	100%	0%	100%	100%	-69%	428%	-74%	-76%	100%	14%
Lake	-76%	-8%	100%	-6%	130%	0%	6%	98%	51%	29%	33%
Marion	100%	-39%	100%	0%	-2%	11%	-76%	-97%	-28%	12%	149%
Orange	99%	-84%	-68%	23%	-78%	-1%	11%	-11%	2%	18%	32%
Osceola	155%	-99%	55%	29%	-98%	-3%	-4%	194%	-4%	100%	-17%
Polk	-60%	100%	413%	100%	-71%	2%	0%	-2%	23%	119%	-82%
Seminole	83%	19%	-95%	92%	-94%	2%	19%	-94%	-3%	-91%	23%
Sumter	-99%	100%	100%	-6%	184%	123%	-23%	-59%	-56%	-11%	126%
Volusia	121%	89%	100%	87%	-63%	22%	-60%	-100%	-2%	46%	-3%

*Red = Greater than 30%; Green = 10%-30%

Source: CFRPM 7, ACS 2015

Table 4-11 Breakdown of HBW Flow Matrix Errors

Error	# Cells	% Cells	Obs Trips	Pct Obs Trips
<= 10%	26	21%	2,570,524	95%
10-30%	23	19%	97,400	4%
> 30%	72	60%	43,078	2%

Source: CFRPM 7, ACS 2015



About 95% of the HBW trips are in cells that have an error of less than 10%. This indicates that the estimated county-to-county flows are generally consistent with the corresponding observed flows for HBW trips.

4.4.2 County-to-County Flow Comparison for HBSH Trips

The following tables compare the county-to-county flows for HBSH trips between the 2009 NHTS data and the estimated results. Table 4-16 summarizes the number of cells and observed trips by error rate.

Table 4-12 HBSH Trips from NHTS

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	253,505	4	8,920	9	8	18,219	23	54	3,788	5	8	284,543
Flagler	39	30,090	129	32	27	509	82	193	208	19	13,482	44,810
Indian River	256	1	20,990	3	3	55	9	21	22	2	3	21,365
Lake	16	5	52	125,008	1,330	13,093	15,155	79	85	959	503	156,285
Marion	12	4	38	4,175	126,159	27,089	24	57	62	2,217	9	159,846
Orange	1	0	4	0	0	512,675	3	1,199	35,086	1	1	548,970
Osceola	6	2	20	0	0	79,116	72,339	30	32	3	5	151,553
Polk	3	1	9	348	0	809	8,038	272,480	14	1	2	281,705
Seminole	2	1	7	0	150	37,688	4	10	157,574	1	2	195,439
Sumter	23	8	76	12,055	3,317	303	49	23,408	124	25,203	599	65,165
Volusia	9	1,174	29	7	6	28,088	19	43	25,308	4	203,060	257,747
Total	253,872	31,290	30,274	141,637	131,000	717,644	95,745	297,574	222,303	28,415	217,674	2,167,428

Source: 2009 NHTS

Table 4-13 HBSH Trips from CFRPM 7 Estimated Results

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	253,264	0	9,128	1	0	16,137	561	612	4,561	0	279	284,543
Flagler	3	30,585	0	8	0	2,378	28	0	1,911	0	9,896	44,810
Indian River	196	0	21,130	0	0	14	19	6	0	0	0	21,364
Lake	0	5	0	116,814	552	22,194	12,559	52	181	974	2,953	156,285
Marion	0	15	0	3,715	127,154	21,521	144	1,815	1,166	2,506	1,810	159,845
Orange	64	0	0	917	0	516,343	6	1,753	29,881	0	7	548,970
Osceola	40	0	11	424	0	70,752	78,096	1,929	301	0	0	151,553
Polk	0	0	1	1,075	0	682	3,896	276,021	30	0	0	281,705
Seminole	4	0	0	3	0	41,762	26	9	153,525	0	111	195,439
Sumter	0	0	0	18,581	3,292	1,632	362	15,323	1,009	24,937	29	65,165
Volusia	302	684	4	99	0	24,229	48	55	29,738	0	202,588	257,746
Total	253,872	31,289	30,275	141,637	130,999	717,644	95,745	297,574	222,303	28,417	217,672	2,167,426

Source: CFRPM 7



Table 4-14 Delta Trips for HBSH

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	-241	-4	208	-8	-8	-2,082	538	558	773	-5	271	0
Flagler	-36	495	-129	-24	-26	1,869	-54	-193	1,703	-19	-3,586	0
Indian River	-60	-1	140	-3	-3	-41	10	-15	-22	-2	-3	0
Lake	-16	0	-52	-8,194	-778	9,101	-2,596	-27	96	15	2,450	0
Marion	-12	11	-38	-460	995	-5,568	120	1,758	1,104	289	1,801	-1
Orange	63	0	-4	917	0	3,668	3	554	-5,205	-1	6	0
Osceola	34	-2	-9	424	0	-8,364	5,757	1,899	269	-3	-5	0
Polk	-3	-1	-8	727	0	-127	-4,142	3,541	16	-1	-2	0
Seminole	2	-1	-7	3	-150	4,074	22	-1	-4,049	-1	109	0
Sumter	-23	-8	-76	6,526	-25	1,329	313	-8,085	885	-266	-570	0
Volusia	293	-490	-25	92	-6	-3,859	29	12	4,430	-4	-472	0
Total	0	-1	1	0	-1	0	0	0	0	2	-2	-2

Source: CFRPM 7, 2009 NHTS

Table 4-15 Percent of Delta Trips for HBSH

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia
Brevard	0%	-94%	2%	-93%	-100%	-11%	2 340%	1 033%	20%	-100%	3 388%
Flagler	-92%	2%	-100%	-75%	-98%	367%	-65%	-100%	819%	-100%	-27%
Indian River	-24%	-100%	1%	-100%	-100%	-74%	108%	-73%	-99%	-100%	-100%
Lake	-99%	6%	-100%	-7%	-58%	70%	-17%	-34%	113%	2%	487%
Marion	-100%	279%	-100%	-11%	1%	-21%	498%	3 084%	1 780%	13%	20 009%
Orange	6 311%	100%	-99%	100%	100%	1%	111%	46%	-15%	-100%	553%
Osceola	567%	-100%	-43%	100%	100%	-11%	8%	6 330%	841%	-100%	-96%
Polk	-100%	-100%	-88%	209%	100%	-16%	-52%	1%	115%	-100%	-98%
Seminole	83%	-100%	-100%	100%	-100%	11%	557%	-12%	-3%	-100%	5 428%
Sumter	-100%	-100%	-100%	54%	-1%	439%	639%	-35%	714%	-1%	-95%
Volusia	3 253%	-42%	-86%	1 313%	-99%	-14%	151%	29%	18%	-100%	0%

*Red = Greater than 30%; Green = 10%-30%

Source: CFRPM 7, 2009 NHTS

Table 4-16 Breakdown of HBSH Flow Matrix Errors

Error	# Cells	% Cells	Obs Trips	% Obs Trips
<= 10%	15	12%	1,812,284	84%
10-30%	16	13%	290,529	13%
> 30%	90	74%	64,615	3%

Source: CFRPM 7, 2009 NHTS



About 85% of the HBSH trips are in cells with an error of less than 10%. Another 13% are in cells between 10-30% different than the observed value. These results generally indicate that the estimated flows are generally consistent with the corresponding observed flows.

4.4.3 County-to-County Flow Comparison for HBSR Trips

The following tables compare the county-to-county flows for HBSR trips between the 2009 NHTS data and the estimated results. Table 4-21 summarizes the number of cells and observed trips by error rate.

Table 4-17 HBSR Trips from NHTS

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	200,126	3	1,798	1,090	16	2,967	2	2	37	21	16	206,078
Flagler	81	27,585	212	127	87	4,156	9	13	207	115	1,308	33,900
Indian River	3,454	1	12,711	7	5	13	0	1	11	6	5	16,214
Lake	13	2	34	99,436	14	14,589	1	433	34	1,961	14	116,531
Marion	415	2	21	6,283	112,185	23	1	100	21	2,901	9	121,961
Orange	5,108	1	11	6	4	401,050	24	1	8,450	6	5	414,666
Osceola	369	70	966	580	399	1,072	90,169	21,979	945	526	405	117,480
Polk	63	12	164	99	68	11,519	669	180,503	18,059	89	69	211,314
Seminole	6	1	17	10	7	32,551	1	1	112,157	9	266	145,026
Sumter	6	1	17	10,361	234	19	1	1	16	36,995	243	47,894
Volusia	3,054	816	28	478	11	12,526	1	2	2,455	15	182,752	202,138
Total	212,695	28,494	15,979	118,477	113,030	480,485	90,878	203,036	142,392	42,644	185,092	1,633,202

Source: 2009 NHTS

Table 4-18 HBSR Trips from CFRPM 7 Estimated Results

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	196,157	94	2,183	311	4	2,953	852	187	1,820	0	1,516	206,077
Flagler	685	25,719	0	567	351	1,618	2	0	1,311	12	3,633	33,899
Indian River	2,531	0	13,286	0	0	214	88	51	25	0	19	16,213
Lake	439	111	0	95,317	12	14,221	1,957	273	2	2,062	2,140	116,533
Marion	5	93	0	4,780	108,533	3,327	125	170	594	3,371	962	121,960
Orange	5,316	84	133	2	1,452	396,016	2	0	8,568	640	2,454	414,665
Osceola	177	3	211	3,489	471	1,108	85,667	22,036	3,146	334	836	117,479
Polk	560	0	95	46	275	13,650	706	178,103	17,384	350	145	211,314
Seminole	1,386	74	24	1,461	189	32,503	440	721	105,767	100	2,361	145,025
Sumter	0	6	0	8,830	358	1	465	1,247	1,039	35,570	379	47,895
Volusia	5,440	2,310	45	3,676	1,387	14,875	574	246	2,734	204	170,646	202,139
Total	212,696	28,493	15,978	118,478	113,032	480,485	90,877	203,035	142,390	42,644	185,091	1,633,199



Table 4-19 Delta Trips for HBSR

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	-3,969	91	385	-779	-12	-14	850	185	1,783	-21	1,500	-1
Flagler	604	-1,866	-212	440	264	-2,538	-7	-13	1,104	-103	2,325	-1
Indian River	-923	-1	575	-7	-5	201	88	50	14	-6	14	-1
Lake	426	109	-34	-4,119	-2	-368	1,956	-160	-32	101	2,126	2
Marion	-410	91	-21	-1,503	-3,652	3,304	124	70	573	470	953	-1
Orange	208	83	122	-4	1,448	-5,034	-22	-1	118	634	2,449	-1
Osceola	-192	-67	-755	2,909	72	36	-4,502	57	2,201	-192	431	-1
Polk	497	-12	-69	-53	207	2,131	37	-2,400	-675	261	76	0
Seminole	1,380	73	7	1,451	182	-48	439	720	-6,390	91	2,095	-1
Sumter	-6	5	-17	-1,531	124	-18	464	1,246	1,023	-1,425	136	1
Volusia	2,386	1,494	17	3,198	1,376	2,349	573	244	279	189	-12,106	1
Total	1	-1	-1	1	2	0	-1	-1	-2	0	-1	-3

Source: CFRPM 7, 2009 NHTS

Table 4-20 Percent of Delta Trips for HBSR

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia
Brevard	-2%	3 033%	21%	-71%	-75%	0%	42 488%	9 253%	4 818%	-100%	9 374%
Flagler	746%	-7%	-100%	347%	303%	-61%	-82%	-100%	533%	-90%	178%
Indian River	-27%	-100%	5%	-100%	-100%	1 543%	100%	5 009%	129%	-100%	281%
Lake	3 273%	5 459%	-100%	-4%	-14%	-3%	195 551%	-37%	-93%	5%	15 184%
Marion	-99%	4 529%	-100%	-24%	-3%	14 365%	12 371%	70%	2 726%	16%	10 588%
Orange	4%	8 281%	1 107%	-73%	36 188%	-1%	-90%	-75%	1%	10 571%	48 979%
Osceola	-52%	-96%	-78%	502%	18%	3%	-5%	0%	233%	-36%	106%
Polk	789%	-100%	-42%	-54%	304%	18%	6%	-1%	-4%	293%	111%
Seminole	22 996%	7 299%	41%	14 513%	2 602%	0%	43 874%	71 955%	-6%	1 016%	788%
Sumter	-100%	473%	-100%	-15%	53%	-94%	46 443%	124 632%	6 391%	-4%	56%
Volusia	78%	183%	62%	669%	12 513%	19%	57 336%	12 203%	11%	1 259%	-7%

*Red = Greater than 30%; Green = 10%-30%

Source: CFRPM 7, 2009 NHTS

Table 4-21 Breakdown of HBSR Flow Matrix Errors

Error	# Cells	% Cells	Obs Trips	% Obs Trips
<= 10%	21	17%	1,563,074	96%
10-30%	10	8%	51,710	3%
> 30%	90	74%	18,418	1%

Source: CFRPM 7, 2009 NHTS



Over 96% of the HBSR trips are in cells with an error of less than 10%. These results generally indicate that the estimated flows are consistent with the corresponding observed flows.

4.4.4 County-to-County Flow Comparison for HBO Trips

The following tables compare the county-to-county flows for HBO trips between the 2009 NHTS data and the 2015 estimated results. Table 4-26 summarizes the number of cells and observed trips by error rate.

Table 4-22 HBO Trips from NHTS

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	623,318	2	2,722	13	19	18,708	8	7	608	12	8	645,425
Flagler	151	86,176	51	112	159	147	71	63	246	102	13,629	100,907
Indian River	194	20	44,312	143	204	189	91	80	315	130	92	45,770
Lake	42	4	14	286,288	45	33,746	2,110	3,688	69	15,190	20	341,216
Marion	14	1	5	13,464	316,840	14	7	6	24	9,427	7	339,809
Orange	8,172	2	8	4,103	24	1,312,126	748	9	34,589	15	11	1,359,807
Osceola	48	5	16	36	51	82,613	305,729	7,265	10,380	33	23	406,199
Polk	43	4	14	11,482	45	8,594	1,323	622,198	70	29	21	643,823
Seminole	9	1	3	148	1,008	58,266	4	4	393,051	6	4	452,504
Sumter	101	10	34	26,296	17,826	98	47	42	164	84,615	3,337	132,570
Volusia	52	369	17	38	54	12,443	24	21	15,054	35	534,878	562,985
Total	632,144	86,594	47,196	342,123	336,275	1,526,944	310,162	633,383	454,570	109,594	552,030	5,031,015

Source: 2009 NHTS

Table 4-23 HBO Trips from CFRPM 7 Estimated Results

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	619,566	394	1,888	508	5	21,255	0	159	906	0	744	645,426
Flagler	686	84,899	0	898	417	1,431	1	0	1,946	14	10,613	100,906
Indian River	196	0	44,827	0	0	269	300	99	35	0	46	45,771
Lake	360	352	0	288,469	10	31,300	3,988	3,113	388	13,131	106	341,217
Marion	4	180	0	11,467	313,888	3,102	84	106	656	8,226	2,096	339,808
Orange	10,787	185	103	4,537	2,293	1,302,631	1,006	1	36,556	1,707	3	1,359,809
Osceola	3	2	229	20	625	82,086	300,384	11,205	9,313	724	1,609	406,200
Polk	539	0	108	11,721	422	8,654	1,767	616,827	2,684	841	260	643,823
Seminole	0	286	14	53	267	62,903	1,562	666	386,111	229	415	452,505
Sumter	0	3	0	24,445	16,575	18	503	1,109	1,061	84,481	4,376	132,571
Volusia	3	293	28	5	1,773	13,297	567	99	14,916	241	531,763	562,985
Total	632,145	86,595	47,197	342,122	336,276	1,526,945	310,163	633,383	454,571	109,593	552,031	5,031,020



Table 4-24 Delta Trips for HBO

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	-3,752	392	-834	495	-14	2,547	-8	152	298	-12	736	1
Flagler	535	-1,277	-51	786	258	1,284	-70	-63	1,700	-88	-3,016	-1
Indian River	2	-20	515	-143	-204	80	209	19	-280	-130	-46	1
Lake	318	348	-14	2,181	-35	-2,446	1,878	-575	319	-2,059	86	1
Marion	-10	179	-5	-1,997	-2,952	3,088	78	100	632	-1,201	2,089	-1
Orange	2,615	183	95	434	2,269	-9,495	258	-8	1,967	1,692	-8	2
Osceola	-45	-3	213	-16	574	-527	-5,345	3,940	-1,067	691	1,586	1
Polk	496	-4	94	239	377	60	444	-5,371	2,614	812	239	0
Seminole	-9	285	11	-95	-741	4,637	1,558	662	-6,940	223	411	1
Sumter	-101	-7	-34	-1,851	-1,251	-80	456	1,067	897	-134	1,039	1
Volusia	-49	-76	11	-33	1,719	854	543	78	-138	206	-3,115	0
Total	1	1	1	-1	1	1	1	0	1	-1	1	5

Source: CFRPM 7, 2009 NHTS

Table 4-25 Percent of Delta Trips for HBO

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia
Brevard	-1%	19 599%	-31%	3 811%	-74%	14%	-100%	2 167%	49%	-100%	9 202%
Flagler	355%	-1%	-100%	702%	162%	874%	-99%	-100%	691%	-87%	-22%
Indian River	1%	-100%	1%	-100%	-100%	42%	230%	23%	-89%	-100%	-50%
Lake	758%	8 704%	-100%	1%	-78%	-7%	89%	-16%	463%	-14%	431%
Marion	-74%	17 851%	-100%	-15%	-1%	22 058%	1 107%	1 667%	2 633%	-13%	29 836%
Orange	32%	9 141%	1 189%	11%	9 456%	-1%	34%	-91%	6%	11 281%	-76%
Osceola	-94%	-61%	1 329%	-45%	1 126%	-1%	-2%	54%	-10%	2 094%	6 897%
Polk	1 154%	-99%	669%	2%	838%	1%	34%	-1%	3 734%	2 800%	1 139%
Seminole	-100%	28 531%	374%	-64%	-73%	8%	38 950%	16 540%	-2%	3 713%	10 265%
Sumter	-100%	-68%	-100%	-7%	-7%	-82%	971%	2 540%	547%	0%	31%
Volusia	-95%	-20%	67%	-87%	3 183%	7%	2 263%	372%	-1%	590%	-1%

**Red* = *Greater than 30%; Green* = 10%-30%

Source: CFRPM 7, 2009 NHTS

Table 4-26 Breakdown of HBO Flow Matrix Errors

Error	# Cells	% Cells	Obs Trips	% Obs Trips
<= 10%	23	19%	4,921,014	98%
10-30%	9	7%	78,658	2%
> 30%	89	74%	31,343	1%

Source: CFRPM 7, 2009 NHTS



Over 95% of the HBO trips are in cells with an error of less than 10%. These results generally indicate that the estimated flows are consistent with the corresponding observed flows.

4.4.5 County-to-County Flow Comparison for NHB Trips

The following tables compare the county-to-county flows for NHB trips between the 2009 NHTS data and the estimated results. Table 4-31 summarizes the number of cells and observed trips by error rate.

Table 4-27 NHB Trips from NHTS

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	493,870	1	2,168	26	5	6,871	32	14	6,409	36	5,331	514,763
Flagler	76	61,406	80	162	31	365	198	85	255	218	18,221	81,097
Indian River	1,797	1	39,189	23	4	52	28	12	37	31	10	41,184
Lake	8	1	8	205,615	2,196	68,899	20	896	2,799	14,224	293	294,959
Marion	24	3	25	22,399	271,491	116	63	27	81	9,951	22	304,202
Orange	1,164	0	3	9,169	1	833,497	14,271	595	69,348	7	1,186	929,241
Osceola	8	1	8	16	3	65,981	168,707	2,413	26	22	7	237,192
Polk	512	1	12	23	5	53,572	3,172	485,195	37	32	10	542,571
Seminole	567	0	4	339	2	147,128	10	4	262,919	11	2,646	413,630
Sumter	14	2	15	31,107	2,003	67	36	15	47	57,520	12	90,838
Volusia	2,876	764	12	1,573	5	37,433	29	12	10,338	32	392,475	445,549
Total	500,916	62,180	41,524	270,452	275,746	1,213,981	186,566	489,268	352,296	82,084	420,213	3,895,226

Source: 2009 NHTS

Table 4-28 NHB Trips from CFRPM 7 Estimated Results

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	495,774	0	5,018	0	0	7,476	251	0	4,280	0	1,965	514,764
Flagler	0	61,127	0	1	0	0	0	0	0	0	19,971	81,098
Indian River	4,664	0	36,502	0	0	0	19	0	0	0	0	41,185
Lake	0	37	0	208,412	1,542	62,718	94	2,642	5,589	12,363	1,561	294,958
Marion	0	0	0	21,260	270,732	7	0	0	1	11,644	557	304,201
Orange	139	0	0	8,002	0	842,291	16,650	105	62,050	0	5	929,242
Osceola	15	0	2	59	0	72,091	159,686	5,311	26	0	0	237,191
Polk	0	0	1	3,147	0	48,355	9,859	481,209	0	0	0	542,571
Seminole	7	0	0	120	0	149,245	7	0	263,021	0	1,229	413,629
Sumter	0	0	0	29,085	3,471	202	1	1	0	58,076	0	90,837
Volusia	316	1,016	0	367	1	31,597	0	0	17,327	0	394,924	445,548
Total	500,915	62,181	41,524	270,452	275,745	1,213,982	186,567	489,269	352,295	82,083	420,212	3,895,226



Table 4-29 Delta Trips for NHB

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	1,904	-1	2,850	-26	-5	605	219	-14	-2,129	-36	-3,366	1
Flagler	-76	-279	-80	-161	-31	-365	-198	-85	-255	-218	1,750	1
Indian River	2,867	-1	-2,687	-23	-4	-52	-9	-12	-37	-31	-10	1
Lake	-8	36	-8	2,797	-654	-6,181	74	1,746	2,790	-1,861	1,268	-1
Marion	-24	-3	-25	-1,139	-759	-109	-63	-27	-80	1,693	535	-1
Orange	-1,025	0	-3	-1,167	-1	8,794	2,379	-490	-7,298	-7	-1,181	1
Osceola	7	-1	-6	43	-3	6,110	-9,021	2,898	0	-22	-7	-1
Polk	-512	-1	-11	3,124	-5	-5,217	6,687	-3,986	-37	-32	-10	0
Seminole	-560	0	-4	-219	-2	2,117	-3	-4	102	-11	-1,417	-1
Sumter	-14	-2	-15	-2,022	1,468	135	-35	-14	-47	556	-12	-1
Volusia	-2,560	252	-12	-1,206	-4	-5,836	-29	-12	6,989	-32	2,449	-1
Total	-1	1	0	0	-1	1	1	1	-1	-1	-1	0

Source: CFRPM 7, 2009 NHTS

Table 4-30 Percent of Delta Trips for NHB

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia
Brevard	0%	-100%	131%	-100%	-100%	9%	684%	-100%	-33%	-100%	-63%
Flagler	-100%	0%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	10%
Indian River	160%	-100%	-7%	-100%	-100%	-100%	-32%	-100%	-100%	-100%	-100%
Lake	-100%	3 605%	-100%	1%	-30%	-9%	372%	195%	100%	-13%	433%
Marion	-100%	-84%	-100%	-5%	0%	-94%	-100%	-100%	-98%	17%	2 432%
Orange	-88%	100%	-100%	-13%	-100%	1%	17%	-82%	-11%	-100%	-100%
Osceola	84%	-100%	-70%	272%	-100%	9%	-5%	120%	1%	-100%	-100%
Polk	-100%	-100%	-91%	13 582%	-100%	-10%	211%	-1%	-100%	-99%	-100%
Seminole	-99%	100%	-100%	-65%	-100%	1%	-30%	-100%	0%	-100%	-54%
Sumter	-100%	-100%	-100%	-7%	73%	202%	-96%	-90%	-100%	1%	-100%
Volusia	-89%	33%	-100%	-77%	-89%	-16%	-100%	-100%	68%	-100%	1%

*Red = Greater than 30%; Green = 10%-30%

Source: CFRPM 7, 2009 NHTS

Table 4-31 Breakdown of NHB Flow Matrix Errors

Error	# Cells	% Cells	Obs Trips	% Obs Trips
<= 10%	20	17%	3,686,088	95%
10-30%	8	7%	156,602	4%
> 30%	93	77%	52,536	1%

Source: CFRPM 7, 2009 NHTS



About 95% of the NHB trips are in cells with an error of less than 10%. These results generally indicate that the estimated flows are consistent with the corresponding observed flows.

4.4.6 County-to-County Flow Comparison for All Five Trip Purposes

The following tables compare the county-to-county flows for all five trip purposes total (HBW, HBSH, HBSR, HBO, and NHB) between the 2015 ACS and 2009 NHTS data and the estimated results. Table 4-36 summarizes the number of cells and observed trips by error rate.

Table 4-32 Trips for All Five Trip Purposes from ACS and NHTS

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	1,896,63 7	158	16,515	1,263	60	68,939	1,227	251	13,054	74	7,827	2,006,005
Flagler	443	236,730	472	511	333	5,618	421	354	1,337	454	65,002	311,675
Indian River	10,686	23	137,51 8	176	216	1,939	176	140	549	169	209	151,801
Lake	233	173	108	838,093	4,532	188,150	21,037	5,819	9,178	37,460	3,637	1,108,420
Marion	465	179	89	69,204	974,178	31,366	446	310	787	34,468	1,107	1,112,599
Orange	15,967	70	32	20,642	190	3,663,362	26,888	2,680	186,328	213	3,816	3,920,188
Osceola	1,194	84	1,029	2,585	573	360,308	721,330	34,438	15,609	584	644	1,138,378
Polk	888	18	214	15,625	189	150,005	32,162	1,821,83 5	19,183	283	343	2,040,745
Seminole	1,264	61	34	1,906	1,201	412,860	960	198	1,097,629	256	8,381	1,524,750
Sumter	170	21	142	90,506	24,342	2,025	253	23,591	713	228,309	4,212	374,284
Volusia	6,837	4,973	86	3,354	181	107,965	305	225	76,869	102	1,548,131	1,749,028
Total	1,934,78 4	242,490	156,23 9	1,043,86 5	1,005,99 5	4,992,537	805,205	1,889,84 1	1,421,236	302,372	1,643,309	15,437,87 3

Source: ACS 2015, 2009 NHTS

Table 4-33 Trips for All Five Trip Purposes from CFRPM 7 Estimated Results

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	1,885,54 5	626	19,075	873	9	70,708	4,326	959	16,083	0	7,803	2,006,007
Flagler	1,455	232,295	0	1,575	773	5,739	31	0	5,679	27	64,100	311,675
Indian River	13,638	2	136,04 3	2	0	1,000	679	162	99	0	178	151,802
Lake	837	653	0	823,171	4,296	188,257	22,589	7,515	15,481	35,136	10,489	1,108,423
Marion	10	390	0	64,049	965,235	32,535	437	2,095	2,850	36,933	8,060	1,112,594
Orange	19,333	279	238	22,511	3,780	3,655,334	30,855	2,636	176,743	2,564	5,918	3,920,190
Osceola	2,183	5	483	6,513	1,098	353,796	705,153	48,581	16,864	1,089	2,614	1,138,378
Polk	1,207	0	282	23,343	717	148,295	35,278	1,808,35 7	21,336	1,480	450	2,040,746
Seminole	2,642	429	38	4,349	458	426,319	3,153	1,406	1,074,765	349	10,841	1,524,749
Sumter	0	9	0	90,978	26,430	5,289	1,424	17,732	3,268	224,323	4,831	374,284
Volusia	7,934	7,804	78	6,502	3,200	105,267	1,283	401	88,069	469	1,528,020	1,749,027
Total	1,934,78 4	242,492	156,23 8	1,043,86 6	1,005,99 5	4,992,540	805,207	1,889,84 2	1,421,235	302,371	1,643,305	15,437,87 4



Table 4-34 Delta Trips for All Five Trip Purposes

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	-11,092	468	2,560	-390	-51	1,769	3,099	708	3,029	-74	-24	2
Flagler	1,012	-4,435	-472	1,064	440	121	-390	-354	4,342	-427	-902	0
Indian River	2,952	-21	-1,475	-174	-216	-939	503	22	-450	-169	-31	1
Lake	604	480	-108	-14,922	-236	107	1,552	1,696	6,303	-2,324	6,852	3
Marion	-455	211	-89	-5,155	-8,943	1,169	-9	1,785	2,063	2,465	6,953	-5
Orange	3,366	209	206	1,869	3,590	-8,028	3,967	-44	-9,585	2,351	2,102	2
Osceola	989	-79	-546	3,928	525	-6,512	-16,177	14,143	1,255	505	1,970	0
Polk	319	-18	68	7,718	528	-1,710	3,116	-13,478	2,153	1,197	107	1
Seminole	1,378	368	4	2,443	-743	13,459	2,193	1,208	-22,864	93	2,460	-1
Sumter	-170	-12	-142	472	2,088	3,264	1,171	-5,859	2,555	-3,986	619	0
Volusia	1,097	2,831	-8	3,148	3,019	-2,698	978	176	11,200	367	-20,111	-1
Total	0	2	-1	1	0	3	2	1	-1	-1	-4	1

Source: CFRPM 7, ACS 2015, 2009 NHTS

Table 4-35 Percent of Delta Trips for All Five Trip Purposes

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia
Brevard	-1%	296%	16%	-31%	-85%	3%	253%	282%	23%	-100%	0%
Flagler	228%	-2%	-100%	208%	132%	2%	-93%	-100%	325%	-94%	-1%
Indian River	28%	-93%	-1%	-99%	-100%	-48%	286%	16%	-82%	-100%	-15%
Lake	259%	277%	-100%	-2%	-5%	0%	7%	29%	69%	-6%	188%
Marion	-98%	118%	-100%	-7%	-1%	4%	-2%	576%	262%	7%	628%
Orange	21%	299%	643%	9%	1 890%	0%	15%	-2%	-5%	1 104%	55%
Osceola	83%	-94%	-53%	152%	92%	-2%	-2%	41%	8%	87%	306%
Polk	36%	-100%	32%	49%	280%	-1%	10%	-1%	11%	423%	31%
Seminole	109%	603%	13%	128%	-62%	3%	228%	610%	-2%	37%	29%
Sumter	-100%	-57%	-100%	1%	9%	161%	463%	-25%	358%	-2%	15%
Volusia	16%	57%	-9%	94%	1 668%	-2%	321%	78%	15%	360%	-1%

*Red = Greater than 30%; Green = 10%-30% Source: CFRPM 7, ACS 2015, 2009 NHTS

Table 4-36 Breakdown of Flow Matrix Errors for All Five Trip Purposes

Error	# Cells	% Cells	Obs Trips	% Obs Trips
<= 10%	35	29%	15,101,294	98%
10-30%	15	12%	228,385	1%
> 30%	71	59%	108,194	1%

Source: CFRPM 7, ACS 2015, 2009 NHTS



About 98% of all trips are in cells with an error of less than 10%. These results indicate that the estimated flows are consistent with the corresponding observed flows.

4.4.7 Number of Counties Traveled

The following table compares the number of counties traveled for each trip for all five trip purposes (HBW, HBSH, HBSR, HBO, and NHB) between the 2015 ACS and 2009 NHTS data and the estimated results. This comparison helps gauge whether the model is overstating intra- or inter-county travel. Overstating intra-county travel can result in under-estimated estimates of VMT, while overstating inter-county travel can result in over-estimated VMT estimates.

Table 4-37 Number of Counties Traveled for All Five Trip Purposes

Num Counties Traveled	Observed Trips	Estimated Trips	Delta Trips	% Delta Trips
1	13,163,752	13,038,239	-125,513	-1%
2	1,860,219	1,924,199	63,980	3%
3	400,098	458,123	58,025	15%
4	13,499	17,314	3,815	28%
5	305	0	-305	-100%

Source: CFRPM 7

The estimated number of counties traveled are generally in line with the corresponding observations for all five trip purposes. There is a slight over-estimate of 3- and 4-county trips. The model does not estimate any 5-county trips.

4.4.8 METROPLAN Orlando vs. Outer Regions

The following tables compare the observed and estimated trip distributions between the METROPLAN Orlando MPO region (Orange, Osceola and Seminole Counties) and the other 8 outer counties for all five trip purposes total (HBW, HBSH, HBSR, HBO, and NHB) using the ACS 2015 and 2009 NHTS data and the estimated results. The reason for reviewing this comparison is that METROPLAN Orlando has the largest population and employment in the region (compared to other MPOs) and is the only MPO with more jobs than workers. Therefore, the METROPLAN Orlando area has a significant impact on travel patterns in the region. Overstating travel to/from the METROPLAN Orlando area would likely result in over-stating VMT.



Table 4-38 Trips Comparison For METROPLAN and Outer Counties

0	Observed Trips*		Estimate	d Trips**	Delta '	Trips	% Delta Trips		
County	METROP LAN Orlando Outer Counties		METROP LAN Orlando	Outer Counties	METROP LAN Orlando	Outer Counties	METROP LAN Orlando	Outer Counties	
METROPLA N Orlando	6,485,27 4	98,042	6,442,980	140,337	-42,294	42,295	-1%	43%	
Outer Counties	733,704	8,120,853	776,002	8,078,55 5	42,298	-42,298	6%	-1%	

Source: *ACS 2015, 2009 NHTS, **CFRPM 7

The estimated trips distributions within the METROPLAN Orlando MPO and the outer counties are generally consistent with the corresponding observations for all five trip purposes. Travel from the out counties to the METROPLAN Orlando area is over-stated by 6%. The smallest market, trips from METROPLAN Orlando to Outer Counties, is over-estimated by 44%. Overall, the estimated results are consistent with observed values.

4.4.9 Orange vs. Seminole/Osceola vs. Outer Region

Building upon the comparisons in 4.4.8, the following table examine the trip distribution of Orange County, the other two counties in the METROPLAN Orlando MPO region, and the other 8 counties for all five trip purposes total (HBW, HBSH, HBSR, HBO, and NHB) using the ACS 2015 and 2009 NHTS data and the estimated results.

Table 4-39 Observed Trips to Key Areas

County	To Orange	To Seminole/ Osceola	To Outer	Total	% to Orange	% to Semi nole/ Osce ola	% to Outer
Brevard	68,939	14,281	1,922,785	2,006,005	3%	1%	96%
Flagler	5,618	1,758	304,299	311,675	2%	1%	98%
Indian River	1,939	725	149,137	151,801	1%	0%	98%
Lake	188,150	30,215	890,055	1,108,420	17%	3%	80%
Marion	31,366	1,233	1,080,000	1,112,599	3%	0%	97%
Orange	3,663,362	213,216	43,610	3,920,188	93%	5%	1%
Osceola	360,308	736,939	41,131	1,138,378	32%	65%	4%
Polk	150,005	51,345	1,839,395	2,040,745	7%	3%	90%
Seminole	412,860	1,098,589	13,301	1,524,750	27%	72%	1%
Sumter	2,025	966	371,293	374,284	1%	0%	99%
Volusia	107,965	77,174	1,563,889	1,749,028	6%	4%	89%



County	To Orange	To Seminole/ Osceola	To Outer	Total	% to Orange	% to Semi nole/ Osce ola	% to Outer
Total	4,992,537	2,226,441	8,218,895	15,437,87 3	32%	14%	53%

Source: ACS 2015, 2009 NHTS

Table 4-40 Estimated Trips to Key Areas

County	To Orange	To Seminole/ Osceola	To Outer	Total	% to Orange	% to Semi nole/ Osce ola	% to Outer
Brevard	70,708	20,409	1,914,889	2,006,007	4%	1%	95%
Flagler	5,739	5,711	300,225	311,675	2%	2%	96%
Indian River	1,000	778	150,024	151,802	1%	1%	99%
Lake	188,257	38,069	882,096	1,108,423	17%	3%	80%
Marion	32,535	3,286	1,076,773	1,112,594	3%	0%	97%
Orange	3,655,334	207,597	57,259	3,920,190	93%	5%	1%
Osceola	353,796	722,016	62,566	1,138,378	31%	63%	5%
Polk	148,295	56,614	1,835,837	2,040,746	7%	3%	90%
Seminole	426,319	1,077,918	20,512	1,524,749	28%	71%	1%
Sumter	5,289	4,692	364,303	374,284	1%	1%	97%
Volusia	105,267	89,352	1,554,408	1,749,027	6%	5%	89%
Total	4,992,540	2,226,442	8,218,892	15,437,87 4	32%	14%	53%

Table 4-41 Delta Trips to Key Areas

County	To Orange	To Seminole/ Osceola	To Outer	Total	% to Orange	% to Semi nole/ Osce ola	% to Outer
Brevard	1,769	6,128	-7,896	2	1%	0%	-1%
Flagler	121	3,953	-4,074	0	0%	1%	-2%
Indian River	-939	53	887	1	0%	1%	1%
Lake	107	7,854	-7,959	3	0%	0%	0%
Marion	1,169	2,053	-3,227	-5	0%	0%	0%
Orange	-8,028	-5,619	13,649	2	0%	0%	0%



County	To Orange	To Seminole/ Osceola	To Outer	Total	% to Orange	% to Semi nole/ Osce ola	% to Outer
Osceola	-6,512	-14,923	21,435	0	-1%	-2%	1%
Polk	-1,710	5,269	-3,558	1	0%	0%	0%
Seminole	13,459	-20,671	7,211	-1	1%	-1%	0%
Sumter	3,264	3,726	-6,990	0	0%	1%	-2%
Volusia	-2,698	12,178	-9,481	-1	0%	1%	0%
Total	3	1	-3	1	0%	0%	0%

Source: CFRPM 7, ACS 2015, 2009 NHTS

The estimated trips distributions are generally consistent with the corresponding observations for all five trip purposes. No major discrepancies were found in the comparison.

4.4.10 Medium Truck County-to-County Flow

The following table displays the county-to-county flows for medium truck using the estimated results. Medium trucks are defined as a single-unit vehicle with three or four axles. These results are provided for information only since there is no county-to-county truck data available for this study.

Table 4-42 Estimated County-to-County Flows for Medium Truck

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	28,910	0	166	0	0	898	204	0	99	0	260	30,537
Flagler	0	2,260	0	5	0	0	0	0	2	0	915	3,183
Indian River	169	0	164	0	0	0	3	0	0	0	0	336
Lake	0	4	0	18,067	1,251	4,912	463	404	504	2,486	432	28,523
Marion	0	0	0	1,392	25,703	12	0	0	1	1,975	26	29,109
Orange	646	0	0	4,468	4	188,296	12,969	1,352	16,672	54	751	225,212
Osceola	125	0	2	457	0	12,813	15,851	1,910	107	1	0	31,266
Polk	0	0	0	377	0	1,345	1,916	37,318	2	6	0	40,963
Seminole	64	1	0	464	1	16,966	106	2	14,462	0	1,984	34,050
Sumter	0	0	0	2,704	1,781	104	1	8	1	5,315	0	9,915
Volusia	233	857	0	463	18	891	0	0	2,262	0	31,082	35,806
Total	30,146	3,123	332	28,398	28,758	226,236	31,512	40,994	34,112	9,837	35,451	468,899



4.4.11 Heavy Truck County-to-County Flow

The following table displays the county-to-county flows for heavy truck using the estimated results. Heavy truck is defined as the truck either with a combination-unit or multiple trailers. These results are provided for information only since there no county-to-county truck data is not available.

Table 4-43 Estimated County-to-County Flows for Heavy Truck

County	Brevard	Flagler	Indian River	Lake	Marion	Orange	Osceola	Polk	Seminole	Sumter	Volusia	Total
Brevard	3,236	7	13	23	6	1,661	262	43	140	4	285	5,680
Flagler	7	85	0	5	6	54	0	0	17	0	197	372
Indian River	13	0	0	0	0	2	0	0	0	0	0	15
Lake	24	5	0	1,407	740	2,586	243	317	325	497	228	6,372
Marion	7	6	0	741	4,154	858	52	58	61	716	136	6,788
Orange	1,655	53	2	2,542	809	36,177	4,026	2,633	4,862	607	2,058	55,424
Osceola	257	0	0	245	49	4,017	1,339	819	263	48	54	7,091
Polk	41	0	0	319	54	2,632	812	5,346	116	68	14	9,402
Seminole	142	17	0	326	59	4,845	260	115	1,408	49	696	7,918
Sumter	5	0	0	499	708	632	49	69	50	444	33	2,491
Volusia	279	196	0	238	134	2,067	53	14	702	33	3,200	6,916
Total	5,665	371	15	6,345	6,720	55,533	7,095	9,414	7,943	2,469	6,901	108,470

Source: CFRPM 7

4.4.12 Internal to External County-to-County Flow

The following table displays the county-to-county flows for Internal to External (IE) trip purpose using CFRPM 7 2015 estimated results. IE attractions were matched with the IE productions from a group of counties near the external station. These results are provided for information only since county-to-county IE data is not available.

Table 4-44 Estimated County-to-County Flows for Internal to External

County	Brevard	Flagler	Indian River	Marion	Osceola	Polk	Sumter	Volusia	Total
Flagler	4,843	7,258	0	4,217	160	0	412	39,314	56,204
Indian River	64,484	0	5,754	0	5,021	8,032	0	3,825	87,116
Marion	12	174	0	70,098	531	679	16,339	3,338	91,171
Osceola	8,800	0	1,114	0	3,669	12,763	14	96	26,457
Polk	1,625	0	47	2,384	15,950	182,330	6,746	2,066	211,147
Sumter	60	4	0	25,187	1,008	8,094	8,371	1,273	43,997
Volusia	166	276	0	950	28	7	154	2,707	4,289
Total	79,989	7,711	6,915	102,835	26,367	211,905	32,037	52,620	520,380



4.5 Special Purposes

The methodology of estimating trips for the unique Central Florida attractions dates to the I-Drive transit projects in the mid-1990s. The methodology was originally applied to the Orlando Urban Area Transportation Study (OUATS) model. In CFRPM 7, this methodology is applied to 6 special activity locations: Orange County Convention Center, Disney area, Universal area, Sea World area, Kennedy Space Center (KSC) Visitors Complex, and Port Canaveral (PC). There are three special purposes to these activity areas: visitor-based trips to hotels, resident-based trips to homes and external-based trips to user-specified external stations.

The model interprets production of these trips for special purposes at gate demand (via international attraction trade reports). Attractions of these special trips depend on hotels, homes, or user-specified external stations.

The methodology was originally applied to OUATS and caused the many issues for CFRPM:

- OUATS contained Orange, Osceola and Seminole counties plus parts of Volusia (southwestern portion), Lake (small portion) and Polk (small portion).
- Visitor-based and resident-based trips mostly came from Orange, Osceola and Seminole counties, and very little from other counties.
- With additional counties in CFRPM 7, these patterns become distorted:
 - Visitor-based and resident-based trips are mostly from Orange county, but not as much as before.
 - Meaningful number of trips are from counties some distance away from tourist areas, including Volusia, Polk (entire county), Marion, Brevard, Lake and Sumter.
 - Any hotel room or dwelling unit has equal opportunity to attract special trips regardless of location, which is a key point not included in the original OUATS specification. Too many resident and visitor trips were from outside major tourist areas in METROPLAN Orlando.
 - Methodology was not designed to sufficiently handle KSC and PC trips, since most visitor trips come from I-Drive/tourist areas.

Consequently, the project team adjusted the distribution of special purpose trips by:

- Analyzing 2015 AirSage dataset to identify observed visitor-based, resident-based and external-based shares by county,
- Adjusting the trip generation equations to reflect these shares by county, and
- Updating other factors based on AirSage data to improve directionality.

The following comparisons between the original and adjusted visitor-based, resident-based and external-based shares by county indicate the distributions after adjustment. Since the adjusted shares directly reflect the observed data, these figures are provided for informational purposes only.



Figure 4-2 shows a comparison for Orange County Convention Center between <u>original</u> shares (OCCVISA-O: visitor-based, OCCRESA-O: resident-based, and OCCEXTA-O: external-based) and <u>adjusted</u> shares (OCCVISA-A: visitor-based, OCCRESA-A: resident-based, and OCCEXTA-A: external-based) by county. The adjusted visitor-based and resident-based shares are reasonable with majority share from Orange county and reduced shares from other counties except for resident-based shares from Osceola county. The external-based shares do not need to be adjusted.

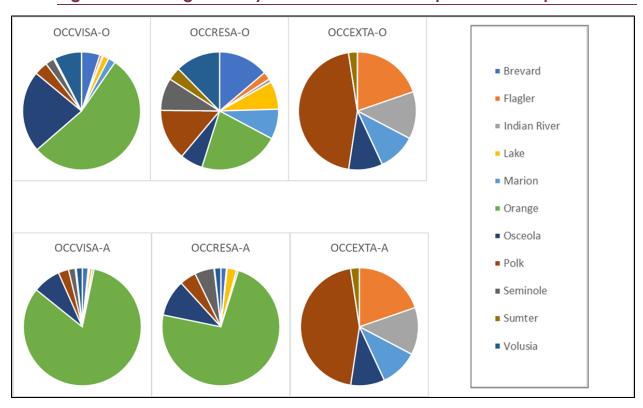


Figure 4-2: Orange County Convention Center Trip Shares Comparison

Figure 4-3 shows a similar type of comparison as for Orange County Convention Center by county level for Disney area. Original shares for the Disney area is presented as DISVISA-O: visitor-based, DISRESA-O: resident-based, and DISEXTA-O: external-based and adjusted shares presented as DISVISA-A: visitor-based, DISRESA-A: resident-based, and DISEXTA-A: external-based. The adjusted visitor-based shares are quite similar to the adjusted shares of Orange County Convention Center. Resident-based adjusted shares for Orange county are less than the shares for Orange County Convention Center while the shares for Osceola county are increased. Please note adjusted shares from other counties reduced a handful amount and the external-based shares do not need to be adjusted.



DISVISA-O DISRESA-O DISEXTA-O Brevard Flagler ■ Indian River Lake Marion Orange Osceola DISVISA-A DISRESA-A DISEXTA-A ■ Polk ■ Seminole Sumter Volusia

Figure 4-3: Disney Area Trip Shares Comparison

Figure 4-4 captures the comparison of trips in between original shares (O) and adjusted shares (A) by county for Universal Area. The comparison is divided into three categories e.g. VISA: visitor-based, RESA: resident-based, and EXTA-O: external-based. The adjusted visitor-based and resident-based shares are reasonable with majority share from Orange county while reduced shares from other counties except for visitor-based shares from Polk county and resident-based shares from Osceola and Polk county. Please note the external-based shares do not need to be adjusted.



UNIVISA-O UNIRESA-O UNIEXTA-O ■ Brevard ■ Flagler ■ Indian River Lake Marion Orange Osceola UNIVISA-A UNIRESA-A UNIEXTA-A ■ Polk ■ Seminole Sumter Volusia

Figure 4-4: Universal Area Trip Shares Comparison

Figure 4-5 shows a comparison for Sea World area between original trip shares and adjusted trip shares and represents quite similar results as trip shares for Orange County Convention Center.



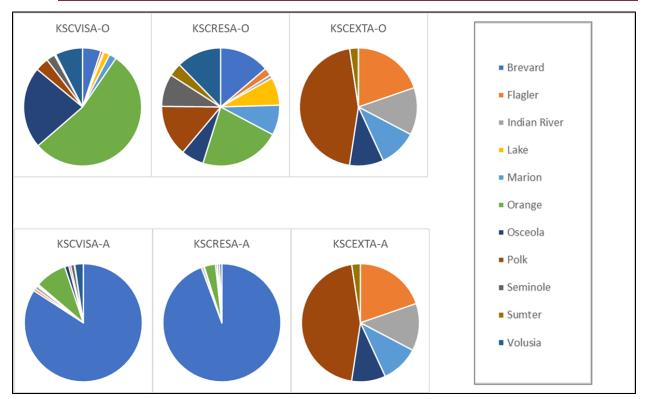
SEAVISA-O SEARESA-O SEAEXTA-O Brevard ■ Flagler ■ Indian River Lake Marion Orange Osceola SEAVISA-A SEARESA-A SEAEXTA-A ■ Polk ■ Seminole Sumter Volusia

Figure 4-5: Sea World Area Trip Shares Comparison

Figure 4-6 shows a comparison for Kennedy Space Center Visitors Complex between original shares (KSCVISA-O: visitor-based, KSCRESA-O: resident-based, and KSCEXTA-O: external-based) and adjusted shares (KSCVISA-A: visitor-based, KSCRESA-A: resident-based, and KSCEXTA-A: external-based). The adjusted visitor-based and resident-based shares are reasonable with majority share from Brevard county and reduced shares from other counties except for visitor-based share from Orange county. Please note the external-based shares do not need to be adjusted.



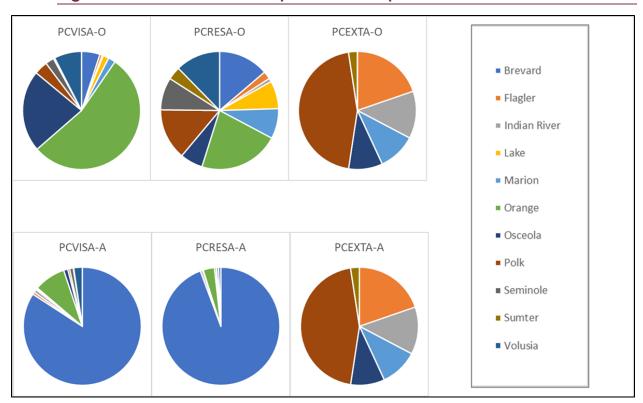
Figure 4-6: Kennedy Space Center Visitors Complex Trip Shares Comparison



Trip share comparison between original and adjusted shares for Port Canaveral is shown in Figure 4-7 and represents quite similar results as trip shares for Kennedy Space Center Visitors Complex.



Figure 4-7: Port Canaveral Trip Shares Comparison



5 Mode Choice

The mode choice step performs three primary functions. One function is to estimate, separately, the number of regional non-motorized trips, person trips by mode traveling to and from the Orlando International Airport (OIA), and the regional transit trips. (Please note that the estimated regional transit trips occurs in the offline CFRPM STOPS model). A second function is to deduce the non-motorized, OIA and transit trips from the person trip tables computed in the Trip Distribution step. The remaining trips are person auto trips. Finally, the third function converts the person auto trips to vehicle trips for highway assignment.

This chapter compares the estimated values from each of these three functions to observed values.

5.1 Non-Motorized Trips

The project team compared CFRPM non-motorized trip results to observed values in three respects: overall magnitude (expressed in terms of non-motorized share of total trips), trip lengths and demand at specific locations.

Non-motorized trips are computed, for each trip purpose, as a share of all trips using a utility equation based on the trip length as well as the origin and destination land uses. This equation was calibrated to match the corresponding share from the 2017 NHTS data (see Table 5-1). Consequently, the estimated non-motorized shares were compared to the observed values from the 2017 NHTS. The error range for the 2017 NHTS data is \pm 22% for a 95% confidence interval. Ranges reflect the margin of error (minimum to maximum) for observed non-motorized trips. The estimated non-motorized shares all reside within the error margins within the NHTS data. This is to be expected because the utility equations were calibrated to produce results within the observed range of values. Please note HBNW trips represents trips made by CFRPM 7 trip purposes HBSC, HBCU, HBSH, HBSR, and HBO.

Table 5-1 Observed and Estimated Non-motorized Shares

Purpose	NHTS Error Range of Observed Non-Motorized Share of Total Trips	Estimated Non-Motorized Share of Total Trips
HBW	2-3%	3%
HBNW	9-15%	12%
NHB	5-9%	9%
TOTAL	7-11%	9%

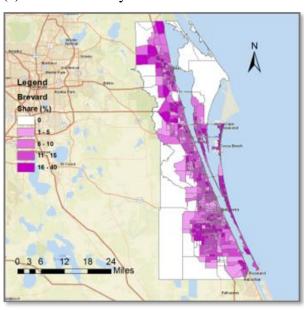
Source: CFRPM 7, 2017 NHTS



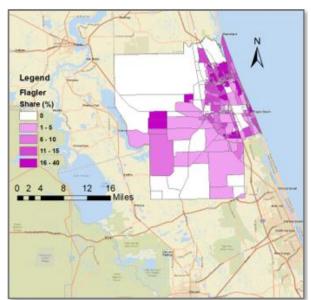
Figure 5-1 illustrates the non-motorized trip shares (visualized using attraction zone share) by zone. The darker colored zones have higher non-motorized trip shares than lighter colored zones. The structure of the utility equation estimates higher shares of non-motorized trips in dense areas such as urban, suburban, and some residential areas. This corresponds with the maps shown in Figure 5-1.

Figure 5-1 Zonal Non-Motorized Shares by County

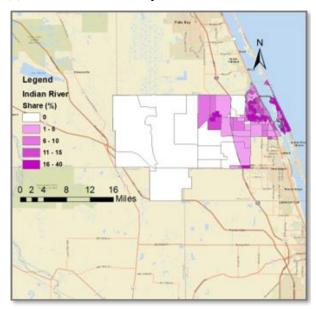
(a) Brevard County



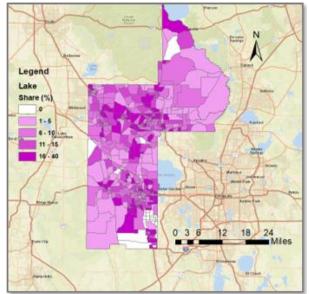
(b) Flager County



(c) Indian River County

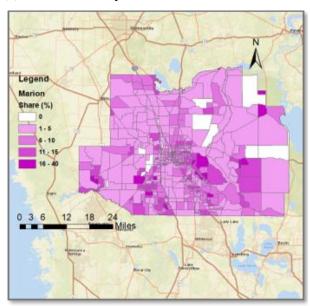


(d) Lake County

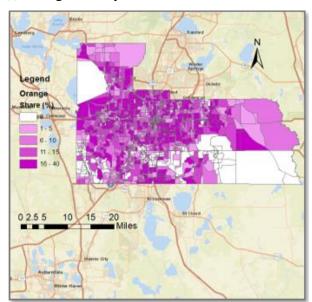




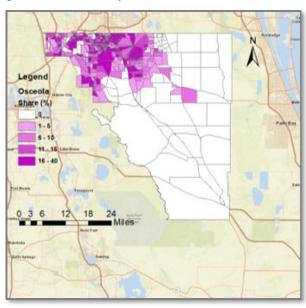
(e) Marion County



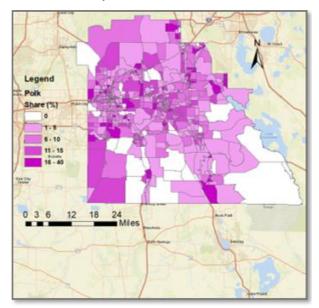
(f) Orange County



(g) Osceola County

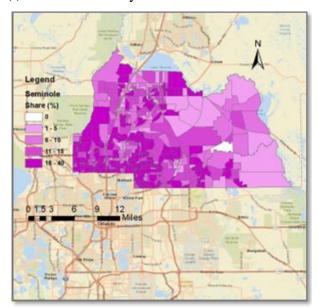


(h) Polk County

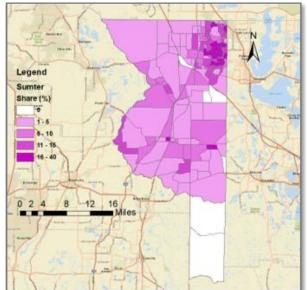




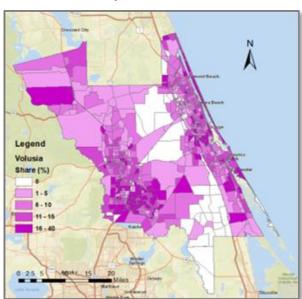
(i) Seminole County



(j) Sumter County



(k) Volusia County



The project team also compared the estimated and observed non-motorized by trip length. Trip lengths were not directly calibrated, so these comparisons can be helpful in assessing the reasonableness of the model estimates. Most non-motorized trips consist of walk and bicycle trips, so their trip length should be shorter than the other trips. Figure 5-2, Figure 5-3, and Figure 5-4 present the trip length for non-motorized trips and total person trips by trip purpose. For all trip purposes, all non-motorized trips are accomplished within four miles, and at least half are between one and three miles. Based on these results, CFRPM non-motorized trip length distributions appear to be reasonable.



Figure 5-2 Percentage of Non-motorized and Total HBW Trip by Distance

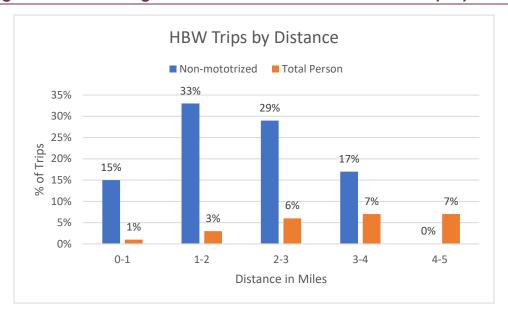
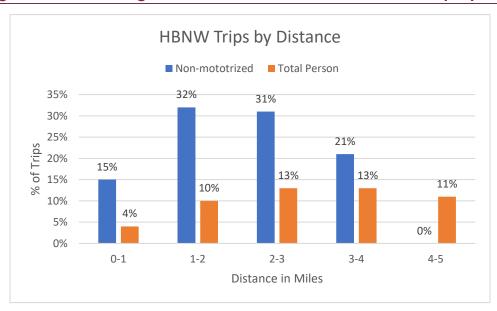


Figure 5-3 Percentage of Non-motorized and Total HBNW Trip by Distance





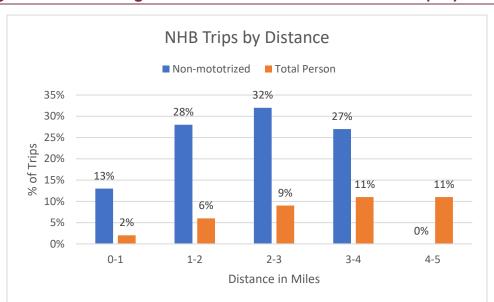


Figure 5-4 Percentage of Non-motorized and Total NHB Trip by Distance

Finally, the project team attempted to compare the estimated non-motorized trips to the bicycle and pedestrian counts recently collected by FDOT District 5. At selected intersections throughout the District, the bicycle/pedestrian count data have daily approach and crossing volumes from each intersection leg. This proved to be challenging because CFRPM estimates non-motorized shares for each zone and does not estimate zone-to-zone flows. These flows would be required to make comparisons to the observed counts.

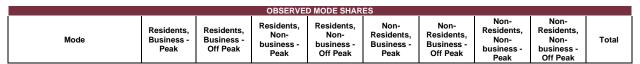
5.2 Orlando International Airport (OIA) Trips

CFRPM 7 includes separate generation, distribution, and mode choice for the Orlando International Airport (OIA). The 2015 Air Passenger Survey conducted by the Greater Orlando Aviation Authority (GOAA), the agency that operates OIA and supplemental GOAA data, formed the basis of the observed data used to calibrate the generation, distribution, and mode choice models.

The mode choice observed/estimated comparisons are shown in Table 5-2 and

Table 5-3. These are for informational purposes only since the mode choice model was calibrated to produce results nearly identical to the observed values.

Table 5-2 Observed and Estimated Airport Passenger Mode Shares





Onsite Parking	1.10%	1.40%	2.70%	4.10%	0.00%	0.00%	0.00%	0.00%	9.20%
Offsite Parking	0.20%	0.70%	1.40%	2.70%	0.00%	0.00%	0.00%	0.00%	5.00%
Dropped off	0.90%	2.10%	4.10%	7.90%	0.40%	0.60%	2.40%	3.80%	22.20%
Rental Car	0.00%	0.00%	0.00%	0.00%	2.70%	4.30%	9.00%	18.60%	34.60%
DME	0.00%	0.00%	0.00%	0.00%	0.20%	0.40%	5.00%	6.50%	12.10%
Taxi	0.30%	0.40%	0.80%	1.30%	1.40%	3.20%	2.80%	5.20%	15.40%
Walk access-local bus	0.10%	0.10%	0.10%	0.20%	0.10%	0.20%	0.20%	0.50%	1.40%
Walk access-premium transit	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Auto access-local bus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Auto access-premium transit	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Transit sub-total	0.10%	0.10%	0.10%	0.20%	0.10%	0.20%	0.20%	0.50%	1.40%
Total	2.60%	4.70%	9.10%	16.20%	4.80%	8.50%	19.50%	34.60%	100.00%
			ESTIMATE	D MODE SHAR	ES				
Mode	Residents, Business - Peak	Residents, Business - Off Peak	Residents, Non- business - Peak	Residents, Non- business - Off Peak	Non- Residents, Business - Peak	Non- Residents, Business - Off Peak	Non- Residents, Non- business - Peak	Non- Residents, Non- business - Off Peak	Total
Onsite Parking	1.00%	1.40%	2.60%	4.10%	0.00%	0.00%	0.00%	0.00%	9.20%
Offsite Parking	0.30%	0.70%							
Dropped off		0.7076	1.40%	2.70%	0.00%	0.00%	0.00%	0.00%	5.10%
Rental Car	0.90%	2.00%	1.40% 4.10%	2.70% 8.00%	0.00%	0.00%	0.00% 2.40%	0.00% 3.90%	5.10% 22.30%
	0.90% 0.00%								
DME		2.00%	4.10%	8.00%	0.40%	0.50%	2.40%	3.90%	22.30%
DME Taxi	0.00%	2.00% 0.00%	4.10% 0.00%	8.00% 0.00%	0.40% 2.70%	0.50% 4.30%	2.40% 9.00%	3.90% 18.60%	22.30% 34.60%
	0.00%	2.00% 0.00% 0.00%	4.10% 0.00% 0.00%	8.00% 0.00% 0.00%	0.40% 2.70% 0.30%	0.50% 4.30% 0.40%	2.40% 9.00% 5.00%	3.90% 18.60% 6.40%	22.30% 34.60% 12.10%
Taxi	0.00% 0.00% 0.20%	2.00% 0.00% 0.00% 0.40%	4.10% 0.00% 0.00% 0.90%	8.00% 0.00% 0.00% 1.20%	0.40% 2.70% 0.30% 1.40%	0.50% 4.30% 0.40% 3.20%	2.40% 9.00% 5.00% 2.80%	3.90% 18.60% 6.40% 5.10%	22.30% 34.60% 12.10% 15.30%
Taxi Walk access-local bus	0.00% 0.00% 0.20% 0.10%	2.00% 0.00% 0.00% 0.40% 0.10%	4.10% 0.00% 0.00% 0.90% 0.10%	8.00% 0.00% 0.00% 1.20%	0.40% 2.70% 0.30% 1.40% 0.10%	0.50% 4.30% 0.40% 3.20% 0.20%	2.40% 9.00% 5.00% 2.80% 0.20%	3.90% 18.60% 6.40% 5.10%	22.30% 34.60% 12.10% 15.30% 1.40%
Taxi Walk access-local bus Walk access-premium transit	0.00% 0.00% 0.20% 0.10% 0.00%	2.00% 0.00% 0.00% 0.40% 0.10%	4.10% 0.00% 0.00% 0.90% 0.10% 0.00%	8.00% 0.00% 0.00% 1.20% 0.20%	0.40% 2.70% 0.30% 1.40% 0.10%	0.50% 4.30% 0.40% 3.20% 0.20% 0.00%	2.40% 9.00% 5.00% 2.80% 0.20% 0.00%	3.90% 18.60% 6.40% 5.10% 0.50% 0.00%	22.30% 34.60% 12.10% 15.30% 1.40% 0.00%
Taxi Walk access-local bus Walk access-premium transit Auto access-local bus	0.00% 0.00% 0.20% 0.10% 0.00%	2.00% 0.00% 0.00% 0.40% 0.10% 0.00%	4.10% 0.00% 0.00% 0.90% 0.10% 0.00%	8.00% 0.00% 0.00% 1.20% 0.20% 0.00%	0.40% 2.70% 0.30% 1.40% 0.10% 0.00%	0.50% 4.30% 0.40% 3.20% 0.20% 0.00%	2.40% 9.00% 5.00% 2.80% 0.20% 0.00%	3.90% 18.60% 6.40% 5.10% 0.50% 0.00%	22.30% 34.60% 12.10% 15.30% 1.40% 0.00%

Table 5-3 Difference between Observed and Estimated Shares

		PERCEN	T DIFFERENCI	E (ESTIMATED	- OBSERVED)				
Mode	Residents, Business - Peak	Residents, Business - Off Peak	Residents, Non- business - Peak	Residents, Non- business - Off Peak	Non- Residents, Business - Peak	Non- Residents, Business - Off Peak	Non- Residents, Non- business - Peak	Non- Residents, Non- business - Off Peak	Total
Onsite Parking	-0.01%	0.05%	-0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.01%
Offsite Parking	0.07%	-0.01%	-0.06%	0.03%	0.00%	0.00%	0.00%	0.00%	0.03%
Dropped off	0.02%	-0.07%	0.04%	0.01%	0.01%	-0.02%	0.01%	0.07%	0.07%
Rental Car	0.00%	0.00%	0.00%	0.00%	-0.02%	-0.01%	-0.01%	0.02%	-0.02%
DME	0.00%	0.00%	0.00%	0.00%	0.01%	0.03%	-0.01%	-0.03%	0.00%
Taxi	-0.09%	0.04%	0.05%	-0.08%	-0.02%	-0.02%	0.01%	-0.06%	-0.15%
Walk access-local bus	-0.01%	-0.01%	-0.02%	0.00%	0.01%	0.02%	0.01%	0.00%	0.00%
Walk access-premium transit	0.01%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Auto access-local bus	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%	-0.01%	0.00%
Auto access-premium transit	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Transit sub-total	0.00%	0.00%	0.00%	0.02%	0.01%	0.01%	0.01%	0.00%	0.05%
Total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Source: 2015 Air Passenger Survey

5.3 Transit Trips

The project team validated transit trips by linked trips, boardings by agency and transfer rates. CFRPM STOPS model, an offline process using FTA's STOPS model, estimates all aspects of transit demand. The results of the STOPS model are compared to observed values in this section.



Linked trips represent the complete journey from origin to destination. Unlinked trips, as called boardings, begin when a rider boards a transit vehicle and ends when the rider alights the same transit vehicle. Unlinked trips are always equal to or greater than the number of linked trips. For any rider's journey, the difference in unlinked and linked trips are transfers. A journey with no transfers produces one linked and one unlinked trip. A journey with two transfers produces one linked and three unlinked trips.

For each agency, the observed unlinked and linked transit trips were taken from locally collected on-board surveys (if available) or imputed from nearby on-board surveys. On-board surveys were available from LYNX, SunRail, LakeXpress and the western portion of VOTRAN. The fieldwork for these surveys was conducted in 2017.

For each of the other agencies, including the remaining portion of VOTRAN, their National Transit Database (NTD) Agency Profile provided the average weekday unlinked trips for 2015 for fixed-route service. Citrus Connection and SunTran provided their most recent ridership (unlinked trip) information, which was used instead of the NTD data. Linked trips by trip purpose and auto ownership were then imputed using the available on-board survey information from LakeXpress, since it serves areas similar to areas served by SCAT, CitrusConnection, and SunTran and their rider characteristics are likely to be similar as well.

5.3.1 Linked Transit Trips

Table 5-4 compares the observed and estimated linked trips from STOPS, and Table 5-5 presents the difference between them. This is for informational purposes only since the STOPS model was calibrated to the linked trips. The differences between the total observed and estimated linked minor – defined as less than 10% or 500 trips – by trip purpose and access mode. Please note HBNW represents trips made by CFRPM 7 HBSH, HBSR and HBO trip purposes.

Table 5-4 Observed and Estimated Linked Trips

Access		Observ	ved					
Mode	HBW	HBNW	NHB	Total	HBW	HBNW	NHB	Total
Walk	36,251	31,463	10,403	78,117	37,079	30,805	10,836	78,720
KNR	1,729	1,347	471	3,547	1,713	1,106	422	3,241
PNR	1,069	567	168	1,804	1,579	203	85	1,867
Total	39,049	33,377	11,042	83,468	40,371	32,114	11,343	83,828

Table 5-5 Delta Linked Trips (Estimated-Observed)

Delta (Estimated - Observed)	% Delta (Delta / Observed)
------------------------------	----------------------------



Access Mode	HBW	HBNW	NHB	Total	HBW	HBNW	NHB	Total
Walk	828	-658	433	603	2%	-2%	4%	1%
KNR	-16	-241	-49	-306	-1%	-18%	-10%	-9%
PNR	510	-364	-83	63	48%	-64%	-49%	3%
Total	1,322	-1,263	301	360	3%	-4%	3%	0%

Source: CFRPM 7, County Transit Agency

5.3.2 Boardings by Agency

The project team compared the boardings by access mode by the transit agency to verify the STOPS results. The observed and estimated boardings are compared in Table 5-6 through Table 5-12. Boardings are not precisely calibrated in STOPS, so this comparison is helpful in assessing the STOPS model's understanding of each county's transit demand.

The public transit agencies that operate in the region include:

- LYNX (Orange, Seminole, Osceola and limited service in Polk Counties),
- SunRail commuter rail (Volusia, Seminole, Orange, Osceola Counties),
- Votran (Volusia County),
- LakeXpress (Lake County),
- Space Coast Area Transit (SCAT) (Brevard County),
- CitrusConnection (Polk County) and
- SunTran (Marion County).

The private I-Ride trolley provides bus transportation along the I-Drive resort area and is extensively used by tourists. The "Synthetic" STOPS mode is designed to reflect transit travel patterns of residents only, so the I-Ride Trolley is not included in this model

For each agency, total estimated trips are within \pm 5% of the observed trips for each agency. The differences by access mode are very minor (within 10% or 500 trips). PNR boardings show a high percentage of delta compared to other access modes. However, this has a slight impact on the model validity since this is the least-used access mode in the region.

Table 5-6 LYNX Boardings by Access Mode

Access Mode	Observed	Estimated	Delta	% Delta
Walk	87,468	86,168	(1,300)	-1%
KNR	3,180	2,675	(505)	-16%
PNR	949	1,141	192	20%
Total	91,597	89,984	(1,613)	-2%



Table 5-7 SunRail Boardings by Access Mode

Access Mode	Observed	Estimated	Delta	% Delta
Walk	1,009	1,198	189	19%
KNR	740	881	141	19%
PNR	1,498	1,166	(332)	-22%
Total	3,247	3,245	(2)	0%

Source: CFRPM 7, County Transit Agency

Table 5-8 Votran Boardings by Access Mode

Access Mode	Observed	Estimated	Delta	% Delta
Walk	3,809	3,665	(144)	-4%
KNR	190	142	(48)	-25%
PNR	15	17	2	13%
Total	4,014	3,824	(190)	-5%

Source: CFRPM 7, County Transit Agency

Table 5-9 LakeXpress Boardings by Access Mode

Access Mode	Observed	Estimated	Delta	% Delta
Walk	1,437	1,374	(63)	-4%
KNR	71	65	(6)	-8%
PNR	6	27	21	350%
Total	1,514	1,466	(48)	-3%

Source: CFRPM 7, County Transit Agency

Table 5-10 SCAT Boardings by Access Mode

Access Mode	Observed	Estimated	Delta	% Delta
Walk	7,773	7,871	98	1%
KNR	387	273	(114)	-29%
PNR	32	43	11	34%
Total	8,192	8,187	(5)	0%



Table 5-11 SunTran Boardings by Access Mode

Access Mode	Observed	Estimated	Delta	% Delta
Walk	1,522	1,478	(44)	-3%
KNR	80	100	20	25%
PNR	-	-	-	-
Total	1,602	1,578	(24)	-1%

Source: CFRPM 7, County Transit Agency

Table 5-12 CitrusConnection Boardings by Access Mode

Access Mode	Observed	Estimated	Delta	% Delta
Walk	5,152	4,901	(251)	-5%
KNR	256	241	(15)	-6%
PNR	21	44	23	110%
Total	5,429	5,186	(243)	-4%

Source: CFRPM 7, County Transit Agency

5.3.3 Transfer Rate

Transfers are the difference between unlinked and linked trips. The transfer rates are calculated using the following equation:

$$Transfer\ Rate = \frac{Unlinked\ Trips}{Linked\ Trips} - 1$$

Transfers are an important characteristic in transit demand since a meaningful percentage of riders transfer within the transit system. Transfers are not precisely calibrated in STOPS, so this comparison is helpful in assessing the STOPS model's understanding of each county's transit demand.

There is an only 3% difference between the observed and estimated regional transfer rate, as seen in Table 5-13, indicating that the transit model understands the transferring activity of Central Florida transfer riders at a regional level.

Table 5-13 Transfer Rate

	Linked Trips	Unlinked Trips	Transfer Rate
Observed	83,466	115,595	38%
Estimated	83,912	113,483	35%



5.4 Auto Occupancy Rates

CFRPM 7 uses average auto occupancy rates to convert auto person trips to vehicle trips. It uses one occupancy rate for each trip purpose. To assess its reasonableness, we make three rate comparisons in Table 5-14: one for "all auto trips", one that reflects only SR 2 auto trips, and another that reflects only SR 3+ auto trips. These three comparisons help ensure that CFRPM is producing a reasonable balance of drive alone and higher-occupancy vehicle trips. Overall, the all auto occupancy rate is in the 95% confidence interval of the rate – (1.24, 1.44) – derived from the 2017 NHTS data for the Orlando-Kissimmee-Sanford area¹⁰.

Table 5-14 CFRPM 7 Average Auto Occupancy Rates

Occupancy	HBW	HBNW*	NHB	Total
All Auto Trips	1.12	1.51	1.35	1.39
SR 2*	2.22	2.36	2.37	2.35
SR 3+**	3.20	3.45	3.30	3.40

^{*} Shared-Ride (SR) 2: two or more people in a vehicle while driving

Source: CFRPM 7

Further comparisons were made with other Florida models and NHTS data (see Figure 5-5). CFRPM 7 auto occupancy rates were compared to the corresponding rates from other trip-based models CFRPM 6.2, TBRPM 8.2, SERPM 6.5.4 as well as 2009 and 2017 NHTS data. Please note 2017 NHTS HBW data for Orlando area is insufficient to estimate.

CFRPM 7 average auto occupancy rates are consistent with rates from other models or NHTS data sources. These high-level comparisons show that CFRPM 7 uses the reasonable average auto occupancy rates.

¹⁰ NHTS table Designer (https://nhts.ornl.gov/), Federal Highway Administration, 2017 NHTS



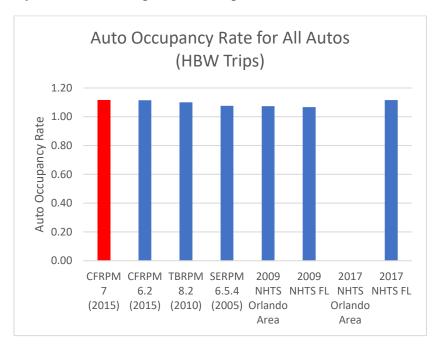
CFRPM7 Model Validation Report // January 2021

^{*} Shared-Ride (SR) 3+: three or more people in a vehicle while driving

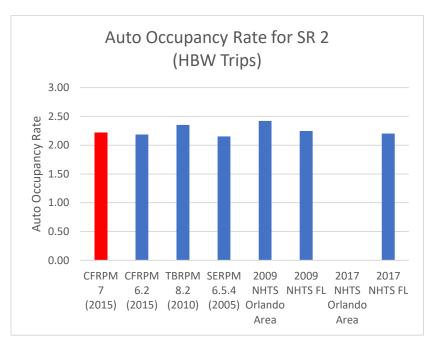
^{*} HBNW = HBSH + HBSR + HBSC + HBCU + HBO

Figure 5-5 Comparison of Auto Occupancy Rate

(a) Auto occupancy rate for HBW trips: all auto trips

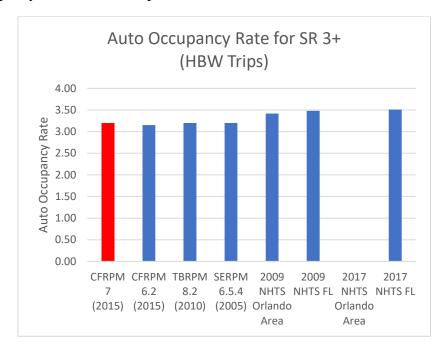


(b) Auto occupancy rate for HBW trips: SR 2

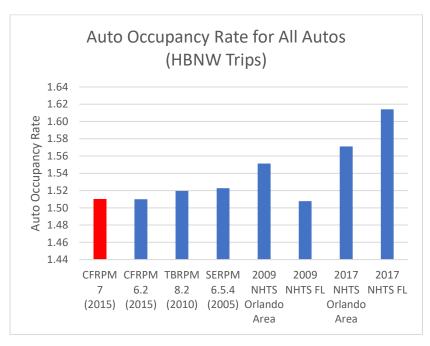




(c) Auto occupancy rate for HBW trips: SR 3+

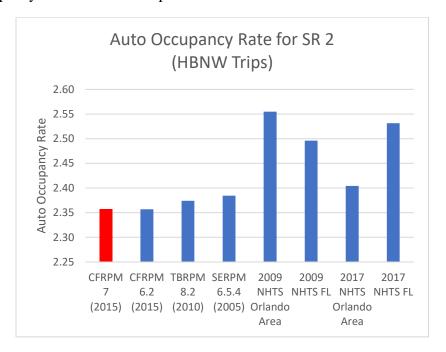


(d) Auto occupancy rate for HBNW trips: all auto trips

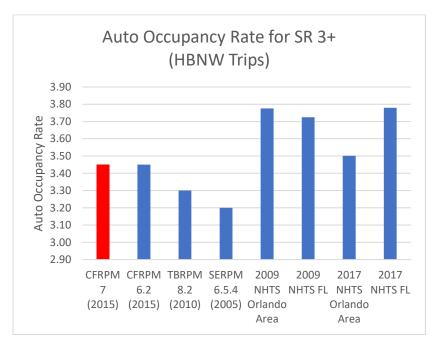




(e) Auto occupancy rate for HBNW trips: SR 2

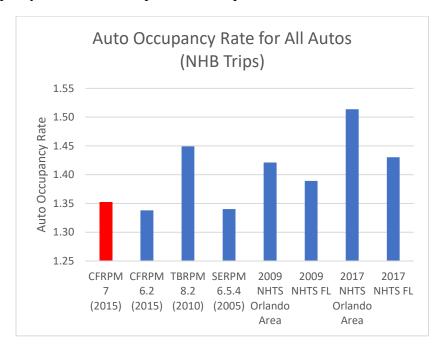


(f) Auto occupancy rate for HBNW trips: SR 3+

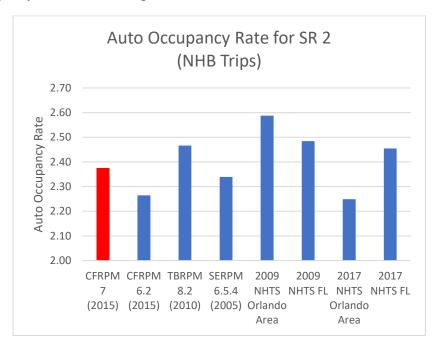




(g) Auto occupancy rate for NHB trips: all auto trips

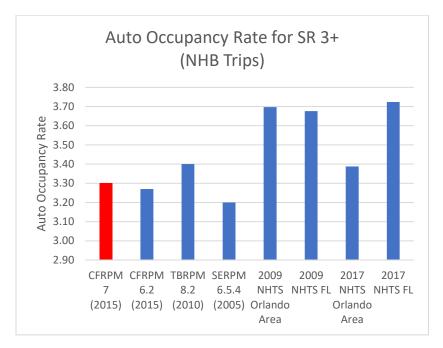


(h) Auto occupancy rate for NHB trips: SR 2





(i) Auto occupancy rate for NHB trips: SR 3+



Another comparison analyzed CFRPM 7's percentages of drive alone, SR 2 and SR 3+ trips (see Table 5-15) with those from other Florida models and the NHTS data (see Figure 5-6). Please note 2017 NHTS HBW data for SR3+ for Orlando area is insufficient to estimate.

Table 5-15 CFRPM 7 Person Trips by Auto Occupancy and Trip Purpose

Auto occupancy	HBW	HBNW	NHB	Total
Drive Alone	81.05%	41.34%	55.00%	52.61%
SR 2*	14.00%	37.52%	27.00%	31.63%
SR 3+**	4.95%	21.14%	18.00%	15.76%
Total	100.00%	100.00%	100.00%	100.00%

^{*} Shared-Ride 2: two people in a vehicle when driving

Source: CFRPM 7

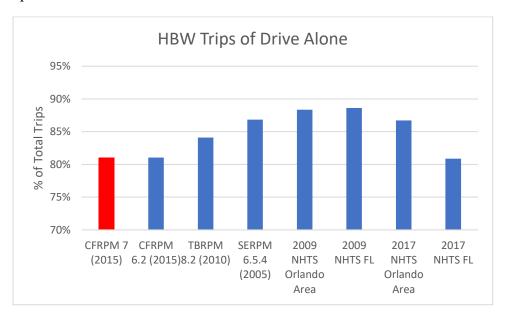
While this comparison does not validate CFRPM 7 values, it does provide reassurance that the values are not significantly incorrect.



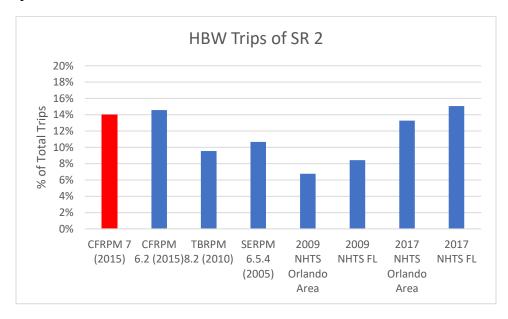
^{*} Shared-Ride 3+: three or more people in a vehicle when driving

Figure 5-6 Percentage of Person Trips by Auto Occupancy and Trip Purpose

(a) HBW trips: Drive Alone

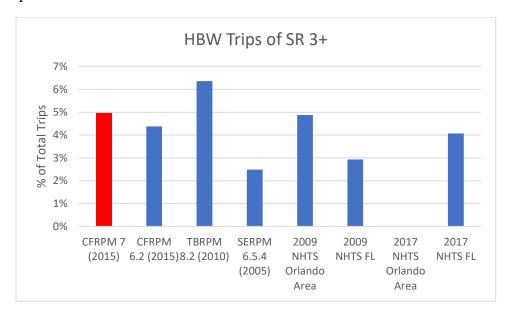


(b) HBW trips: SR 2

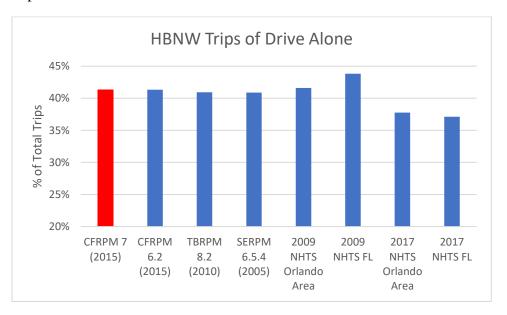




(c) HBW trips: SR 3+

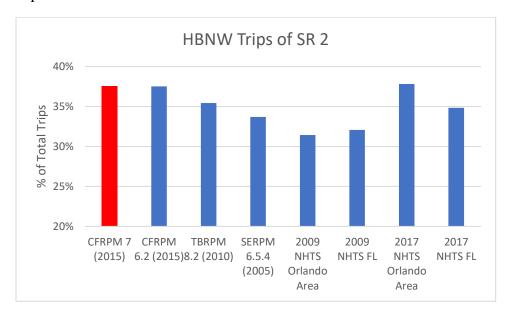


(d) HBNW trips: Drive Alone

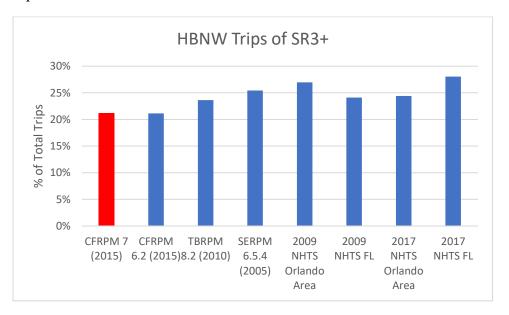




(e) HBNW trips: SR 2

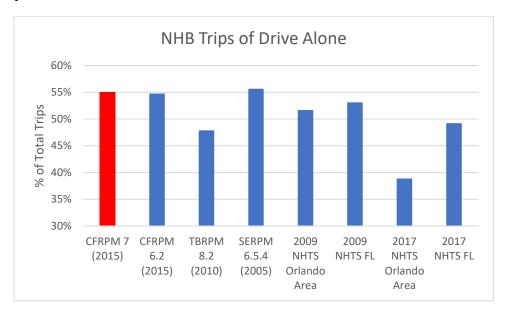


(f) HBNW trips: SR 3+

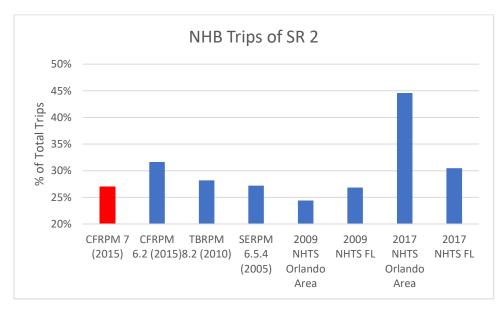




(g) NHB trips: Drive Alone

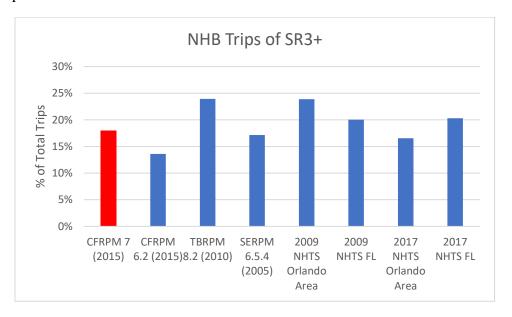


(h) NHB trips: SR 2





(i) NHB trips: SR 3+



The comparisons of auto occupancy rates and percentages of trips by auto occupancy indicate that CFRPM 7's values are similar to those from the NHTS datasets and other Florida models. This indicates that CFRPM 7's estimates of auto trips for these purposes are reasonable given the number of person trips produced by the Trip Distribution step.



6 Highway Assignment

Validating the highway (or roadway) assignment helps to ensure users that CFRPM 7 reasonably reflects auto travel patterns and the demand of the roadway network. This chapter summarizes the process used to validate highway assignment and provides numerous comparisons of observed data (traffic counts and travel time observations) and model estimates.

6.1 Methodology

The validation process begins by comparing model estimates to observed data. Then, where significant differences exist, the root cause is identified and CFRPM has adjusted accordingly. This compare \rightarrow identify \rightarrow adjust process is repeated until no significant differences remain.

The primary observed datasets used for comparison are the 2015 traffic counts and travel speed observations. For CFRPM 7, 11,335 directional traffic counts in 15-minute increments were collected from 6,349 count stations. Also, 20,174 15-minute travel speed observations were collected from 8,242 Traffic Message Channels (TMCs). Both the traffic counts and observed speeds were aggregated into four time periods. The traffic counts were also converted to Average Peak Season Weekday Traffic (PSWDT) levels. The observed speeds are used to verify modeled travel time estimates.

Model estimates are considered "valid" if they fall within pre-specified ranges of benchmarks or metrics. These ranges were specified in 2016 in a document intended for an earlier version of CFRPM, *Recommendations for Expanded Validation Metrics for CFRPM v6.2*. Ranges were specified for many metrics and benchmarks.

Table 6-1 Highway Assignment Benchmarks

Metric	Acceptable	Preferable
Freeway Volume-over-Count Ratio (FT 10s, 80s)	+/- 7%	+/- 6%
Divided Arterial Volume-over-Count Ratio (FT 20s)	+/- 15%	+/- 10%
Undivided Arterial Volume-over-Count Ratio (FT 30s)	+/- 15%	+/- 10%
Collector Volume-over-Count Ratio (FT 40s)	+/- 25%	+/- 20%
One-way/Frontage Road Volume-over-Count Ratio (FT 60s)	+/- 25%	+/- 20%
Ramps Volume-over-Count Ratio (FT 70s)	+/- 25%	+/- 20%
Toll Roads-Freeway Volume-over-Count Ratio (FT 91)	+/- 7%	+/- 6%
Toll Roads-Arterial Volume-over-Count Ratio (FT 92)	+/- 15%	+/- 15%
Volume-over-Count Ratio for External Model Cordon Lines	+/- 1%	+/- 1%
Regional Volume-over-Count Ratio	+/- 16%	+/- 12%
Assigned VMT-over-Count Ratio Regionwide	+/- 5%	+/- 2%
Assigned VHT-over-Count Ratio Regionwide	+/- 5%	+/- 2%



Metric	Acceptable	Preferable
Assigned VMT-over-Count Ratio by FT/AT/No. of Lanes	+/- 25%	+/- 15%
Assigned VHT-over-Count Ratio by FT/AT/No. of Lanes	+/- 25%	+/- 15%
Screenlines with greater than 70,000 AADT	+/- 1	0%
Screenlines with 35,000 to 70,000 AADT	+/- 1	5%
Screenlines with less than 35,000 AADT	+/- 2	20%
Percent error for volume group < 10,000 AADT	50%	25%
Percent error for volume group 10,000-30,000 AADT	30%	20%
Percent error for volume group 30,000-50,000 AADT	25%	15%
Percent error for volume group 50,000-65,000 AADT	20%	10%
Percent error for volume group 65,000-75,000 AADT	15%	5%
Percent error for volume group 75,001+ AADT	10%	5%
RMSE for links with < 5,000 vehicles per day	100%	45%
RMSE for links with 5,000-9,999 vehicles per day	45%	35%
RMSE for links with 10,000-14,999 vehicles per day	35%	27%
RMSE for links with 15,000-19,999 vehicles per day	30%	25%
RMSE for links with 20,000-29,999 vehicles per day	27%	15%
RMSE for links with 30,000-49,999 vehicles per day	25%	15%
RMSE for links with 50,000-59,999 vehicles per day	20%	10%
RMSE for links with 60,000+ vehicles per day	19%	10%
RMSE regionwide	45%	35%
	80% of	50% of
AM peak roadway travel times in selected travel corridors	corridors	corridors
	within 20% 80% of	within 10% 50% of
Midday roadway travel times in selected travel corridors	corridors	corridors
	within 20%	within 10%
	80% of	50% of
PM peak roadway travel times in selected travel corridors	corridors	corridors
	within 20%	within 10%

Many adjustments were identified throughout the calibration and validation of the highway assignment process. These adjustments, briefly described here individually, are grouped into the team's three perspectives:

- 1. "Big Picture": for a particular aspect of travel demand, is the assignment correctly reflecting the overall magnitude or perspective?
- 2. "Regional Focus": for a particular aspect of travel demand, is the assignment correctly reflecting the county-to-county travel demand in magnitude?
- 3. "Localized Focus": for a particular aspect of travel demand, is the assignment correctly reflecting the travel demand within each county?



This chapter reflects CFRPM 7 results after all adjustments have been made. These adjustments include:

- The CONFAC¹¹ values, originally defined as the number of hours within each time period, was adjusted to reflect the ratio of peak hour volume to time period volume. The original definition was resulting in extensive free-flow conditions, even during peak periods.
- HBSC trips were adjusted so that they were balanced at the county-level to avoid illogically long student trips that were contributing to inflated VMT and VHT levels.
- HBCU productions were limited to occur only within 20 miles of college campuses to avoid illogically long student trips that were also contributing to inflated VMT and VHT levels.
- Some external trip productions were adjusted to match the latest external counts. They previously were adjusted to an earlier set of external counts.
- Trips to/from the special purposes were modified to better reflect actual travel patterns, as
 defined by the 2015 AirSage data collected by the Department in 2016. These travel
 patterns had not been validated in previous versions of CFRPM.
- There were several adjustments to the HBW, HBNW & NHB trip production rates. Earlier versions produced substantially higher VMT and VHT.
- Estimated free-flow speeds were reduced by 5 mph to freeways and collectors. The original free-flow speeds led to higher VMT on these facilities.

Some model adjustments made to improve CFRPM's representation of the county-to-county travel demand magnitude or perspective include:

- County-to-county K-factors were applied for the HBW, HBNW and NHB trip purposes
 to better reflect the nuanced travel patterns between the Orlando urban area and the
 surrounding counties. Without these changes travel to/from the Orlando urban area was
 over-stated.
- The truck generation rates were adjusted for each county. The original rates were consistent across the region and produced extremely high truck volumes.
- The trip generation rates of the counties outside the METROPLAN Orlando area were reduced by 9%. The earlier rates produced significantly higher traffic in those counties.
- The rural roadway capacities to be more consistent with urban/suburban capacities. The
 original rural roadway capacities were substantially lower than the corresponding
 urban/suburban capacities.

¹¹ The Capacity Factors (CONFAC) are designed to convert peak hour capacity to time period capacity for the TOD model. The CONFAC values are determined by the time period count to peak hour count ratios using the traffic count database. For more details, see Chapter 8.1 in *CFRPM 7 Model Description Report*.



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- An additional 1-2 minutes of terminal time was added to certain area types so that they were consistent with the terminal times used for the observed TLFDs.
- The IE trip attractions were adjusted towards the non-Orlando urban counties. The original rates resulted in most of the IE trips traveling to the Orlando urban area, resulting in significantly high volumes along I-4.

Some model adjustments were made to improve CFRPM's representation of the demand magnitude within each county include:

- The value-of-time was increased. The original values-of-time, based on the average wage
 rates for the Orlando area, was causing illogical paths near toll plazas. Vehicles used offand on-ramps to avoid toll plazas in at least three different counties.
- A distance factor was applied to better reflect the demand on freeways that do not experience regular congestion (i.e., all counties except Orange County). Before applying this factor, freeway demand was much higher than arterial demand in these areas.

6.2 Traffic Volume-Related Comparisons

CFRPM 7 model output volumes were examined and compared to the actual 2015 FDOT traffic ground counts collected on various roadways throughout the network in the following sections.

6.2.1 Daily Comparison for Volume Over Count

Assigned daily volumes from highway assignment are compared to observed daily traffic counts to confirm that the model sufficiently represents the travel patterns of the model area. The volume-to-count ratio (i.e., volume/count) is the primary metric (see Table 6-2) for this comparison. There are acceptable and preferable ranges of the volume/count ratio for each facility type. These ranges have a reciprocal relationship to the count on the facility. For instance, the ratio of a facility with low traffic counts is more sensitive to change in the volume, so it has a wider range. Therefore, a freeway for the heaviest traffic has a narrower range. Exceptionally, the range of an external station connector is the shortest. Since the production of the external station connector is calculated using the traffic counts on the connector, the volume and count should be the same in this case. As seen in Table 6-2, the ratios of all facility types lie within the preferable benchmark range.

Table 6-2 Volume Count Ratio by Facility Type (Daily)

Facility Type	No. of Links	Volume	Count	Volume / Count*	Acceptable	Preferable
Freeway	119	4,181,588	4,038,151	1.04	+/- 7%	+/- 6%
Divided Arterial	3,208	48,697,255	46,397,646	1.05	+/- 15%	+/- 10%



Undivided Arterial	1,549	10,802,601	10,516,651	1.03	+/- 15%	+/- 10%
Collector	4,236	12,170,101	14,495,452	0.84	+/- 25%	+/- 20%
External Station Connector	114	619,342	618,642	1.00	+/- 1%	+/- 1%
One-way/Frontage	108	1,463,019	1,493,796	0.98	+/- 25%	+/- 20%
Ramps	802	5,204,578	5,042,715	1.03	+/- 25%	+/- 20%
Toll Road-Freeway	245	6,880,665	6,621,189	1.04	+/- 7%	+/- 6%
Toll Road-Arterial	4	36,618	38,264	0.96	+/- 15%	+/- 15%
Region	10,385	90,055,767	89,262,506	1.01	+/- 16%	+/- 12%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Another key metric is the Percent of Root Mean Square Error (% RMSE), expressed below:

$$\%RMSE = \sqrt{\frac{\sum_{a \in A_v} (V_{assign}^a - V_{obs}^a)^2}{n-1}} * \frac{100 * n}{\sum_{a \in A_v} V_{obs}^a}$$

Where V_{assign}^a and V_{obs}^a are the assigned volumes and observed volumes (traffic counts) on link a; n is the total number of links that have available link volumes; and, A_v , represents the set of links with available volumes.

Table 6-3 presents %RMSE between the volume and count. Ranges of acceptable and preferable for %RMSE is also reciprocal to the count. All the %RMSE results are within the acceptable benchmark range, with the 15,000 and 19,999 count group in the preferable range.

Table 6-3 %RMSE by Count Group (Daily)

Count Group	No. of Links	Volume	Count	% RMSE*	Acceptable	Preferable
<5,000	4,534	11,694,548	10,885,289	91%	100%	45%
5,000-9,999	2,513	18,188,826	18,203,621	44%	45%	35%
10,000-14,999	1,508	18,864,922	18,638,219	33%	35%	27%
15,000-19,999	930	16,159,719	16,005,141	24%	30%	25%
20,000-29,999	680	16,270,721	16,271,540	18%	27%	15%
30,000-49,999	177	6,143,043	6,407,725	20%	25%	15%
50,000-59,999	19	1,024,041	1,039,971	13%	20%	10%
>=60,000	24	1,709,947	1,810,999	10%	19%	10%
Region	10,385	90,055,767	89,262,506	38%	45%	35%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

The volume/count and %RMSE metrics are applied to screenlines to ensure that the model reflects observed traffic demand throughout all geographic areas. Screenlines are imaginary lines across a certain boundary or along a specific road in an area. CFRPM 7 screenlines are shown in Figure 6-1. Except for Indian River County, all County boundaries are screenlines, and the other screenlines represent the major movement of the travel patterns in CFRPM 7 area.



Figure 6-1 CFRPM Screenlines

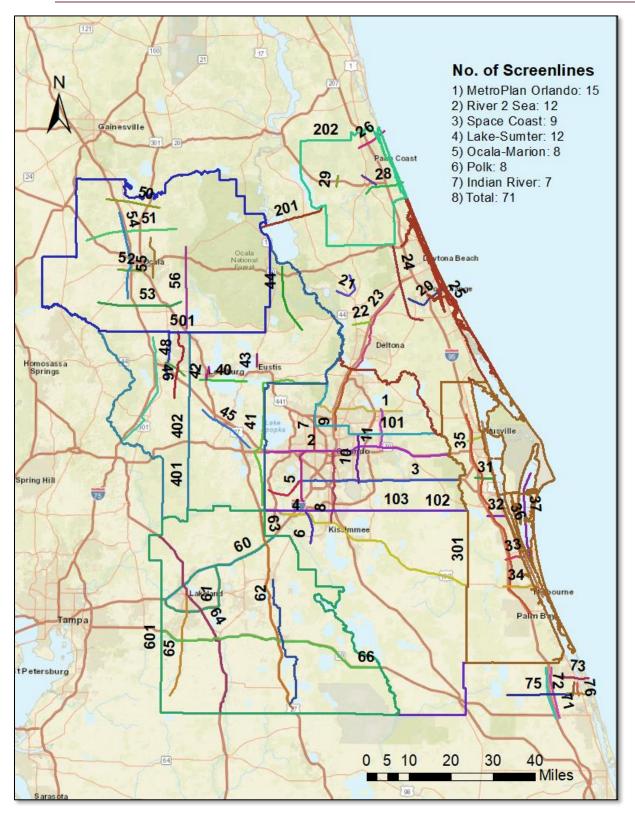


Table 6-4 shows the screenline comparisons for the volume/count ratio and %RMSE metrics. CFRPM 7 overestimates traffic across Volusia County and Flagler County boundaries and



assigns more volumes on SR 60 (Indian River), Polk Parkway (Polk), and SR 19 (Lake). But overall, the screenline analysis shows that CFRPM 7 reasonably reflects traffic demand throughout most areas in the region.

Table 6-4 Screenline Analysis (Daily)

#	County	Direction	Location	Volume	Count	Volume / Count	%RMSE	No. of Links
1	Seminole	East-West	SR 434	837,681	814,505	1.03	13	52
2	Orange	East-West	SR 50	1,990,449	1,844,857	1.08	20	88
3	Orange	East-West	SR 482 - SR 528	1,547,010	1,558,725	0.99	19	57
4	Osceola	East-West	US 192	1,391,060	1,354,541	1.03	12	62
5	Orange	North-South	W of Apopka Vineland	213,991	237,808	0.9	32	18
6	Osceola	North-South	E of Poinciana Blvd	83,717	89,117	0.94	30	12
7	Orange	North-South	E of Hiawassee Rd	183,337	153,400	1.2	39	16
8	Orange	North-South	E of US 441	448,064	485,099	0.92	45	35
9	Seminole	North-South	E of I-4	365,237	406,458	0.9	24	30
10	Orange	North-South	W of Goldenrod Rd	446,513	478,866	0.93	16	24
11	Seminole	North-South	E of SR 434	106,592	117,653	0.91	25	14
12	Orange	North-South	W of I-4	65,349	76,213	0.86	40	10
20	Volusia	East-West	N of SR 44	52,113	45,456	1.15	29	8
21	Volusia	East-West	SE of DeLeon Springs	29,944	21,792	1.37	67	8
22	Volusia	East-West	S of DeLand	148,000	139,772	1.06	11	8
23	Volusia	North-South	E of I-4	167,963	139,360	1.21	41	16
24	Volusia	North-South	W of I-95	92,624	59,425	1.56	59	10
25	Volusia	North-South	Intracoastal Waterway	117,571	100,851	1.17	47	11
26	Flagler	East-West	NE of Flagler	17,615	18,304	0.96	28	6
27	Flagler	North-South	W of US 1	42,344	26,464	1.6	77	4
28	Flagler	East-West	S of SR 100	113,981	107,860	1.06	30	12
30	Brevard	East-West	S of SR 406	37,498	44,474	0.84	30	6
31	Brevard	East-West	S of Fay Blvd	98,848	83,582	1.18	26	6
32	Brevard	East-West	S of SR 520	72,620	59,187	1.23	27	4
33	Brevard	East-West	S of SR 404	165,357	157,531	1.05	26	6
34	Brevard	East-West	N of US 192	139,783	156,276	0.89	20	16
35	Brevard	North-South	E of I-95	420,175	442,647	0.95	26	50
36	Brevard	North-South	E of US 1	239,391	234,196	1.02	13	14
37	Brevard	North-South	W of A1A	105,828	100,303	1.06	9	6
40	Lake	East-West	S of US 441	74,424	67,821	1.1	11	4
41	Lake	NA	Lake-Orange County Line	165,264	152,883	1.08	26	18
42	Lake	North-South	E of US 27	69,429	71,601	0.97	13	6
43	Lake	North-South	W of SR 19	26,914	29,306	0.92	31	6
44	Lake	North-South	E of SR 19	28,077	11,356	2.47	214	8
45	Lake	East-West	S of Turnpike	79,899	62,345	1.28	63	12
46	Sumter	North-South	E of I-75	59,497	45,717	1.3	82	12
47	Sumter	North-South	E of US 301	79,659	71,468	1.11	40	18
48	Sumter	North-South	W of Morse Blvd	117,201	119,820	0.98	30	26



49	Sumter	East-West	N of Turnpike	57,007	38,332	1.49	72	8
50	Marion	East-West	N of CR 316	33,696	23,156	1.46	55	4
51	Marion	East-West	N of SR 326	107,267	82,581	1.3	37	6
52	Marion	East-West	S of SR 40	135,276	110,763	1.22	23	4
53	Marion	East-West	N of CR 484	77,480	55,163	1.4	42	6
54	Marion	North-South	W of I-75	100,898	79,316	1.27	44	6
55	Marion	North-South	E of CR 200A	82,589	84,938	0.97	11	8
56	Marion	North-South	E of SR 30 - US 441	16,941	11,317	1.5	50	2
60	Polk	East-West	1-4	767,727	747,752	1.03	18	16
61	Polk	East-West	POLK PKWY	182,544	84,526	2.16	137	8
62	Polk	North-South	SR 17	79,436	102,111	0.78	49	30
63	Polk	North-South	SR 25/US 27	638,922	443,301	1.44	50	24
64	Polk	North-South	SR 35/US 98	656,579	579,641	1.13	22	34
65	Polk	North-South	SR 37	419,534	402,431	1.04	20	30
66	Polk	East-West	SR 60	457,178	266,444	1.72	74	26
70	Indian River	East-West	N of 65th ST	0	8,495	0	100	2
71	Indian River	North-South	E of I-95	64,746	42,079	1.54	60	4
72	Indian River	North-South	W of I-95	27,645	9,543	2.9	190	2
73	Indian River	East-West	N of 85th St	71,262	49,764	1.43	74	8
74	Indian River	North-South	E of 66th Ave	29,117	16,135	1.8	100	8
75	Indian River	East-West	N of SR 60	7,401	1,908	3.88	421	4
76	Indian River	North-South	W of US 1	27,815	15,404	1.81	89	6
98	Region	NA	All External Stations	619,342	61,8642	1	8	114
99	Region	NA	All Other Counts	71,277,714	72,108,022	0.99	39	9001
101	Seminole	NA	Seminole County Boundary	654,216	595,405	1.1	32	50
102	Orange	NA	Orange County Boundary	1,315,423	1,263,850	1.04	27	78
103	Osceola	NA	Osceola County Boundary	346,578	318,703	1.09	40	28
201	Volusia	NA	Volusia County Boundary	100,175	60,123	1.67	117	18
202	Flagler	NA	Flagler County Boundary	57,765	26,089	2.21	185	8
301	Brevard	NA	Brevard County Boundary	209,269	136,578	1.53	66	20
401	Lake	NA	Lake County Boundary	291,858	185,313	1.57	80	34
402	Sumter	NA	Sumter County Boundary	281,952	203,182	1.39	75	26
501	Marion	NA	Marion County Boundary	80,564	46,780	1.72	97	12
601	Polk	NA	Polk County Boundary	338,832	257,680	1.31	59	31
Total				90,055,767	89,262,506	1.01	38	10385
	~======							

Source: CFRPM 7

CFRPM 7 generates truck production separately from the truck model. Heavy trucks are applied Passenger Car Equivalent factor (PCE) to heavy trucks as 1.8 and restricted to access to local roads in the highway assignment. Truck counts from the count sites with detectors that can distinguish vehicle classes are compared with the assigned truck volume as seen in Table 6-5. There are no known benchmarks for truck assignments. The total truck volume/count ratio is within a reasonable range (within 2%), but truck volumes in some areas are inaccurate. Truck



volumes in Flagler County are underestimated by 34% but overestimated by 34% in Indian River County. The high %RMSE means that CFRPM 7 may not assign the truck volume on correct roadways.

Table 6-5 Truck Volume Analysis (Daily)

County	Volume	Count	Volume/Count	%RMSE	Num of Links
Brevard	76,070	78,440	0.97	79	127
Flagler	12,149	18,527	0.66	119	156
Indian River	15,831	11,776	1.34	81	26
Lake	97,911	106,559	0.92	55	115
Marion	79,949	83,719	0.95	151	117
Orange	1,390,353	1,392,823	1.00	91	742
Osceola	87,781	92,128	0.95	96	136
Polk	480,548	493,835	0.97	66	481
Seminole	63,312	67,009	0.94	77	78
Sumter	58,942	63,637	0.93	101	72
Volusia	103,016	102,675	1.00	95	176
D5 Counties	1,969,484	2,005,517	0.98	105	1,719
Total	2,465,864	2,511,128	0.98	99	2,226

Source: CFRPM 7

6.2.2 Time-of-Day Comparison for Volume-Count

Assigned volumes as a result of highway assignment were compared with observed time-of-day counts from Table 6-6 to Table 6-9. CFRPM 7 can generally produce good volume to count ratios for all four time-of-day periods. The PM freeway volumes are slightly over assigned in CFRPM 7 which may need further investigation by users for traffic studies that involve the PM peak period.

Table 6-6 Volume Count Ratio by Facility Type (AM Peak)

Facility Type	No. of Links	Volume	Count	Volume / Count*	Acceptable	Preferable
Freeway	119	815,795	736,447	1.11	+/- 7%	+/- 6%
Divided Arterial	3,208	9,574,651	8,597,360	1.11	+/- 15%	+/- 10%
Undivided Arterial	1,549	2,168,613	2,006,541	1.08	+/- 15%	+/- 10%
Collector	4,236	2,443,589	2,710,162	0.90	+/- 25%	+/- 20%
External Station Connector	114	104,834	109,475	0.96	+/- 1%	+/- 1%
One- way/Frontag e	108	290,755	277,501	1.05	+/- 25%	+/- 20%



Ramps	802	1,066,769	1,018,275	1.05	+/- 25%	+/- 20%
Toll Road- Freeway	245	1,603,488	1,394,624	1.15	+/- 7%	+/- 6%
Toll Road- Arterial	4	9,307	6,084	1.53	+/- 15%	+/- 15%
Region	10,385	18,077,801	16,856,469	1.07	+/- 16%	+/- 12%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-7 Volume Count Ratio by Facility Type (Middle Day)

Facility Type	No. of Links	Volume	Count	Volume / Count*	Acceptable	Preferable
Freeway	119	1,313,583	1,279,582	1.03	+/- 7%	+/- 6%
Divided Arterial	3,208	15,167,379	15,531,035	0.98	+/- 15%	+/- 10%
Undivided Arterial	1,549	3,299,715	3,540,750	0.93	+/- 15%	+/- 10%
Collector	4,236	3,700,729	4,758,408	0.78	+/- 25%	+/- 20%
External Station Connector	114	232,032	211,592	1.10	+/- 1%	+/- 1%
One- way/Frontag e	108	457,804	516,860	0.89	+/- 25%	+/- 20%
Ramps	802	1,574,177	1,537,079	1.02	+/- 25%	+/- 20%
Toll Road- Freeway	245	1,872,618	1,916,668	0.98	+/- 7%	+/- 6%
Toll Road- Arterial	4	8,917	11,856	0.75	+/- 15%	+/- 15%
Region	10,385	27,626,954	29,303,830	0.94	+/- 16%	+/- 12%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-8 Volume Count Ratio by Facility Type (PM Peak)

Facility Type	No. of Links	Volume	Count	Volume / Count*	Acceptable	Preferable
Freeway	119	982,231	817,764	1.20	+/- 7%	+/- 6%
Divided Arterial	3,208	10,890,940	10,381,748	1.05	+/- 15%	+/- 10%
Undivided Arterial	1,549	2,549,461	2,421,607	1.05	+/- 15%	+/- 10%
Collector	4,236	2,953,932	3,424,976	0.86	+/- 25%	+/- 20%
External Station Connector	114	150,074	132,119	1.14	+/- 1%	+/- 1%
One- way/Frontag e	108	323,618	330,618	0.98	+/- 25%	+/- 20%



Facility Type	No. of Links	Volume	Count	Volume / Count*	Acceptable	Preferable
Ramps	802	1,237,625	1,129,746	1.10	+/- 25%	+/- 20%
Toll Road- Freeway	245	1,796,355	1,598,077	1.12	+/- 7%	+/- 6%
Toll Road- Arterial	4	11,703	9,453	1.24	+/- 15%	+/- 15%
Region	10,385	20,895,939	20,246,108	1.03	+/- 16%	+/- 12%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-9 Volume Count Ratio by Facility Type (Night)

Facility Type	No. of Links	Volume	Count	Volume / Count*	Acceptable	Preferable
Freeway	119	1,069,979	1,204,347	0.89	+/- 7%	+/- 6%
Divided Arterial	3,208	13,064,285	11,875,083	1.10	+/- 15%	+/- 10%
Undivided Arterial	1,549	2,784,812	2,547,702	1.09	+/- 15%	+/- 10%
Collector	4,236	3,071,851	3,602,849	0.85	+/- 25%	+/- 20%
External Station Connector	114	132,402	166,377	0.80	+/- 1%	+/- 1%
One- way/Frontag e	108	390,842	368,821	1.06	+/- 25%	+/- 20%
Ramps	802	1,326,007	1,372,472	0.97	+/- 25%	+/- 20%
Toll Road- Freeway	245	1,608,204	1,711,828	0.94	+/- 7%	+/- 6%
Toll Road- Arterial	4	6,691	10,869	0.62	+/- 15%	+/- 15%
Region	10,385	23,455,073	22,860,349	1.03	+/- 16%	+/- 12%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

The %RMSE between the volume and count for all four time periods are shown from Table 6-10 to Table 6-13. On time-of-day level, CFRPM 7 produces %RMSE results to meet acceptable standards for almost all volume groups.

Table 6-10 %RMSE by Count Group (AM Peak)

Count Group	No. of Links	Volume	Count	% RMSE*	Acceptable	Preferable
<5,000	9,988	15,186,375	13,986,441	54%	100%	45%
5,000-9,999	349	2,202,059	2,214,580	27%	45%	35%



10,000- 14,999	36	465,421	440,920	22%	35%	27%
15,000- 19,999	9	160,474	151,672	17%	30%	25%
20,000- 29,999	3	63,472	62,855	8%	27%	15%
30,000- 49,999	0	0	0	0%	25%	15%
50,000- 59,999	0	0	0	0%	20%	10%
>=60,000	0	0	0	0%	19%	10%
Region	10,385	18,077,801	16,856,469	51%	45%	35%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-11 %RMSE by Count Group (Middle Day)

Count Group	No. of Links	Volume	Count	% RMSE*	Acceptable	Preferable
<5,000	8,519	14,828,954	15,479,421	56%	100%	45%
5,000-9,999	1,686	10,491,935	11,348,174	24%	45%	35%
10,000- 14,999	136	1,453,658	1,596,199	25%	35%	27%
15,000- 19,999	29	501,628	500,393	11%	30%	25%
20,000- 29,999	13	294,328	314,169	13%	27%	15%
30,000- 49,999	2	56,451	65,474	20%	25%	15%
50,000- 59,999	0	0	0	0%	20%	10%
>=60,000	0	0	0	0%	19%	10%
Region	10,385	27,626,954	29,303,830	42%	45%	35%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-12 %RMSE by Count Group (PM)

Count Group	No. of Links	Volume	Count	% RMSE*	Acceptable	Preferable
<5,000	9,732	16,281,082	15,700,878	49%	100%	45%
5,000-9,999	584	3,664,732	3,655,461	26%	45%	35%
10,000- 14,999	55	685,325	646,558	20%	35%	27%
15,000- 19,999	14	264,800	243,211	13%	30%	25%



20,000- 29,999	0	0	0	0%	27%	15%
30,000- 49,999	0	0	0	0%	25%	15%
50,000- 59,999	0	0	0	0%	20%	10%
>=60,000	0	0	0	0%	19%	10%
Region	10,385	20,895,939	20,246,108	45%	45%	35%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-13 %RMSE by Count Group (Night)

Count Group	No. of Links	Volume	Count	% RMSE*	Acceptable	Preferable
<5,000	9,360	16,326,339	15,041,939	57%	100%	45%
5,000-9,999	888	5,567,170	5,885,384	26%	45%	35%
10,000- 14,999	98	907,688	1,146,954	30%	35%	27%
15,000- 19,999	22	315,040	372,832	27%	30%	25%
20,000- 29,999	15	287,666	348,058	20%	27%	15%
30,000- 49,999	2	51,170	65,182	31%	25%	15%
50,000- 59,999	0	0	0	0%	20%	10%
>=60,000	0	0	0	0%	19%	10%
Region	10,385	23,455,073	22,860,349	50%	45%	35%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

6.3 Vehicle-Miles-Traveled Comparisons

Comparing observed and estimated Vehicle-Miles-Traveled (VMT) helps to evaluate both the demand and trip distance on roadways. The VMT outputs from CFRPM were compared to observed VMT in two ways: (1) mostly from traffic counts (traffic count multiplied by link distance) and (2) from FDOT's 2015 Road Mileage and Travel (DVMT) Report.

6.3.1 Daily Comparison for VMT

The VMT comparison from the count and volumes by facility type is presented in Table 6-14. Regionally, vehicles in CFRPM 7 travel 6% longer distance than actual VMT. This difference is slight over the acceptable range and 4% higher than the preferable range. Except for the



undivided arterial VMT, all VMTs of facility types are in the preferable range. Undivided arterials have 20% greater VMT from the volume than the count, but it is in the acceptable range. Generally, CFRPM 7 produces good results to match the observed VMTs.

Table 6-14 VMT Analysis by Facility Type (Daily)

Facility Type	No. of Links	VMT from Count (VMT Cnt)	VMT from Volume (VMT Vol)	VMT Ratio (VMT Vol/VMT Cnt)*	Acceptable	Preferable
Freeway	119	6,794,827	7,619,774	1.12	+/- 25%	+/- 15%
Divided Arterial	3,208	15,529,779	16,718,482	1.08	+/- 25%	+/- 15%
Undivided Arterial	1,549	4,496,402	5,398,394	1.20	+/- 25%	+/- 15%
Collector	4,236	5,926,248	5,235,078	0.88	+/- 25%	+/- 15%
External Station Connector	114	240,620	240,885	1.00	+/- 25%	+/- 15%
One-way/Frontage	108	332,119	309,992	0.93	+/- 25%	+/- 15%
Ramps	802	2,103,610	2,201,090	1.05	+/- 25%	+/- 15%
Toll Roads- Freeway	245	5,905,659	6,662,194	1.13	+/- 25%	+/- 15%
Toll Roads-Arterial	4	33,567	32,370	0.96	+/- 25%	+/- 15%
Region	10,385	41,362,831	44,418,260	1.07	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

The VMT comparison by area type in Table 6-15 shows that the estimated vehicles in Rural areas is 43% more than the traffic count. However, the other area types show the preferable VMT ratio.

Table 6-15 VMT Analysis by Area Type (Daily)

Area Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VMT Cnt)*	Acceptable	Preferable
CBD Areas	234	422,747	434,979	1.03	+/- 25%	+/- 15%
CBD Fringe Areas	211	574,138	604,379	1.05	+/- 25%	+/- 15%
Residential Areas	6,547	24,705,937	25,506,512	1.03	+/- 25%	+/- 15%
OBD Areas	2,509	10,385,462	9,920,410	0.96	+/- 25%	+/- 15%
Rural Areas	884	5,274,546	7,951,979	1.51	+/- 25%	+/- 15%
Region	10,385	41,362,831	44,418,260	1.07	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

The DVMT Report also includes observed VMT by county. This data is compared to CFRPM estimates in Table 6-17. Regionally, CFRPM VMT estimates are within 3%. The county estimates are relatively close as well. Regionally CFRPM is 10% high for interstate/freeways, 33% high for principal/divided arterials, and <10% low for minor/undivided arterials and



collectors. CFRPM is significantly lower local roadways, which is expected since CFRPM only includes 25% of all local roadways in the region.

Table 6-16 Daily VMT from 2015 DVMT Report

Daily VMT	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
Brevard	3,896,783	5,287,232	1,976,909	1,303,388	4,372,720	16,837,032
Flagler	1,016,859	664,401	468,339	276,749	1,253,332	3,679,680
Lake	1,039,246	3,404,809	739,165	2,138,586	1,898,870	9,220,676
Marion	2,472,547	2,927,717	1,373,460	2,249,116	2,619,873	11,642,713
Orange	12,206,387	6,870,730	7,101,497	5,035,361	5,987,285	37,201,260
Osceola	3,107,520	3,157,433	1,248,448	1,309,110	1,571,767	10,394,278
Polk	3,339,924	5,443,310	2,001,183	3,176,152	5,349,699	19,310,268
Seminole	2,680,388	2,571,239	1,529,899	1,615,164	2,255,345	10,652,035
Sumter	1,910,677	622,174	409,425	764,398	596,346	4,303,020
Volusia	4,278,609	4,674,549	1,564,926	1,614,835	3,555,594	15,688,513
Total	35,948,940	35,623,594	18,413,251	19,482,859	29,460,831	138,929,475

Source: 2015 DVMT Report

Table 6-17 Daily VMT from CFRPM 7

Daily VMT	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
Brevard	5,503,888	5,020,408	2,414,770	1,126,554	1,011,576	15,077,196
Flagler	1,071,193	933,889	560,063	343,599	257,444	3,166,188
Lake	1,470,406	3,586,441	1,719,593	2,443,275	756,495	9,976,210
Marion	2,653,575	3,912,916	1,826,605	2,698,168	912,069	12,003,333
Orange	13,082,491	13,776,925	1,463,840	4,087,640	2,723,819	35,134,715
Osceola	2,688,031	3,610,860	1,566,784	1,138,977	542,117	9,546,769
Polk	3,740,848	8,321,720	3,693,340	2,622,981	1,675,999	20,054,888
Seminole	2,715,562	3,847,052	720,394	1,465,030	775,682	9,523,720
Sumter	2,173,474	985,315	1,060,286	819,894	276,761	5,315,730
Volusia	4,521,223	5,407,216	2,247,187	1,317,766	785,349	14,278,741
Total	39,620,691	49,402,742	17,272,862	18,063,884	9,717,311	134,077,490

Source: CFRPM 7

Table 6-18 Delta Percentages Between 2015 DVMT Report and CFRPM 7

Daily VMT	Inter-state/ Freeway/ Turnpike	Principal/ Divided Arterials	Minor/ Undivided Arterials	Major/ Minor Collectors	Locals	Total
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Brevard	41.24%	-5.05%	22.15%	-13.57%	-76.87%	-10.45%
Flagler	5.34%	40.56%	19.58%	24.16%	-79.46%	-13.95%
Lake	-26.01%	-23.30%	-53.43%	-57.97%	-80.58%	-43.51%
Marion	41.49%	5.33%	132.64%	14.25%	-60.16%	8.19%
Orange	7.32%	33.65%	32.99%	19.97%	-65.19%	3.10%
Osceola	7.18%	100.52%	-79.39%	-18.82%	-54.51%	-5.56%
Polk	-13.50%	14.36%	25.50%	-13.00%	-65.51%	-8.15%
Seminole	12.00%	52.88%	84.56%	-17.42%	-68.67%	3.86%
Sumter	1.31%	49.62%	-52.91%	-9.30%	-65.61%	-10.59%
Volusia	13.75%	58.37%	158.97%	7.26%	-53.59%	23.53%
Total	5.67%	15.67%	43.60%	-18.40%	-77.91%	-8.99%

Source: CFRPM 7, 2015 DVMT Report

6.3.2 Time-of-Day Comparison for VMT

The VMT comparisons by facility type for four time periods are presented from Table 6-19 to Table 6-22. Generally, CFRPM produces VMT volume/count ratios within the acceptable benchmark range. A small category, arterial toll roads (only 4 links), is outside the acceptable range in three time periods. Regionally, the AM and PM Peak periods are outside the acceptable benchmark range. Overall, these results indicate that CFRPM produces acceptable estimates of VMT by time period.

Table 6-19 VMT Analysis by Facility Type (AM Peak)

Facility Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VMT Cnt)*	Acceptable	Preferable
Freeway	119	1,228,101	1,489,403	1.21	+/- 25%	+/- 15%
Divided Arterial	3,208	2,895,011	3,300,516	1.14	+/- 25%	+/- 15%
Undivided Arterial	1,549	854,617	1,065,385	1.25	+/- 25%	+/- 15%
Collector	4,236	1,120,881	1,056,483	0.94	+/- 25%	+/- 15%
External Station Connector	114	44,350	40,822	0.92	+/- 25%	+/- 15%
One- way/Frontag e	108	58,472	61,071	1.04	+/- 25%	+/- 15%
Ramps	802	424,872	459,109	1.08	+/- 25%	+/- 15%
Toll Roads- Freeway	245	1,224,071	1,530,813	1.25	+/- 25%	+/- 15%
Toll Roads- Arterial	4	5,363	8,266	1.54	+/- 25%	+/- 15%
Region	10,385	7,855,738	9,011,867	1.15	+/- 5%	+/- 2%

*Green = Preferable; Blue = Acceptable; Red = Out of Range



Table 6-20 VMT Analysis by Facility Type (Middle Day)

Facility Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VMT Cnt)*	Acceptable	Preferable
Freeway	119	2,194,384	2,404,555	1.10	+/- 25%	+/- 15%
Divided Arterial	3,208	5,138,623	5,206,715	1.01	+/- 25%	+/- 15%
Undivided Arterial	1,549	1,491,814	1,672,995	1.12	+/- 25%	+/- 15%
Collector	4,236	1,917,544	1,585,592	0.83	+/- 25%	+/- 15%
External Station Connector	114	83,589	90,119	1.08	+/- 25%	+/- 15%
One- way/Frontag e	108	114,779	97,848	0.85	+/- 25%	+/- 15%
Ramps	802	637,347	661,719	1.04	+/- 25%	+/- 15%
Toll Roads- Freeway	245	1,724,794	1,810,228	1.05	+/- 25%	+/- 15%
Toll Roads- Arterial	4	10,387	7,856	0.76	+/- 25%	+/- 15%
Region	10,385	13,313,262	13,537,627	1.02	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-21 VMT Analysis by Facility Type (PM Peak)

Facility Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VM T Cnt)*	Acceptable	Preferable
Freeway	119	1,386,101	1,837,446	1.33	+/- 25%	+/- 15%
Divided Arterial	3,208	3,494,615	3,772,677	1.08	+/- 25%	+/- 15%
Undivided Arterial	1,549	1,024,255	1,286,922	1.26	+/- 25%	+/- 15%
Collector	4,236	1,397,722	1,281,587	0.92	+/- 25%	+/- 15%
External Station Connector	114	52,559	58,430	1.11	+/- 25%	+/- 15%
One- way/Frontag e	108	72,921	68,562	0.94	+/- 25%	+/- 15%
Ramps	802	472,483	522,324	1.11	+/- 25%	+/- 15%
Toll Roads- Freeway	245	1,437,238	1,759,609	1.22	+/- 25%	+/- 15%
Toll Roads- Arterial	4	8,297	10,353	1.25	+/- 25%	+/- 15%
Region	10,385	9,346,190	10,597,911	1.13	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range



Table 6-22 VMT Analysis by Facility Type (Night)

Facility Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VM T Cnt)*	Acceptable	Preferable
Freeway	119	1,986,229	1,888,370	0.95	+/- 25%	+/- 15%
Divided Arterial	3,208	3,997,817	4,438,573	1.11	+/- 25%	+/- 15%
Undivided Arterial	1,549	1,125,636	1,373,092	1.22	+/- 25%	+/- 15%
Collector	4,236	1,489,979	1,311,416	0.88	+/- 25%	+/- 15%
External Station Connector	114	60,635	51,515	0.85	+/- 25%	+/- 15%
One- way/Frontag e	108	85,940	82,511	0.96	+/- 25%	+/- 15%
Ramps	802	573,390	557,938	0.97	+/- 25%	+/- 15%
Toll Roads- Freeway	245	1,519,550	1,561,545	1.03	+/- 25%	+/- 15%
Toll Roads- Arterial	4	9,518	5,894	0.62	+/- 25%	+/- 15%
Region	10,385	10,848,694	11,270,854	1.04	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

The VMT comparison by area type from Table 6-23 to Table 6-26 shows that CFRPM significantly overestimates traffic demand in rural areas in all time periods. Regionally, the AM and PM Peak periods are outside the acceptable benchmark range. Overall, these results indicate that CFRPM produces acceptable estimates of VMT by time period.

Table 6-23 VMT Analysis by Area Type (AM Peak)

Area Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VMT Cnt)*	Acceptable	Preferable
CBD Areas	234	81,300	88,097	1.08	+/- 25%	+/- 15%
CBD Fringe Areas	211	112,613	123,707	1.10	+/- 25%	+/- 15%
Residential Areas	6,547	4,762,033	5,241,088	1.10	+/- 25%	+/- 15%
OBD Areas	2,509	1,934,388	1,987,148	1.03	+/- 25%	+/- 15%
Rural Areas	884	965,404	1,571,828	1.63	+/- 25%	+/- 15%
Region	10,385	7,855,738	9,011,867	1.15	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-24 VMT Analysis by Area Type (Middle Day)

Avec Torre	No. of	VMT from	VMT from	VMT Ratio	Associable	Dueferable
Area Type	Links	Count	Volume	(VMT Vol/VMT Cnt)*	Acceptable	Preferable



CBD Areas	234	146,704	134,851	0.92	+/- 25%	+/- 15%
CBD Fringe Areas	211	197,177	185,033	0.94	+/- 25%	+/- 15%
Residential Areas	6,547	7,854,014	7,676,603	0.98	+/- 25%	+/- 15%
OBD Areas	2,509	3,396,863	3,044,215	0.90	+/- 25%	+/- 15%
Rural Areas	884	1,718,504	2,496,927	1.45	+/- 25%	+/- 15%
Region	10,385	13,313,262	13,537,627	1.02	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-25 VMT Analysis by Area Type (PM Peak)

Area Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VMT Cnt)*	Acceptable	Preferable
CBD Areas	234	94,002	97,356	1.04	+/- 25%	+/- 15%
CBD Fringe Areas	211	126,668	135,627	1.07	+/- 25%	+/- 15%
Residential Areas	6,547	5,697,684	6,132,392	1.08	+/- 25%	+/- 15%
OBD Areas	2,509	2,304,999	2,297,656	1.00	+/- 25%	+/- 15%
Rural Areas	884	1,122,837	1,934,879	1.72	+/- 25%	+/- 15%
Region	10,385	9,346,190	10,597,911	1.13	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

Table 6-26 VMT Analysis by Area Type (Night)

Area Type	No. of Links	VMT from Count	VMT from Volume	VMT Ratio (VMT Vol/VMT Cnt)*	Acceptable	Preferable
CBD Areas	234	100,753	114,676	1.14	+/- 25%	+/- 15%
CBD Fringe Areas	211	137,672	160,012	1.16	+/- 25%	+/- 15%
Residentia I Areas	6,547	6,396,764	6,456,430	1.01	+/- 25%	+/- 15%
OBD Areas	2,509	2,745,560	2,591,391	0.94	+/- 25%	+/- 15%
Rural Areas	884	1,467,944	1,948,345	1.33	+/- 25%	+/- 15%
Region	10,385	10,848,694	11,270,854	1.04	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range



6.4 Vehicle-Hours-Travel Comparisons

Vehicle-Hours-Traveled (VHT) is another metric to evaluate both the demand and congestion on roadways. The estimated VHT outputs are compared to the observed values (traffic counts multiplied by the travel time needed to traverse the link).

6.4.1 Daily Comparison for VHT

The VHT of CFRPM region is 3% higher than the VHT from the count. It is out of the preferable range but within the acceptable range. Table 6-27 shows the result of the VHT analysis by facility type. CFRPM 7 appears to estimate VHT reasonably well across multiple dimensions, including facility and area types.

Table 6-27 VHT Analysis by Facility Type (Daily)

Facility Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
Freeway	119	114,723	128,605	1.12	+/- 25%	+/- 15%
Divided Arterial	3,208	407,544	432,328	1.06	+/- 25%	+/- 15%
Undivided Arterial	1,549	122,495	145,254	1.19	+/- 25%	+/- 15%
Collector	4,236	178,761	152,502	0.85	+/- 25%	+/- 15%
External Station Connector	114	4,421	4,426	1.00	+/- 25%	+/- 15%
One-way/Frontage	108	11,836	11,249	0.95	+/- 25%	+/- 15%
Ramps	802	62,257	64,305	1.03	+/- 25%	+/- 15%
Toll Roads- Freeway	245	99,224	110,474	1.11	+/- 25%	+/- 15%
Toll Roads-Arterial	4	611	589	0.96	+/- 25%	+/- 15%
Region	10,385	1,001,871	1,049,733	1.05	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

The VHT analysis by area type is also conducted as shown in Table 6-28. Similar to the result of the VMT, the VHT ratio of the rural area is out of the preferable and acceptable range. The VHT for rural areas from the volume is 45% greater than the count. This result indicates that CFRPM 7 assigns more vehicles in rural areas, and they travel longer than actual travel time.

Table 6-28 VHT Analysis by Area Type (Daily)

Area Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
CBD Areas	234	14,400	14,829	1.03	+/- 25%	+/- 15%



Area Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
CBD Fringe Areas	211	17,127	17,912	1.05	+/- 25%	+/- 15%
Residential Areas	6,547	601,109	608,443	1.01	+/- 25%	+/- 15%
OBD Areas	2,509	269,923	257,373	0.95	+/- 25%	+/- 15%
Rural Areas	884	99,312	151,175	1.52	+/- 25%	+/- 15%
Region	10,385	1,001,871	1,049,733	1.05	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Average travel speed can be calculated using the VMT and VHT as an equation below:

$$Average\ travel\ speed = \frac{VMT}{VHT}$$

The daily average travel speed for CFRPM 7 is 39.40 mph as in Table 6-29. There is no equivalent observed value to compare with this estimate. This speed is high when compared to other urban travel demand models. However, this average speed may be reasonable since CFRPM has substantial amounts of uncongested roadways outside the Orlando urban area.

Table 6-29 VMT, VHT, and Average Speed for All Links by Time of Day

Period	VMT	VHT	Average Speed
Daily	141,839,231	3,599,559	39.40
AM	28,077,579	744,135	37.73
MD	44,152,650	1,071,623	41.20
PM	33,355,637	910,006	36.65
NT	36,253,365	873,794	41.49

Source: CFRPM 7

6.4.2 Time of Day Comparison for VHT

Estimated and observed VHT comparisons were made for the four time periods. CFRPM generates results within the acceptable range for most time periods and facilities types. VHT is overestimated for the AM and PM Peaks. Please note speeds are validated in Section 6.5 while the average congested speed per county by facility type is described in *CFRPM 7 Model Description Report*.

Table 6-30 VHT Analysis by Facility Type (AM Peak)

Facility Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
Freeway	119	21,297	26,614	1.25	+/- 25%	+/- 15%



Facility Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
Divided Arterial	3,208	80,385	90,524	1.13	+/- 25%	+/- 15%
Undivided Arterial	1,549	24,396	30,891	1.27	+/- 25%	+/- 15%
Collector	4,236	34,409	31,795	0.92	+/- 25%	+/- 15%
External Station Connector	114	816	752	0.92	+/- 25%	+/- 15%
One-way/Frontage	108	2,126	2,205	1.04	+/- 25%	+/- 15%
Ramps	802	12,889	13,720	1.06	+/- 25%	+/- 15%
Toll Roads- Freeway	245	21,509	26,981	1.25	+/- 25%	+/- 15%
Toll Roads-Arterial	4	98	150	1.54	+/- 25%	+/- 15%
Region	10385	197,924	223,633	1.13	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-31 VHT Analysis by Facility Type (Middle Day)

Facility Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
Freeway	119	34,518	37,622	1.09	+/- 25%	+/- 15%
Divided Arterial	3,208	127,800	127,506	1.00	+/- 25%	+/- 15%
Undivided Arterial	1,549	38,501	41,991	1.09	+/- 25%	+/- 15%
Collector	4,236	56,349	44,533	0.79	+/- 25%	+/- 15%
External Station Connector	114	1,540	1,653	1.07	+/- 25%	+/- 15%
One-way/Frontage	108	3,958	3,501	0.88	+/- 25%	+/- 15%
Ramps	802	18,236	18,700	1.03	+/- 25%	+/- 15%
Toll Roads- Freeway	245	27,171	28,132	1.04	+/- 25%	+/- 15%
Toll Roads-Arterial	4	189	143	0.76	+/- 25%	+/- 15%
Region	10,385	308,262	303,782	0.99	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-32 VHT Analysis by Facility Type (PM Peak)

Facility Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
Freeway	119	25,628	34,809	1.36	+/- 25%	+/- 15%
Divided Arterial	3,208	100,707	107,412	1.07	+/- 25%	+/- 15%
Undivided Arterial	1,549	31,151	39,749	1.28	+/- 25%	+/- 15%
Collector	4,236	44,068	39,773	0.90	+/- 25%	+/- 15%
External Station Connector	114	975	1,076	1.10	+/- 25%	+/- 15%
One-way/Frontage	108	3,003	2,808	0.93	+/- 25%	+/- 15%
Ramps	802	14,703	16,536	1.12	+/- 25%	+/- 15%



Toll Roads- Freeway	245	25,235	31,261	1.24	+/- 25%	+/- 15%
Toll Roads-Arterial	4	151	189	1.25	+/- 25%	+/- 15%
Region	10,385	245,623	273,612	1.11	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-33 VHT Analysis by Facility Type (Night)

Facility Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
Freeway	119	31,185	29,561	0.95	+/- 25%	+/- 15%
Divided Arterial	3,208	97,759	106,886	1.09	+/- 25%	+/- 15%
Undivided Arterial	1,549	27,610	32,623	1.18	+/- 25%	+/- 15%
Collector	4,236	43,296	36,401	0.84	+/- 25%	+/- 15%
External Station Connector	114	1,099	945	0.86	+/- 25%	+/- 15%
One-way/Frontage	108	2,725	2,734	1.00	+/- 25%	+/- 15%
Ramps	802	16,183	15,349	0.95	+/- 25%	+/- 15%
Toll Roads- Freeway	245	23,934	24,100	1.01	+/- 25%	+/- 15%
Toll Roads-Arterial	4	173	107	0.62	+/- 25%	+/- 15%
Region	10,385	243,965	248,707	1.02	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

The VHT analysis by area type for all four time periods are also conducted as shown from Table 6-34 to Table 6-37. Like the daily result, the VHT of the rural area has been over assigned.

Table 6-34 VHT Analysis by Area Type (AM Peak)

Area Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
CBD Areas	234	2,825	3,049	1.08	+/- 25%	+/- 15%
CBD Fringe Areas	211	3,467	3,848	1.11	+/- 25%	+/- 15%
Residential Areas	6,547	120,748	131,983	1.09	+/- 25%	+/- 15%
OBD Areas	2,509	52,381	54,072	1.03	+/- 25%	+/- 15%
Rural Areas	884	18,503	30,681	1.66	+/- 25%	+/- 15%
Region	10,385	197,924	223,633	1.13	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range



Table 6-35 VHT Analysis by Area Type (Middle Day)

Area Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
CBD Areas	234	4,878	4,499	0.92	+/- 25%	+/- 15%
CBD Fringe Areas	211	5,660	5,256	0.93	+/- 25%	+/- 15%
Residential Areas	6,547	182,177	173,092	0.95	+/- 25%	+/- 15%
OBD Areas	2,509	84,698	75,419	0.89	+/- 25%	+/- 15%
Rural Areas	884	30,849	45,516	1.48	+/- 25%	+/- 15%
Region	10,385	308,262	303,782	0.99	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Table 6-36 VHT Analysis by Area Type (PM Peak)

Area Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
CBD Areas	234	3,551	3,635	1.02	+/- 25%	+/- 15%
CBD Fringe Areas	211	4,110	4,380	1.07	+/- 25%	+/- 15%
Residential Areas	6,547	149,771	159,617	1.07	+/- 25%	+/- 15%
OBD Areas	2,509	64,798	64,752	1.00	+/- 25%	+/- 15%
Rural Areas	884	23,394	41,228	1.76	+/- 25%	+/- 15%
Region	10,385	245,623	273,612	1.11	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

Table 6-37 VHT Analysis by Area Type (Night)

Area Type	No. of Links	VHT from Count	VHT from Volume	VHT Ratio (VHT Vol/VHT Cnt)*	Acceptable	Preferable
CBD Areas	234	3,155	3,647	1.16	+/- 25%	+/- 15%
CBD Fringe Areas	211	3,801	4,428	1.16	+/- 25%	+/- 15%
Residential Areas	6,547	145,151	143,750	0.99	+/- 25%	+/- 15%
OBD Areas	2,509	66,842	63,131	0.94	+/- 25%	+/- 15%
Rural Areas	884	25,016	33,751	1.35	+/- 25%	+/- 15%
Region	10,385	243,965	248,707	1.02	+/- 5%	+/- 2%

^{*}Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

6.5 Travel Time Comparison

Travel time comparisons are used to evaluate the traffic congestion along key roadways. For each time period, the acceptable benchmark is for 80% of the links to have an estimated travel



time within 20% of the observed. The preferable benchmark is for 50% of the links to have an estimated travel time within 10% of the observed. Table 6-38 shows that CFRPM passes this threshold for all four periods.

Table 6-38 Travel Time Analysis

Period	Acceptable Percentage*	Acceptable Standard	Preferable Percentage*	Preferable Standard
AM	88% of links are within 20%	80% of links are within 20%	62% of links are within 10%	50% of links are within 10%
MD	83% of links are within 20%	80% of links are within 20%	52% of links are within 10%	50% of links are within 10%
PM	82% of links are within 20%	80% of links are within 20%	53% of links are within 10%	50% of links are within 10%
NT	99% of links are within 20%	80% of links are within 20%	94% of links are within 10%	50% of links are within 10%

^{*}Green = Within Range; Red = Out of Range

Source: CFRPM 7, Department's Model Calibration and Validation Standards Report

Next, observed and estimated travel times of 100 roadway corridors were calculated for all time periods and shown in Table 6-39. Using the same standards, differences within the preferable range (< 10%) are highlighted green, while blue indicates results within the acceptable range (< 20%). Results outside the acceptable range are red.

Generally, CFRPM estimates travel times well, but there is the trend that congestion along I-4 is over-estimated.



Table 6-39 Corridor Travel Time Comparison

Road	Dir	Section	Length	AM Travel Time (min)			MD Travel Time (min)			PM Travel Time (min)			NT Travel Time (min)		
			(mile)	Obs	Est	%∆	Obs	Est	%Δ	Obs	Est	%Δ	Obs	Est	%Δ
I-4	EB	North Polk Boundary to SR 408	24.9	27.2	47.8	76	27.5	29.2	6	31.5	28.5	-9	24.7	30.1	22
I-4	WB	SR 408 to North Polk Boundary	24.9	25.6	27	6	25.1	29.8	19	31.6	48.1	52	25	29.5	18
1-4	EB	SR 408 to I-95	49.5	47.9	48.6	2	47.6	51	7	55.6	70.4	27	46.6	50.1	8
I-4	WB	I-95 to SR 408	48.7	50	61.6	23	45.8	49	7	49.3	50.8	3	45.5	48.5	7
SR 429	NB	I-4 to SR 441	41.4	39	38	-3	38.9	36.2	-7	38.5	37	-4	39	36.1	-7
SR 429	SB	SR 441 to I-4	41	38.2	36	-6	38.6	35.7	-7	38.2	37.2	-2	38.8	35.7	-8
SR 417	NB	I-4 to I-4	52.3	47.6	48.3	1	47.8	45.4	-5	48.7	48.6	0	48.2	45.4	-6
SR 417	SB	I-4 to I-4	51.4	46.9	45.9	-2	46.8	44.5	-5	47	47.4	1	47	44.5	-5
Florida Tpk	NB	West Indian River boundary to SR 417	58.7	49.8	51.2	3	49.8	50.6	2	49.9	50.4	1	50.5	50.5	0
Florida Tpk	SB	SR 417 to West Indian River boundary	59.7	51.1	51.2	0	51	51.5	1	51	53.4	5	51.7	51.3	-1
Florida Tpk	NB	SR 417 to East Lake Boundary	24.1	21.5	25.4	18	21.4	21.4	0	21.4	22.9	7	21.5	21.2	-1
Florida Tpk	SB	East Lake Boundary to SR 417	23.9	21	22.8	9	21	21.3	1	21.3	25.2	18	21.1	20.7	-2
SR 528	EB	I-4 to SR 417	14.6	16.4	15.6	-5	15.7	15.5	-1	16.8	17.4	4	16.1	15.4	-4
SR 528	WB	SR 417 to I-4	14.7	15.2	16.4	8	15.2	15.6	2	17.3	16	-7	15.4	15.6	1
SR 528	EB	SR 417 to SR A1A	38.4	36.1	34.6	-4	36.4	34.8	-4	36.1	43.9	21	36.7	34.7	-5
SR 528	WB	SR A1A to SR 417	38.2	35	43.6	25	34.9	34.6	-1	34.7	34.8	0	35.4	34.6	-2
SR 408	EB	Florida Tpk to SR 50	22.3	23.2	25.3	9	22.6	22.6	0	24	24.6	3	22.8	22.5	-1
SR 408	WB	SR 50 to Florida Tpk	21.7	23.1	23.6	2	21.6	22	2	22	25.1	14	21.7	21.9	1
SR 50	EB	SR 429 to SR 520	28.9	58	52	-10	63.2	51.2	-19	68.9	67.5	-2	47.8	49.1	3
SR 50	WB	SR 520 to SR 429	28.9	60.2	64.5	7	63.6	49.2	-23	65.3	53.9	-17	47.3	49	4
SR 436	NB	SR 528 to US 17	15.2	30.5	25.3	-17	31.4	23.2	-26	34.1	26.6	-22	24.3	22.4	-8
SR 436	SB	US 17 to SR 528	14.9	30.4	24.7	-19	31.8	23.4	-26	35	26.3	-25	24.3	22.6	-7
US 192	EB	I-4 to Florida Turnpike	15.1	28.8	22.6	-22	32.4	23.2	-29	35.1	31.7	-10	25	22.7	-9
US 192	WB	Florida Turnpike to I-4	15.1	29.7	30	1	32.2	23.5	-27	32.3	24.6	-24	24.4	23.1	-5



110 444	NE	110 400 / 00 50	4= 0	00.4	00.0		40.0	00.0		45.4	00.1		04 =	07.5	40
US 441	NB	US 192 to SR 50	17.2	38.1	36.6	-4	42.2	28.2	-33	45.1	28.1	-38	31.5	27.5	-12
US 441	SB	SR 50 to US 192	17.2	36.6	26.9	-26	40.4	29.2	-28	45.5	37.9	-17	31.3	27.7	-11
US 17/92	NB	SR 50 to SR 46	17.5	35.2	27.5	-22	37.6	27.5	-27	40.5	35.1	-13	29.7	26.9	-10
US 17/92	SB	SR 46 to SR 50	17.6	36	33.4	-7	37.5	27.7	-26	38.2	29.2	-24	29.6	27.5	-7
I-95	NB	North Brevard Boundary to South ST Johns Boundary	63.9	55.1	55.7	1	55.3	55.5	0	55.1	56.6	3	56	55.4	-1
I-95	SB	South ST Johns Boundary to North Brevard Boundary	64.5	55.6	56.2	1	55.8	56	0	55.4	56.5	2	56.5	55.9	-1
US 17	NB	Volusia County Boundary to Glenwood Rd	16.4	30.5	26	-15	32.7	25.4	-22	32.7	33.9	3	26.8	25.1	-6
US 17	SB	Glenwood Rd to Volusia County Boundary	16.4	30.5	31	1	32.7	25.3	-23	32.3	27.1	-16	26.7	24.9	-7
US 1	NB	Halifax Ave to I-95	37.6	58.7	53	-10	61.7	52.5	-15	60.1	55.1	-8	53.5	52	-3
US 1	SB	I-95 to Halifax Ave	37.6	59.2	53.9	-9	62.3	52.5	-16	61.6	55.1	-11	53.7	52.2	-3
SR 40	EB	SR 11 to SR A1A	18.3	26	23.2	-11	27.5	21.9	-20	26.8	22.9	-15	23.2	21.9	-5
SR 40	WB	SR A1A to SR 11	18.3	26	22.4	-14	27.1	21.9	-19	26.8	24.5	-8	23.4	21.8	-7
US 92	EB	Kepler Road to SR A1A	19.4	26.4	23.6	-10	29	22.6	-22	27.9	24.1	-14	24.3	23.1	-5
US 92	WB	SR A1A to Kepler Road	19.4	27	23.4	-13	30	22.3	-26	29.6	24.7	-17	24.7	22.2	-10
SR 421	NB/E B	Howland Blvd to SR A1A	24.4	35.2	31.9	-9	36.5	30.2	-17	35.7	30.8	-14	32	30.3	-6
SR 421	SB/ WB	SR A1A to Howland Blvd	24.4	35.5	30.6	-14	37.1	30.3	-18	36.9	33.9	-8	32.4	30.2	-7
SR 100	EB	US 1 to SR A1A	8.2	13.3	11	-18	14	10.9	-22	13.6	11.1	-19	11.7	10.9	-6
SR 100	WB	SR A1A to US 1	8.2	13.5	11	-19	14	10.9	-22	13.7	11	-20	11.9	10.9	-8
I-95	NB	SR 60 to South Volusia Boundary	86.5	74.4	77.9	5	74.6	75.4	1	74.6	76.7	3	75.2	74.4	-1
I-95	SB	South Volusia Boundary to SR 60	86.4	74.1	74.9	1	74.3	75.3	1	74	81.4	10	75	74.3	-1
Wickham Road	NB	SR 514 to St Andrews Blvd	15.9	31.5	32.6	3	32.8	26.3	-20	32.6	26.8	-18	26.2	26.1	0
Wickham Road	SB	St Andrews Blvd to SR 514	15.9	30.3	25.5	-16	31.7	26.6	-16	32.5	34.6	6	26	25.9	0
US 1	NB	SR 514 to US 192	5.9	8.5	10.7	26	8.5	8.4	-1	8.3	8.5	2	7.8	8.4	7
US 1	SB	US 192 to SR 514	5.9	8.5	8.3	-2	8.8	8.5	-3	8.9	11.6	30	8	8.4	5
SR 520	EB	Brevard County Boundary to SR A1A	16.2	24.8	23.1	-7	26.7	22.1	-17	27.1	23.8	-12	22.4	22	-2
SR 520	WB	SR A1A to Brevard County Boundary	16.2	24.7	23.6	-5	26.2	22.4	-15	25.9	24.5	-5	22.1	22.2	1%
US 192	EB	Deer Park Road to SR A1A	19.7	26.3	23.2	-12	28	23.3	-17	27.6	26.7	-3	24.1	23.1	-4



US 192	WB	SR A1A to Deer Park Road	19.7	26.5	25.7	-3	28.6	23.2	-19	28.7	24.1	-16	24.4	23	-6
			_												-6 -5
SR 404	EB	I-95 to SR A1A	6.8	10.1	8.8	-13	9.7	8.7	-10	9.7	9.6	-1	9.2	8.7	_
SR 404	WB	SR A1A to I-95	6.8	9.2	9.2	0	9.2	8.7	-6	9.3	9	-3	8.7	8.6	-1
US 1	NB	Indian River Blvd to SR 514	22.2	28.3	31.9	13	29.2	30.8	6	28.3	33.2	17	26.9	28.6	6
US 1	SB	SR 514 to Indian River Blvd	23.8	30.2	30.5	1	31.5	32.3	3	30.4	38.6	27	28.6	30.2	6
US 1	NB	US 192 to SR 528	24.4	36.5	35.1	-4	37.3	33.2	-11	37.9	34.7	-8	33.3	33.2	0
US 1	SB	SR 528 to US 192	24.3	37.8	34.5	-8	38.3	33.4	-13	37.9	37.1	-2	33.3	33.1	-1
US 1	NB	SR 528 to SR 46	19.7	27.6	25.8	-6	28.2	25.4	-10	27.5	25.9	-6	25.7	25.4	-1
US 1	SB	SR 46 to SR 528	19.7	28.5	25.5	-11	29.7	25.1	-16	29.1	25.8	-12	26.3	25.1	-5
Florida Tpk	NB	I-75 to Orange Boundary	34.6	30	29.7	-1	30.3	32.2	6	30.1	48.9	62	30.4	30.5	0
Florida Tpk	SB	Orange Boundary to I-75	34.5	30.3	39.7	31	30.4	31	2	30.2	30.7	2	30.8	29.8	-3
US 27	NB	Florida Turnpike to CR 466	17.1	24.7	25.3	2	25.9	24.7	-5	25	29.4	17	22.7	24.1	6
US 27	SB	CR 466 to Florida Turnpike	17.3	25.2	27.8	10	26.7	25.3	-5	26.3	27.9	6	23	24.4	6
US 50	EB	Sumter Boundary to Florida Turnpike	20	30.9	39.9	29	31	30.2	-2	30.3	29.1	-4	27.7	28.5	3
US 50	WB	Florida Turnpike to Sumter Boundary	19.3	28.5	25.9	-9	29.2	29.9	3	29.6	42.6	44	26.3	27.6	5
US 441	EB	US 27 to US 46	18.3	27.9	31.1	12	29.7	26	-13	29.1	28.8	-1	25.4	25.7	1
US 441	WB	US 46 to US 27	18.3	28.6	26.6	-7	30.2	26.3	-13	30	33.4	11	25.5	26.1	2
US 19	NB	US 441 to CR 445	15.7	22.7	21.4	-5	23.3	21.7	-7	23	24.4	6	21.3	21.6	2
US 19	SB	CR 445 to US 441	15.4	22.2	23	3	23.1	20.9	-10	22.7	20.9	-8	20.9	20.8	0
I-75	NB	North Hernando Boundary to South Alachua Boundary	61.3	52.6	52.9	1	53.4	53.3	0	53.1	56.1	6	53.5	52.6	-2
I-75	SB	South Alachua Boundary to North Hernando Boundary	59.9	51.6	52.8	2	51.7	52.4	1	51.8	53.9	4	52.1	51.4	-1
SR 200	NB	Citrus Boundary to US 301	18.4	27.2	25.8	-5	30.5	23.7	-22	29.2	24.3	-17	24.5	23.1	-6
SR 200	SB	US 301 to Citrus Boundary	18.4	26.6	23.3	-12	30	24	-20	29.3	27.9	-5	24.4	23.2	-5
SR 40	EB	Hwy 328 to US 301	10.4	15.5	23.1	49	15.8	17.1	8	15.9	20.8	31	13.7	14.5	6
SR 40	WB	US 301 to Hwy 328	10.4	15.6	14.6	-6	15.7	18.2	16	15.9	26.5	67	13.7	14.9	8
SR 464	EB	SR 200 to SE 110th	14	22.9	18.9	-18	23.3	19.4	-17	23.2	22.3	-4	20	19	-5
SR 464	WB	SE 110th to SR 200	14	22.5	21.4	-5	23.1	19.2	-17	23.3	19.8	-15	20.2	18.9	-6
US 27	NB	SE Highway 42 to SR 464	16.5	24.3	22.6	-7	25.1	21.7	-14	24.9	25.1	1	21.1	20.9	-1



US 27	SB	SR 464 to SE Highway 42	16.5	24.3	23.3	-4	24.9	21.8	-12	24.7	24.3	-2	21	21.4	2
US 41	NB	Citrus Boundary to Levy Boundary	12.9	16.6	14.7	-11	17.6	16.2	-8	17.3	22.2	29	15.4	14.9	-4
US 41	SB	Levy Boundary to Citrus Boundary	10.8	13.5	13.6	1	14.4	13.5	-6	14	14.2	2	12.5	12.5	0
SR 40	EB	US 301 to Hwy 314	10.8	16.8	16.1	-4	18.1	17.6	-3	17.9	18.3	2	15.6	16.2	4
SR 40	WB	Hwy 314 to US 301	10.8	17.1	17.9	5	18.1	17.4	-4	17.5	17.5	0	15.5	15.9	3
I-4	EB	East Hillsborough Boundary to West Osceola boundary	32	27.8	38.1	37	27.9	29.1	4	27.9	30.1	8	28.1	29.2	4
I-4	WB	West Osceola boundary to East Hillsborough Boundary	32	27.7	28.1	2	27.9	29.1	4	27.8	43.3	56	27.8	28.2	1
SR 570	EB	I-4 to I-4	23.8	23.8	22.8	-4	23.8	22.8	-4	23.6	23.2	-2	23.7	22.6	-4
SR 570	WB	I-4 to I-4	23.7	23.6	22.8	-3	23.8	22.8	-4	23.6	23.1	-2	23.6	22.6	-4
US 98	NB	South Polk County Boundary to North Polk County Boundary	49	71.9	73	1	74.3	75.4	2	73.8	78.6	7%	63.6	67.7	6
US 98	SB	North Polk County Boundary to South Polk County Boundary	48.4	69	69.5	1	70.7	73.3	4	70.8	80.4	14	61.4	65.2	6
SR 37	NB	SR 674 to US 98	24.5	35.7	33.2	-7	38.1	31.6	-17	38	32.6	-14	32.4	31.3	-4
SR 37	SB	US 98 to SR 674	24.5	36	31.3	-13	37.7	31.7	-16	37.4	35	-6	32.5	31.2	-4
SR 60	EB	West Polk County Boundary to East Polk County Boundary	55.2	63.3	60	-5	64.5	63.3	- 2	63.1	71.6	14	59.5	59.1	-1
SR 60	WB	East Polk County Boundary to West Polk County Boundary	55.9	63.9	64.8	1	64.6	64.1	-1	63.2	68.8	9	60	59.8	0
US 27	NB	South Polk County Boundary to North Polk County Boundary	49.8	62.1	65.8	6	64.3	56.4	-12	63.8	55.2	-14	56.9	57.9	2
US 27	SB	North Polk County Boundary to South Polk County Boundary	49.8	61.7	53.5	-13	63.5	56.4	-11	63.7	71.5	12	56.9	54.7	-4
CR 580	EB	Power Line Rd to Old Plesant Hill Rd	10	14.7	15.9	8	15.2	15.5	2	15	83.1	454	13.3	15.2	14
CR 580	WB	Old Plesant Hill Rd to Power Line Rd	10	14	78.2	459	14.5	15	3	15.3	36.8	141	13	14	7
SR 512	EB	I-95 to US 1	6.4	10.7	9.2	-15	10.7	9.2	-14	10.5	12	14	9.4	9	-4
SR 512	WB	US 1 to I-95	6.5	11.3	10	-11	11.3	9.3	-18	11.2	10	-11	10.1	9.2	-8
			2,648	3,264	3,29 4	1	3,36 3	3,07	-9	3,396	3,50 7	3	3,032	3,00	-1

*Green = Preferable; Blue = Acceptable; Red = Out of Range

Source: CFRPM 7, HERE Observed Travel Time

6.6 Volume-Delay Functions

Volume-delay functions (VDFs) are used in highway assignment to estimate speeds and travel times degraded (delayed) by auto congestion (volume to capacity). Generally, VDFs do not degrade travel speeds when the volume is significantly below capacity. As volume approaches capacity, speeds are assumed to degrade. Speeds are assumed to degrade rapidly when volume exceeds capacity.

It is difficult to verify VDFs at a link-level. However, by comparing the results of observed/estimated comparisons of volume, VMT, VHT, and travel times, a broad conclusion can be made that CFRPM's VDFs do appear to be reasonable. The VDFs used for I-4 may need to be revised in future versions since the volumes are accurate, but the congested travel times are over-estimated for some roadway facilities.



7 Longitudinal Tests

CFRPM is primarily used to forecast impacts from changes over time to the transportation system and socio-economic conditions. The tests and benchmarks in this report until now have focused on "snapshot" data: how close is CFRPM to observed data in 2015. While it is important that CFRPM reasonably reflect 2015 conditions, the latest year with all available input data, it is equally important that CFRPM provide reasonable forecasts given changes to the input data.

A helpful method to assess CFRPM's forecast ability is to conduct longitudinal tests. Longitudinal tests evaluate how the demand model responds to changes in the transportation system and socio-economic conditions over time. Two longitudinal tests were performed for CFRPM 7. The stronger test was a backcast (i.e., a forecast to a year in the past) to 2010 conditions. The other test evaluated changes to an estimated 2045 "no action" scenario.

7.1 2010 Backcast

This longitudinal test involved developing the 2010 socio-economic data and roadway network and comparing the model results to (a) changes in the model inputs, (b) the 2010 traffic counts used for CFRPM 6 validation and the (c) CFRPM 6 model outputs.

The 2010 roadway network was developed by using the 2015 roadway network as a base and then revising the number of lanes for limited-access facilities and major arterials to match 2010 conditions. Changes in these facilities were identified by reviewing the current Transportation Improvement Program (TIP) and past Long Range Transportation Plans (LRTP) for projects constructed between 2010 and 2015. This network was then compared to CFRPM 6 2010 network and the 2011 Highway Performance Monitoring System (HPMS) roadway GIS file.

The 2010 socio-economic data was developed in multiple steps. The 2015 socio-economic data was scaled down to the 2010 population and employment control totals by county from CFRPM 6. However, the 2010 total population in Volusia and Flagler Counties from CFRPM 6 is higher than the Census, adjustments were made to match the population control totals using the 2010 Census minus group quarter population for these two counties. The special purpose input data use the same attendance levels as CFRPM 6 2010 base year, except for OIA. The 2010 OIA passenger levels were scaled back by using the Compound Annual Growth Rate (CAGR) and transfer rate from the *GOAA traffic summary report*¹².

¹² Please note all inputs were same as trucks, diurnal factor, external trips, IE trips between 2010 backcast and 2015 base year. Also, all number of transit trips are the same. So, the STOPS files used in 2010 are the same as 2015. No 2010 STOPS files were created.



7.1.1 Major Inputs and Outputs

Table 7-1 compares the major inputs (population and employment) and outputs (VMT and VHT) for 2010 and 2015. The table shows that CFRPM 7's traffic levels decreased at the same level as the population and employment levels, although VHT decreases at a greater amount. This indicates there is more auto congestion in 2015 than 2015.

Table 7-1 Comparison of Major Inputs and Outputs

Year	lr	nput	Output			
	Population	Employment	VMT	VHT		
2015	4,814,794	2,054,592	139,771,874	3,822,669		
2010	4,574,959 1,927,363 136,095,549 3,3		3,398,093			
Growth%	-5%	-6%	-3%	-11%		

Source: CFRPM 7

7.1.2 2010 Traffic Counts

The next test compared the 2010 CFRPM 7 results against the 2010 daily traffic counts used for CFRPM 6 validation. Only 5,572 of CFRPM 6's 6,859 (81%) 2010 daily traffic counts were used for this comparison. The count site IDs for the remaining 19% could not be matched with CFRPM 7 sites. Count site IDs for 613 truck counts for 2010 could be matched. CFRPM 6 documentation was unclear whether the 2010 traffic counts reflected Peak Season Weekday Traffic.

The assignment results are shown in Table 7-2. Overall, CFRPM 7 produces more traffic than is reflected in the daily traffic counts. Assuming the traffic count issues described above are not contributing to these results, they suggest that CFRPM 7's trip lengths are longer than observed in 2010. The amount of traffic appears to be correct given the results in the previous Table 7-1.

Table 7-2 Comparing the Backcast Results to 2010 Traffic Counts

Category	CFRPM 7 (2010)
Regional Volume/Count Ratio (%RMSE), Daily	1.08 (37%)
Volume/Count Ratio (%RMSE), Freeways	1.10 (23%)
Volume/Count Ratio (%RMSE), Trucks	0.90 (83%)
VMT V/Cnt Ratio	1.17
VHT V/Cnt Ratio	1.14

Source: CFRPM 7



7.1.3 Comparison with CFRPM 6 Results

The final backcast test compared the 2010 CFRPM 7 results with the corresponding results from CFRPM 6. This comparison helps to identify major differences between CFRPM 6 and 7 beyond model characteristics.

CFRPM 6 consisted of two different models: one producing daily traffic volumes and another for time-of-day traffic (TOD). The daily model was used to produce the official validation metrics. Only a selected number of CFRPM 6 time-of-day metrics were documented. CFRPM 6 had slightly different time period settings, making direct time period comparisons difficult. There are other differences between CFRPM 6 and 7; these are summarized in the following Table 7-3.

Table 7-3 Difference Summary of CFRPM 6 and CFRPM 7

Category	CFRPM 6 (both TOD and daily models)	CFRPM 7	%Delta
Traffic Analysis Zones (TAZs) (includes zone numbers reserved for future use)	5,406	9,057	+68%
Roadway network links Not including centroid connectors Including centroid connectors	40,503 60,980	46,784 72,898	+16% +20%
Total lane-miles (not including centroid connectors)	22,263	24,911	+12%
Lines of code	34,000	12,000	-65%
Traffic Counts (Time-of-Day)	5,665	10,335	+82%
Traffic Counts (Daily)	6,859	10,426	+52%
Truck Traffic Counts (Daily)	613	2,216	+260%
% of links with traffic counts (TOD)	9%	14%	+56%
% of links with traffic counts (daily)	11%	14%	+27%
Base year	2010	2015	

Source: CFRPM 7, CFRPM 6

With these differences in mind, Table 7-4 compares the 2010 results of CFRPM 6 daily model, CFRPM 6 time-of-day model and CFRPM 7.

Table 7-4 Comparison CFRPMs 6 (daily and TOD) and 7

Category	CFRPM 6 (Daily)	CFRPM 6 (TOD)	CFRPM 7 (TOD)
Regional Volume/Count Ratio (%RMSE), Daily	1.03 (35%)	1.06 (40%)	1.08 (37%)
Volume/Count Ratio (%RMSE), Freeways	0.97 (13%)	1.17 (34%)	1.10 (23%)
Volume/Count Ratio (%RMSE), Trucks	1.11 (44%)	n/a*	0.90 (83%)
Regional Vehicle Miles Traveled (VMT)	110M	110M	136M
VMT V/Cnt Ratio	1.03	1.08	1.17



Category	CFRPM 6 (Daily)	CFRPM 6 (TOD)	CFRPM 7 (TOD)
Regional Vehicle Hours Traveled (VHT)	3.1M	2.5M	3.4M
VHT V/Cnt Ratio	1.04	1.09	1.14
Regional Vehicle Trips (daily)	12M	12M	11M
Average congested speed	36.5 mph	41.0 mph	40.0 mph

^{*} CFRPM 6 combined LOV, LTRK, and HTRK trips together in assignment

Source: CFRPM 7, CFRPM 6

If the structural and traffic count differences between CFRPM 6 and 7 are not significant, the results indicate that CFRPM 7 produces more traffic than CFRPM 6 at a slightly higher average speed. The VMT comparisons in Chapter 6 indicate that CFRPM 7 has approximately the right level of traffic demand (in the form of VMT). These results indicate that the trip lengths might be longer than what might be observed in the real-world. It is interesting that CFRPM 7's results are similar to CFRPM 6 TOD model results. This may indicate that both time-of-day models are not reflecting travel lengths or patterns correctly throughout the day. Overall, these results show that CFRPM 7 produces volume-to-count metrics similar to those from CFRPM 6.

7.2 2045 E+C Forecast

This longitudinal test involved developing the 2045 socio-economic data and roadway network and comparing the model results to changes in the model inputs.

The 2045 roadway network reflects only existing and committed (E+C) projects such as the I-4 Ultimate and Wekiva Parkway. Table 7-5 shows the assumed growth in lane-miles between 2015 and 2045. Lane-miles increase by 11% regionally, with limited-access roadway capacity growing by 26%.

Table 7-5 2045 Network changes (Lane-miles)

	Limited-access		Arterial Road		Local Road			Total				
County	2015	2045	Growth %	2015	2045	Growth %	2015	2045	Growth	2015	2045	Growth %
Brevard	567	614	8%	1,379	1,644	19%	765	815	7%	2,712	3,074	13%
Flagler	119	120	1%	340	360	6%	277	279	1%	736	760	3%
Indian River	67	87	30%	232	264	14%	135	151	12%	434	502	16%
Lake	102	242	137%	748	888	19%	1,076	1,082	1%	1,926	2,211	15%
Marion	239	240	0%	1,012	1,142	13%	1,639	1,661	1%	2,891	3,043	5%
Orange	1,199	1,541	29%	2,385	2,703	13%	1,503	1,643	9%	5,087	5,887	16%
Osceola	395	528	34%	792	945	19%	620	660	6%	1,806	2,133	18%
Polk	337	393	17%	1,916	2,055	7%	1,598	1,630	2%	3,851	4,078	6%
Seminole	201	296	47%	662	747	13%	570	582	2%	1,434	1,626	13%



Sumter	183	253	38%	413	484	17%	393	417	6%	989	1,154	17%
Volusia	391	480	23%	1,321	1,442	9%	1,150	1,170	2%	2,861	3,093	8%
Total	3,799	4,795	26%	11,201	12,675	13%	9,726	10,090	4%	24,726	27,560	11%

Source: CFRPM 7

The 2045 population and employment were developed for the 2045 LRTPs currently being conducted by the MPO/TPOs. The changes between 2015 and 2045 are shown in Table 7-6. The population and employment are expected to grow significantly: a regional 51% and 79% increase, respectively.

Table 7-6 2045 ZDATA Changes

		Population		Employment			
County	2015	2045	Growth%	2015	2045	Growth%	
Brevard	555,850	705,162	27%	252,418	371,095	47%	
Flagler	101,289	182,148	80%	25,805	50,167	94%	
Indian River	47,391	66,824	41%	14,926	18,653	25%	
Lake	318,365	511,433	61%	129,709	252,743	95%	
Marion	333,186	444,911	34%	111,501	174,481	56%	
Orange	1,213,443	1,973,025	63%	809,785	1,364,337	68%	
Osceola	313,899	655,186	109%	93,859	276,410	194%	
Polk	655,197	917,301	40%	194,740	434,262	123%	
Seminole	449,141	588,820	31%	186,966	364,489	95%	
Sumter	108,557	223,979	106%	30,189	71,336	136%	
Volusia	503,615	698,777	39%	204,694	305,529	49%	
Total	4,599,933	6,967,566	51%	2,054,592	3,683,502	79%	

Source: CFRPM 7

Like the 2010 backcast, the 2045 forecast also uses 2045 special purpose productions used for CFRPM 6. OIA passengers for 2045 were based upon *GOAA's traffic summary report*. Estimates for Universal Studio's third theme park were also included.

The resulting person trips, VHT and average speed for 2015 and 2045 are shown in Table 7-7. CFRPM 7 generates person trips by county at a rate similar to the population growth rate. VHT and average speed changes are indicators for congestion of the roadways. For example, an increase in the VHT or a decrease in the average speed means that traffic condition is worse than before. Congestion increases regionally since the demand growth is greater than the supply growth: a 56% increase in person trips is 5 times higher than the 11% increase in capacity.



The growth rate of the VHT and average speed may look remarkable given the growth rate of demand for some counties. However, considering that the relationship between volume and delay is exponential, this trend is reasonable.

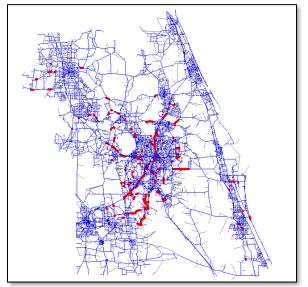
Table 7-7 2045 Results Changes

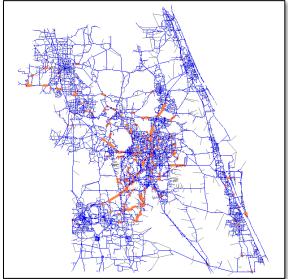
	Р	erson Trips			VHT		Avera	ge Speed (mph)
County	2015	2045	Growth %	2015	2045	Growth %	2015	2045	Growth %
Brevard	2,044,259	2,569,511	26%	369,955	499,333	35%	42	41	-2%
Flagler	315,197	567,622	80%	65,438	106,634	63%	49	43	-12%
Indian River	153,521	207,492	35%	54,934	63,864	16%	47	48	1%
Lake	1,121,694	1,758,176	57%	265,249	507,613	91%	39	32	-17%
Marion	1,133,548	1,495,334	32%	295,910	407,177	38%	41	36	-12%
Orange	4,309,078	7,458,100	73%	1,003,944	1,817,046	81%	37	33	-11%
Osceola	1,214,634	2,810,861	131%	263,951	785,555	198%	38	22	-41%
Polk	2,069,806	3,024,242	46%	533,877	853,036	60%	39	36	-8%
Seminole	1,567,474	2,043,435	30%	277,665	455,755	64%	36	33	-7%
Sumter	376,805	757,429	101%	120,503	1,587,060	1217%	45	6	-87%
Volusia	1,766,730	2,459,456	39%	348,133	610,245	75%	42	36	-15%
Total	16,072,744	25,151,658	56%	3,599,559	7,693,316	114%	39	28	-29%

Heavy congested roads with a ratio of volume to LOS C capacity higher than 1.5 are shown in Figure 7-1 and Figure 7-2 for 2015 and 2045. Congestion is expected to increase throughout the Orlando urban area, along I-75 into Marion County, along I-4 into Polk and Volusia Counties.

Figure 7-1 2015 Congestion (Volume to LOS C Capacity Ratio > 1.5)

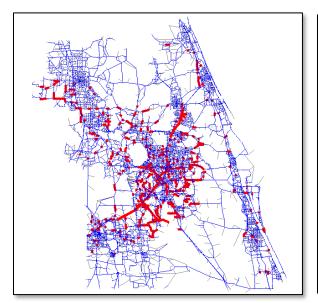
(a) AM (b) PM







(a) AM (b) PM



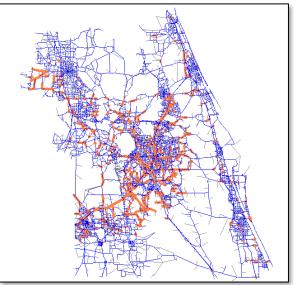


Figure 7-3 AM Volume Change Between 2015 and 2045

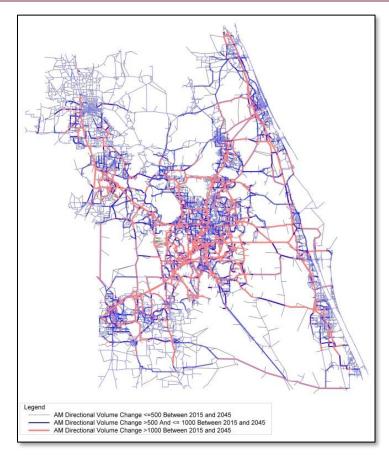
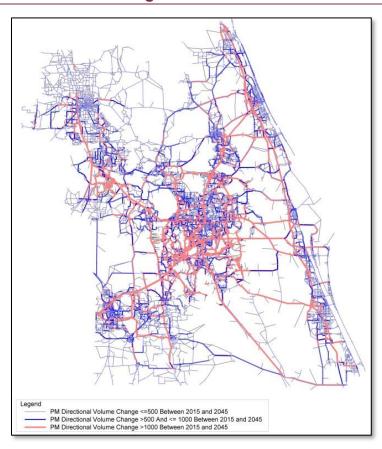




Figure 7-4 PM Volume Change Between 2015 and 2045





8 Summary

The results of each component of CFRPM 7 have been tested against a broad range of tests, benchmarks and metrics. Where possible, results have been compared to observed data. If observed data is not available, results were compared against benchmarks and manual reviews. Taken together, CFRPM 7 has undergone the most comprehensive review more than any previous version.

Initially, the ZDATA (socio-economic data) was run through 53 error and reasonableness tests. Zones that failed to achieve positive results were manually inspected for reasonableness. Then separate tests and comparisons were conducted separately for the household, employment, and K-12 school ZDATA data.

The household data compares favorably to alternate data sources such as BEBR, BEA and the American Community Survey (ACS). The employment data is consistent generally with data from Bureau of Labor Statistics (BLS), American Community Survey (ACS), County Business Patterns (CBP), Woods & Poole (W&P), and Bureau of Economic Analysis (BEA) 2015. One issue is that BEA has significantly more employment in Orange, Osceola, Polk, and Seminole Counties; the reasons for these strong differences are unknown at this time. CFRPM K-12 school enrollment is higher than the ACS data, the only data available during model development, in all counties. Most differences are minor, but there are significant differences in Osceola and Seminole Counties. The reasons for these significant differences are unknown but they correspond to similar differences in the employment data comparisons.

The roadway network is the biggest component to CFRPM. The posted speeds of all 46,784 links were verified against FDOT data and available maps and GPS data. Adjustments were made to 5% of all links. The number of lanes were verified using similar data, with less than 1% of all links requiring corrections. Several other roadway network data, including area types, facility types and turn prohibitors, were reviewed and adjusted via visual inspection.

The estimated free-flow speeds were compared to observed speeds during an average Sunday between 7-8 AM. There is a significant variation in the results by facility type. One reason for this variation is that the estimated free-flow speed equations were developed at an aggregate level due to significant noise in the observed dataset. Another reason is that, due to schedule constraints, the free-flow speed equations had to be developed before the roadway posted speeds could be verified. Generally, the project team concludes that the estimated free-flow speeds, at a regional level, are reasonable for long-range planning use. In subsequent updates, the observed free-flow speed data – especially for ramps – should be reviewed thoroughly before use and updates to the equations should be made after posted speeds are verified.

The trip generation results are mostly within national benchmarks. Sumter County is showing a lower number of work trips than the benchmarks and higher numbers of non-work trips. This may be due to a larger proportion of retired households in that county. Overall, the trip generation results are superior to those from the previous version of CFRPM.

The trip distribution results were reviewed at a regional level using benchmarks. The average trip lengths were longer than mid-point of the benchmark values, but mostly within the ranges. The percentage of intrazonal trips were generally much lower than the benchmarks. These results



may imply that CFRPM might be slightly over-estimating traffic, but the new zone system – which produced, on average, smaller area zones – might be contributing to the results.

The county-to-county trip flows were reviewed manually by purpose. Across all purposes, over 85% of county-to-county movements have errors of less than 10%. This indicates that the estimated county-to-county flows are generally consistent with the corresponding observed flows. Additionally, the estimated trip flows within the METROPLAN Orlando MPO and the outer counties are generally consistent with the corresponding observations for all five trip purposes.

The trips computed in CFRPM's mode choice step were also reviewed for reasonableness. The number of non-motorized trips and their trip lengths are reasonable and consistent with the corresponding NHTS data. The calibrated OIA trip results match their observed values.

The transit results indicate that CFRPM STOPS model understands the transit travel patterns of Central Florida. The differences between the total observed and estimated linked trips are minor – defined as less than 10% or 500 trips – by trip purpose and access mode. For each agency, total estimated trips are within \pm 5% of the observed trips. PNR boardings show a high percentage of delta compared to other access modes. However, this has a slight impact on the model validity since this is the least-used access mode in the region. There is only 3% difference between the observed and estimated regional transfer rate, indicating that the transit model understands the transferring activity of Central Florida transfer riders at a regional level.

The comparisons of auto occupancy rates and percentages of trips by auto occupancy indicate that CFRPM 7's values are similar to those from the NHTS datasets and other Florida models. This indicates that CFRPM 7's estimates of auto trips for these purposes are reasonable given the number of person trips produced in the Trip Distribution step.

The highway assignment results were compared using benchmarks for traffic volume, VMT, VHT, and travel time. The daily results are all within the acceptable or preferable benchmark ranges. The screenline results indicate overestimated traffic across Volusia County and Flagler County boundaries and SR 60 (Indian River), Polk Parkway (Polk), and SR 19 (Lake). But overall the screenline analysis shows that CFRPM 7 reasonably reflects traffic demand throughout most areas in the region. Comparisons of VMT to the DVMT Report indicate that CFRPM is producing VMT 3% within observed values.

There was a common theme among the time of day assignment results. Traffic demand in the AM and PM Peak periods tended to be higher than the acceptable benchmark, but within the acceptable or preferable benchmarks for the midday and evening periods. Overall, CFRPM produces time-of-day results that generally meet acceptable standards. CFRPM estimates travel times well, but there is the trend that congestion along I-4 is over-estimated.

It is difficult to verify VDFs at a link-level. However, by comparing the results of observed/estimated comparisons of volume, VMT, VHT and travel times, a broad conclusion can be made that CFRPM's VDFs do appear to be reasonable. The VDFs used for I-4 may need to be revised in future versions since the volumes are accurate, but the congested travel times are overestimated.

While it is important that CFRPM reasonably reflect 2015 conditions, the latest year with all available input data, it is equally important that CFRPM provide reasonable forecasts given



changes to the input data. Two longitudinal tests were performed for CFRPM 7 to help assess this ability. The stronger test was a backcast (i.e., a forecast to a year in the past) to 2010 conditions. The other test evaluated changes to an estimated 2045 "no action" scenario.

In the 2010 backcast, CFRPM 7 produces more traffic than is reflected in the daily traffic counts. This suggests that CFRPM 7's trip lengths are longer than observed in 2010. The results also indicate that CFRPM 7 produces more traffic than CFRPM 6 at a slightly higher average speed. The VMT comparisons in Chapter 6 indicate that CFRPM 7 has approximately the right level of traffic demand (in the form of VMT). It is interesting that CFRPM 7's results are similar to CFRPM 6 TOD model results. This may indicate that both time-of-day models are not reflecting travel lengths or patterns correctly throughout the day. Overall, these results show that CFRPM 7 produces volume-to-count metrics similar to those from CFRPM 6.

In the 2045 "no action" forecast, CFRPM 7 generates person trips by county at a rate similar to the population growth rate. Congestion increases regionally since the demand growth is greater than the supply growth: a 56% increase in person trips is 5 times higher than the 11% increase in capacity. The growth rate of the VHT and average speed may look remarkable given the growth rate of demand for some counties. However, considering that the relationship between volume and delay is exponential, this trend is reasonable.

Through this extensive review, CFRPM 7 has been shown to reasonably reflect Central Florida transportation demand and travel patterns and is a reliable technical tool for long-range planning analyses.



Appendix A: Average Annual Daily Traffic Development

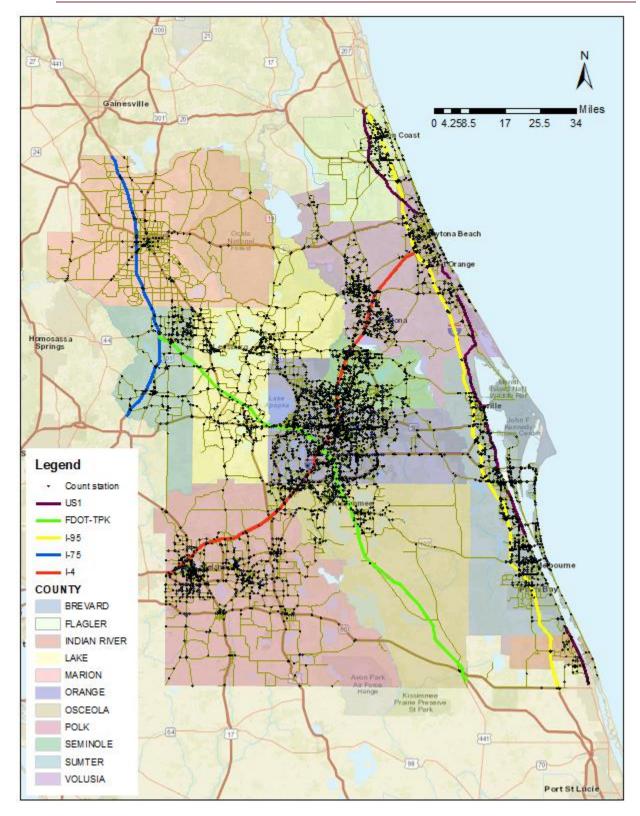
Traffic count data are key pieces of data used to validate the Central Florida Regional Planning Model (CFRPM). In the Central Florida region, traffic counts are collected by different sources, including the Florida Department of Transportation (FDOT), Florida's Turnpike (FDOT-TRK), Central Florida Expressway Authority (CFX), Reedy Creek Improvement District (RCID), Greater Orlando Aviation Authority (GOAA), as well as numerous cities, municipalities and counties. As a result, multiple count data may exist for the same facility.

A master count database was developed for CFRPM validation and other applications. All counts are in 15-minute increments by direction and reflect 2015 conditions, although some counts were collected as early as 2014 and as recent as 2017. The original count data were merged into a common format and converted to Peak Seasonal Weekday Average Daily Traffic (PSWADT). Then multiple count data records (essentially duplicative count records) were removed from the database. Counts with anomalous values were also removed. Finally, the counts are linked to CFRPM highway network for model validation.

The assembled data came from 6,349 count stations and represent 11,335 counts by direction, each by 15-minute increments. The count stations are shown in Figure A-1.



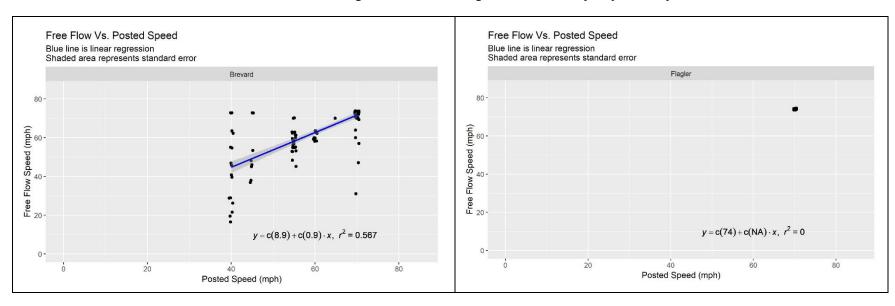
Figure A-1 Count Locations in CFRPM Area



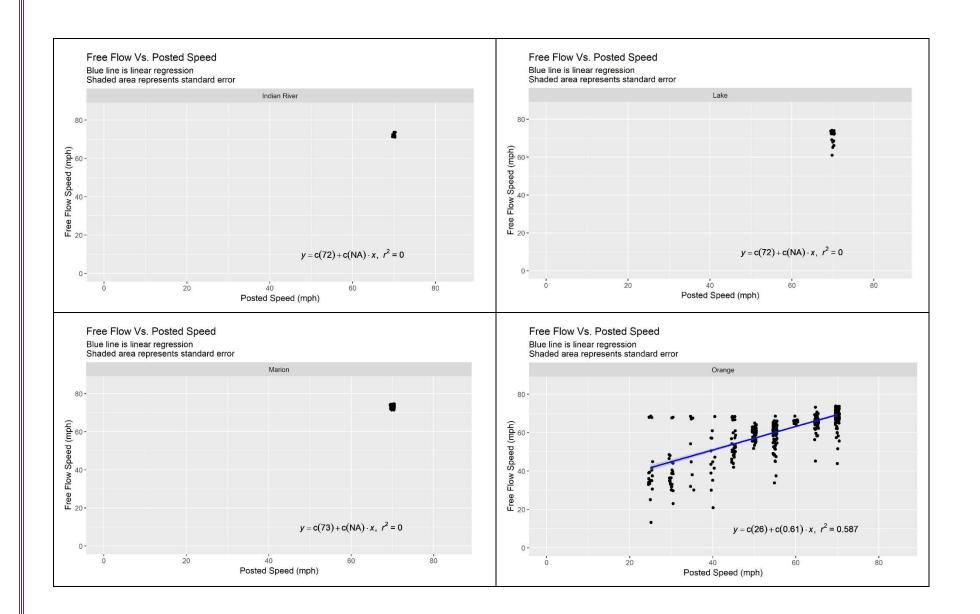


Appendix B: Regression Analysis of Posted and Free Flow Speeds

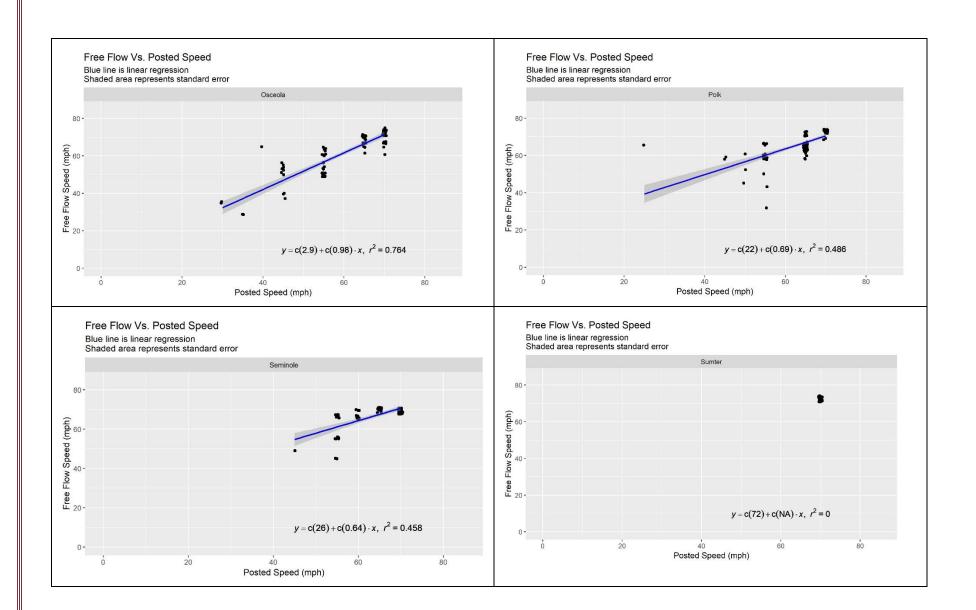
Free Flow Speed Vs. Posted Speed on Freeways by County



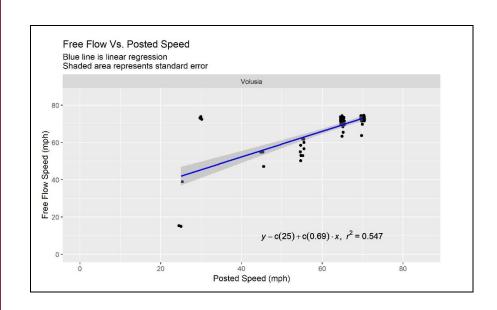




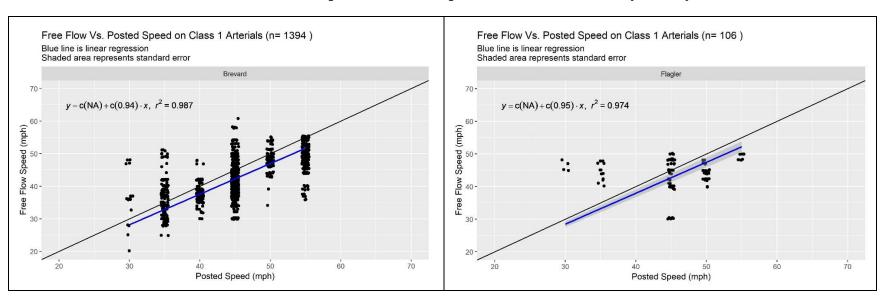




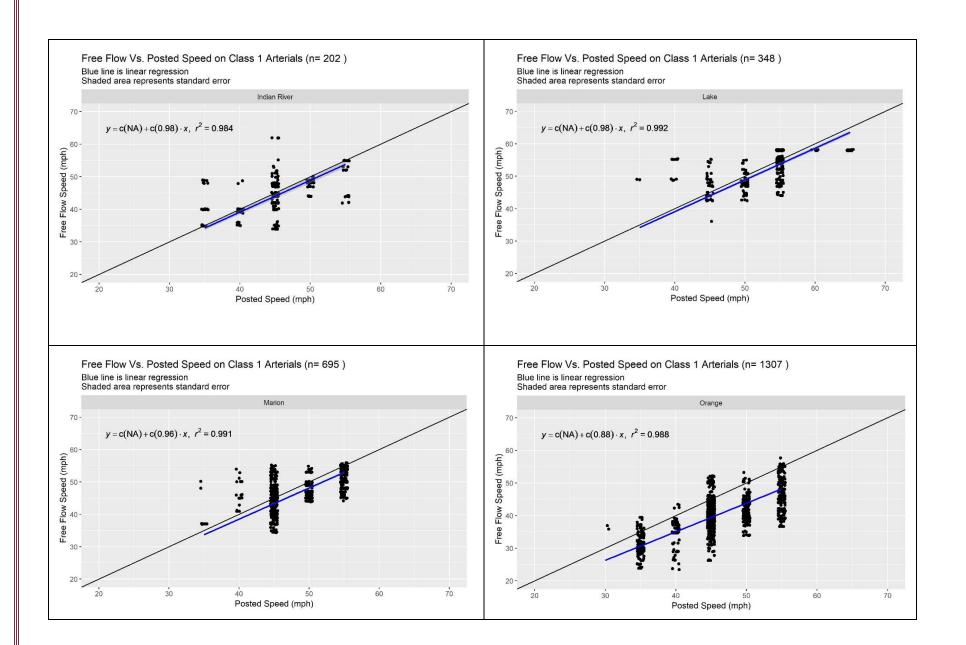




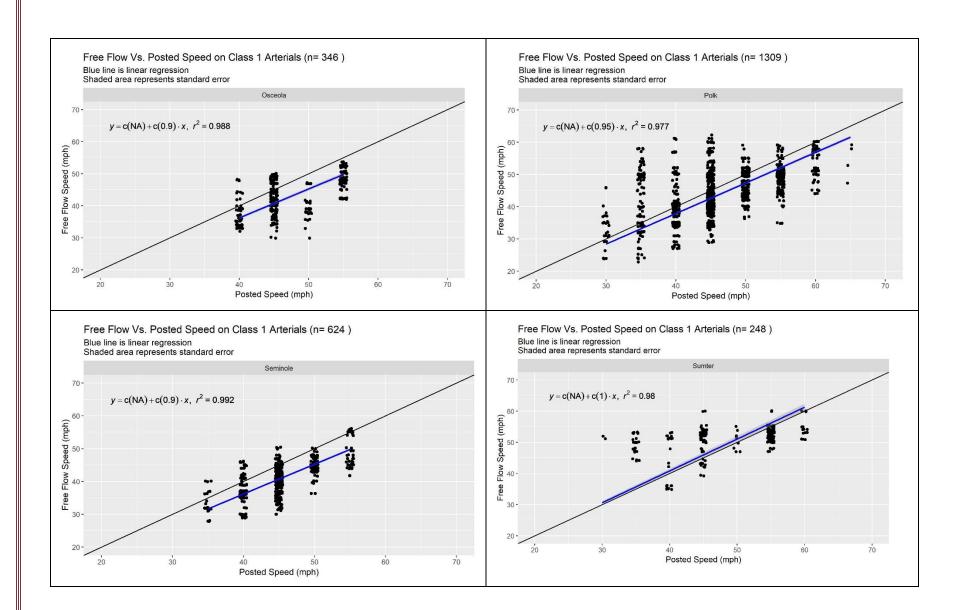
Free Flow Speed Vs. Posted Speed on Class I Arterials by County



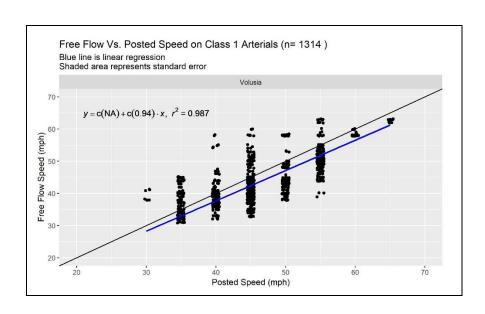




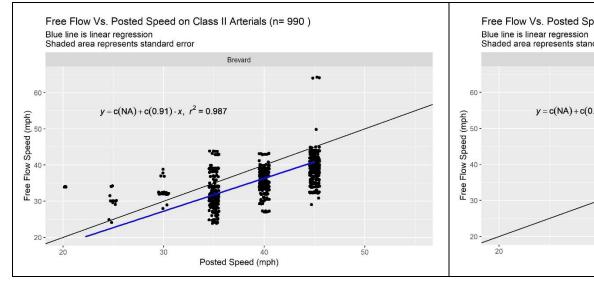


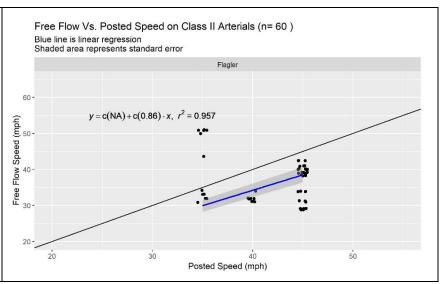




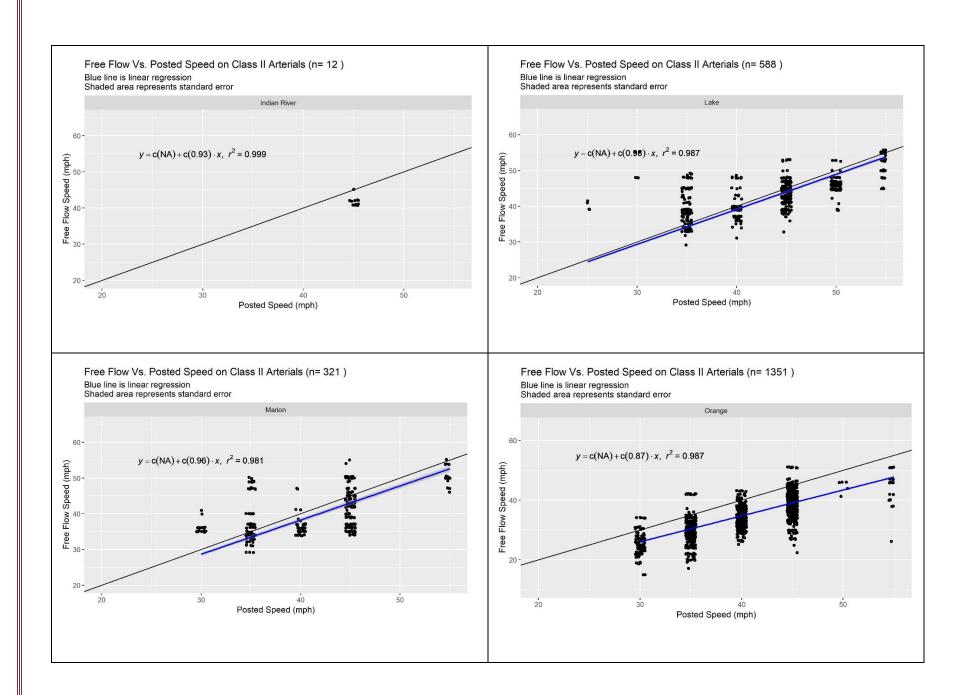


Free Flow Speed Vs. Posted Speed on Class II Arterials by County

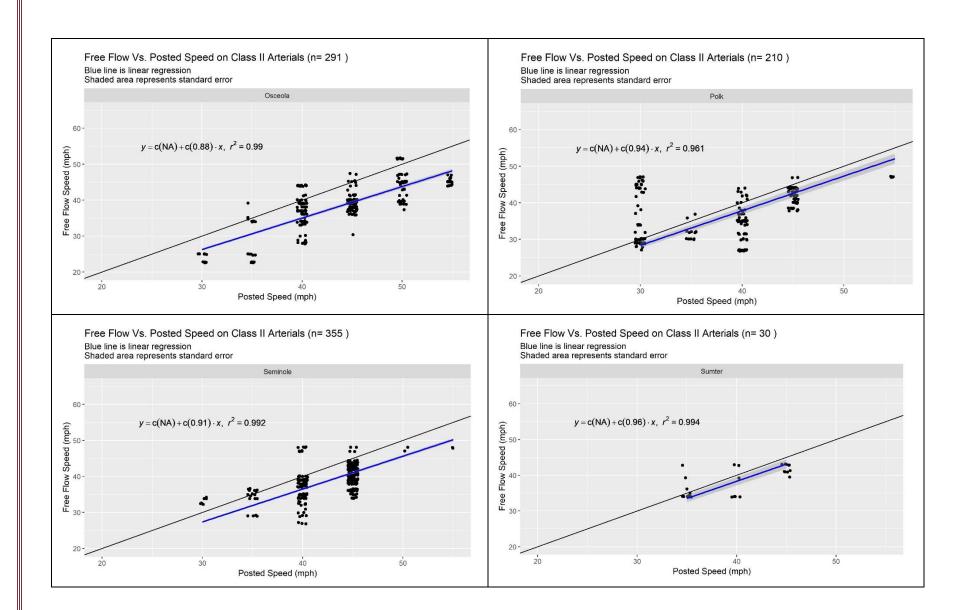




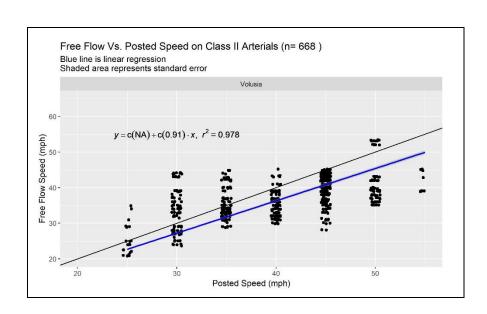




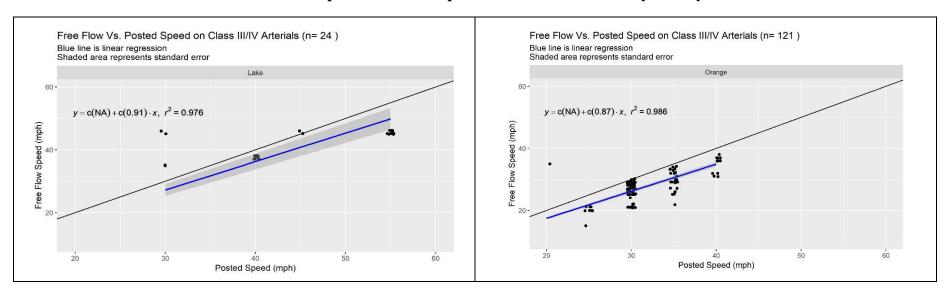


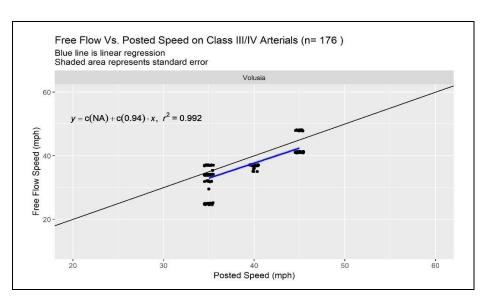




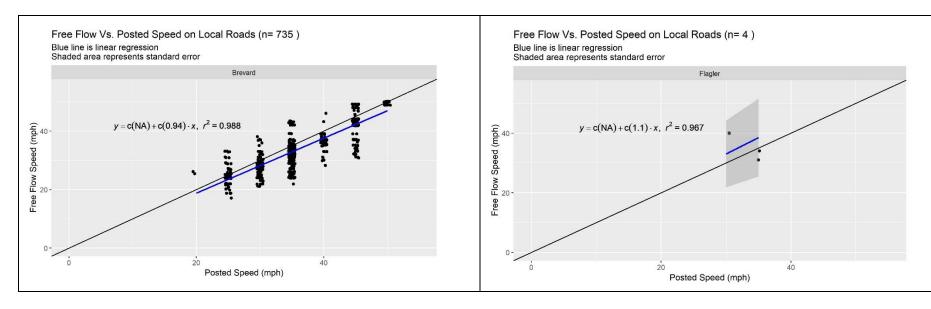


Free Flow Speed Vs. Posted Speed on Class III Arterials by County

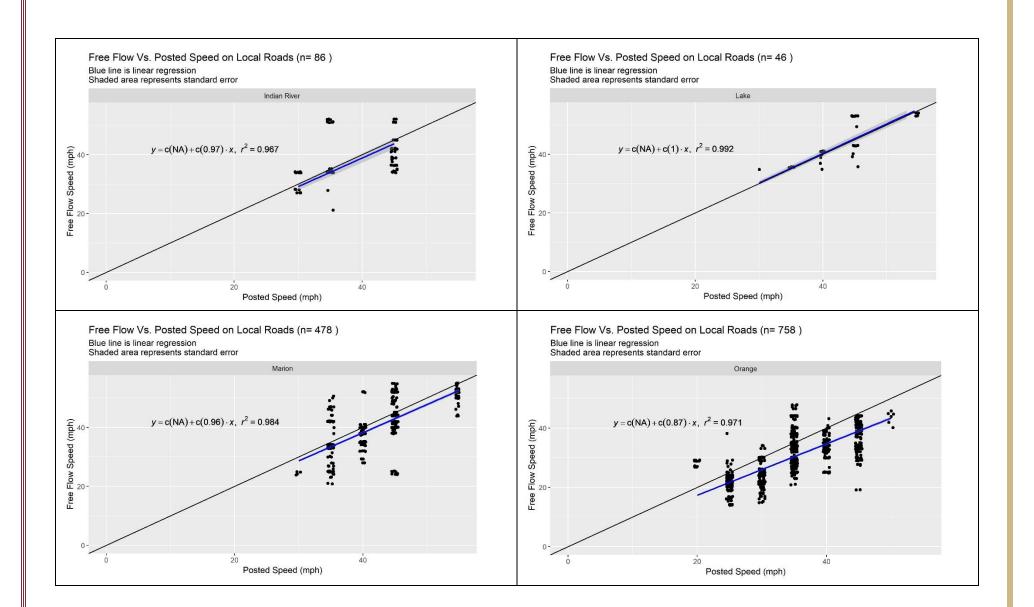




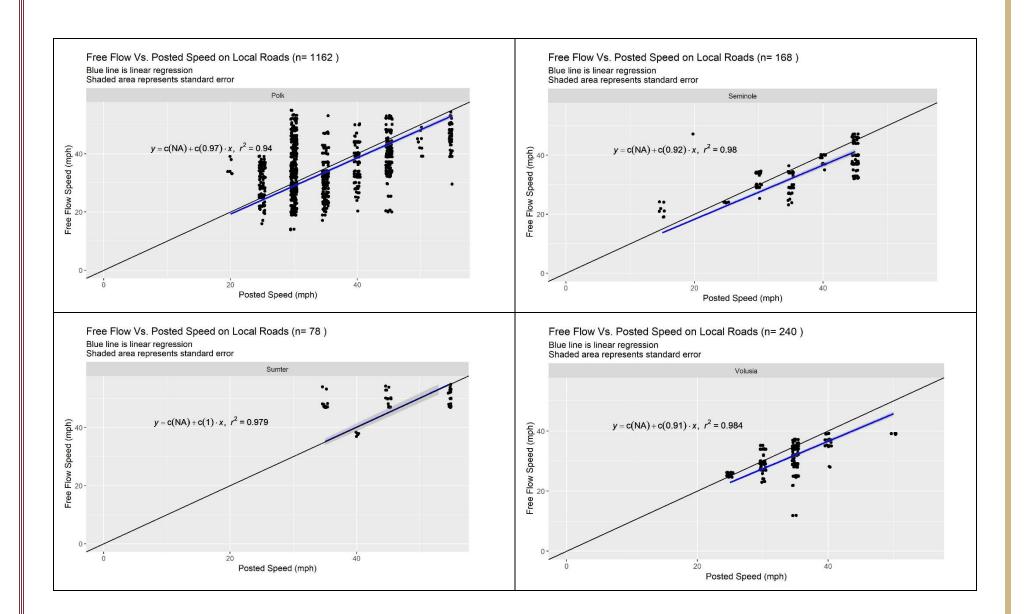
Free Flow Vs. Posted Speed on Local Roads by County



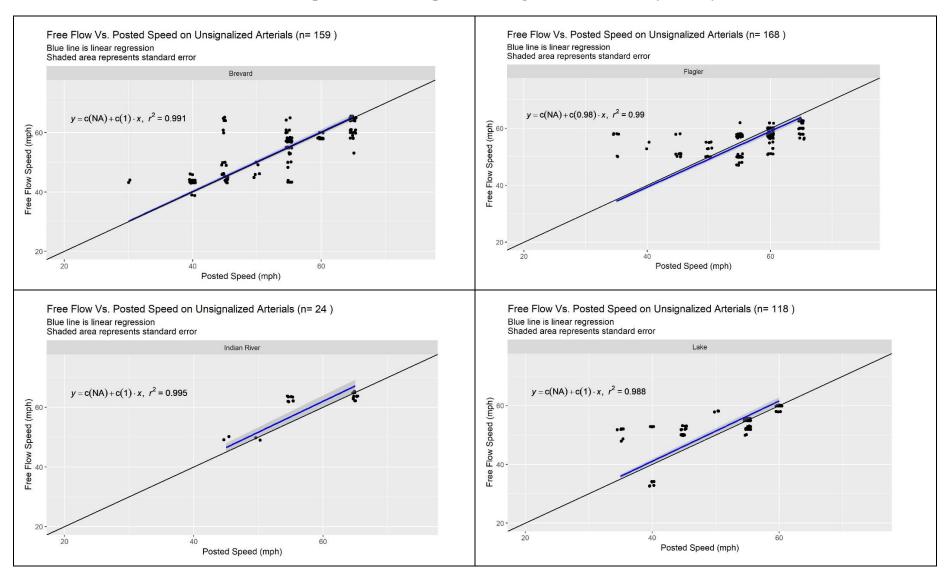




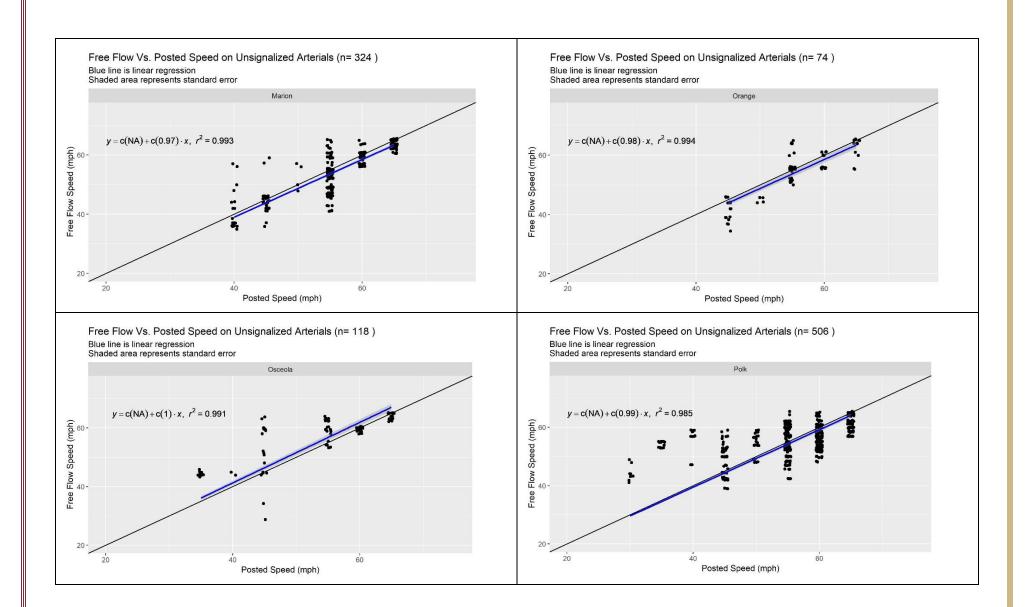




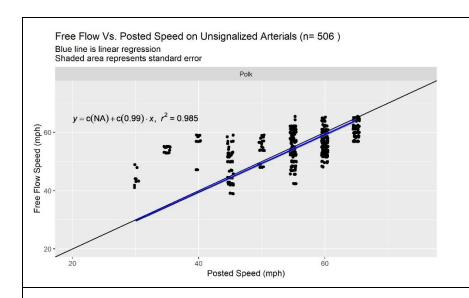
Free Flow Speed Vs. Posted Speed on Unsignalized Arterials by County

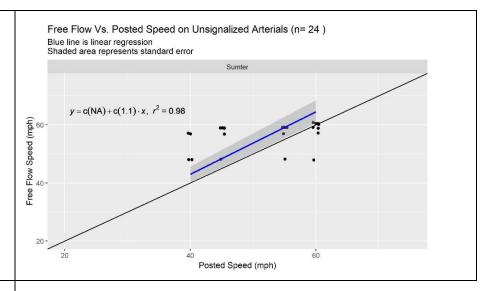


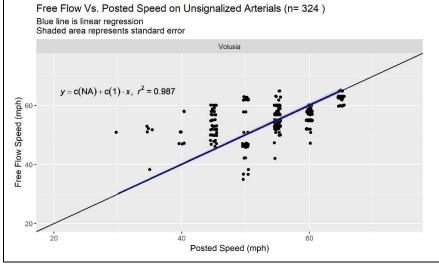














Appendix C: Comparison of Observed and Estimated Free Flow Speed

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Brevard County

Facility Type Code	Facility Type	Perc with Spee	Total No. of Links		
0000		< 0.9	Between 0.9-1.1	> 1.1	Liiiko
11	Freeway Non-Toll	2.31	91.54	6.15	130
21	Divided Arterial Unsignalized (Speed 55 & above mph)	8.79	86.81	4.40	91
22	Divided Arterial Unsignalized (Speed 45 & 50 mph)	25.00	75.00	0.00	8
23	Divided Arterial Class I	14.10	72.83	13.07	773
24	Divided Arterial Class II	9.43	75.09	15.47	530
31	Undivided Arterial Unsignalized with Turn Bays	3.45	86.21	10.34	58
32	Undivided Arterial Class I with Turn Bays	9.79	67.26	22.95	623
33	Undivided Arterial Class II with Turn Bays	15.65	70.00	14.35	460
41	Major Local Divided Roadway	0.00	100.00	0.00	58
42	Major Local Undivided Roadway with Turn Bays	5.63	81.79	12.58	302
43	Major Local Undivided Roadway without Turn Bays	27.20	64.80	8.00	125
44	Other Local Divided Roadway	75.00	0.00	25.00	12
45	Other Local Undivided Roadway with Turn Bays	0.00	20.00	80.00	10
46	Other Local Undivided Roadway without Turn Bays	0.00	100.00	0.00	8
47	Low Speed Collector	18.52	71.30	10.19	216
62	One-Way Facilities Class I	8.33	91.67	0.00	12
63	One-Way Facilities Class II	52.27	43.18	4.55	44
71	Freeway On/Off Ramp-Service Interchange	28.57	57.14	14.29	7
72	Freeway On/Off Loop Ramp-Service Interchange	25.00	0.00	75.00	8
73	Other On/Off Ramp-Urban Interchange	0.00	100.00	0.00	2
76	Freeway-Collector/Distributor Ramp	80.00	20.00	0.00	10
All	All Facility Type	12.70	72.96	14.34	3,487



Comparison of Estimated and Observed Free Flow Speed by Facility Type in Flagler County

Facility Type	Facility Type	Perce with Speed	Total No. of		
Code		< 0.9	Between 0.9-1.1	> 1.1	Links
11	Freeway Non-Toll	0.00	100.00	0.00	16
21	Divided Arterial Unsignalized (Speed 55 & above mph)	7.58	75.76	16.67	66
23	Divided Arterial Class I	20.00	70.00	10.00	80
24	Divided Arterial Class II	14.29	47.62	38.10	42
31	Undivided Arterial Unsignalized with Turn Bays	7.14	82.14	10.71	56
32	Undivided Arterial Class I with Turn Bays	31.82	50.00	18.18	44
33	Undivided Arterial Class II with Turn Bays	0.00	50.00	50.00	4
35	Undivided Arterial Unsignalized without Turn Bays	21.43	78.57	0.00	28
42	Major Local Undivided Roadway with Turn Bays	0.00	100.00	0.00	2
46	Other Local Undivided Roadway without Turn Bays	100.00	0.00	0.00	2
52	External Station Connector	33.33	66.67	0.00	6
63	One-Way Facilities Class II	0.00	64.29	35.71	14
92	Toll Facility - Arterial	0.00	50.00	50.00	2
All	All Facility Type	15.19	69.06	15.75	362

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Indian River County

Facility Type Code	Facility Type		entage of L Estimated d / Observe Speed Between 0.9-1.1	FF	Total No. of Links
11	Freeway Non-Toll	0.00	100.00	0.00	11
21	Divided Arterial Unsignalized (Speed 55 & above mph)	40.00	60.00	0.00	20
23	Divided Arterial Class I	29.69	59.38	10.94	128



31	Undivided Arterial Unsignalized with Turn Bays	0.00	100.00	0.00	4
32	Undivided Arterial Class I with Turn Bays	16.22	70.27	13.51	74
33	Undivided Arterial Class II with Turn Bays	0.00	100.00	0.00	12
42	Major Local Undivided Roadway with Turn Bays	0.00	75.00	25.00	32
43	Major Local Undivided Roadway without Turn	42.86	35.71	21.43	28
43	Bays	42.00	55.71	21.43	20
45	Other Local Undivided Roadway with Turn Bays	14.29	85.71	0.00	14
47	Low Speed Collector	50.00	50.00	0.00	12
All	All Facility Type	23.28	65.37	11.34	335

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Lake County

Facility Type Code	Facility Type		Percentage of Links with Estimated FF Speed / Observed FF Speed		
Code		< 0.9	Between 0.9-1.1	> 1.1	Links
22	Divided Arterial Unsignalized (Speed 45 & 50 mph)	0.00	100.00	0.00	2
23	Divided Arterial Class I	7.09	85.04	7.87	254
24	Divided Arterial Class II	26.90	72.08	1.02	394
31	Undivided Arterial Unsignalized with Turn Bays	20.93	72.09	6.98	86
32	Undivided Arterial Class I with Turn Bays	18.48	80.43	1.09	92
33	Undivided Arterial Class II with Turn Bays	37.21	61.63	1.16	172
34	Undivided Arterial Class III/IV with Turn Bays	20.83	79.17	0.00	24
35	Undivided Arterial Unsignalized without Turn Bays	20.00	80.00	0.00	30
37	Undivided Arterial Class II without Turn Bays	50.00	50.00	0.00	6
42	Major Local Undivided Roadway with Turn Bays	48.48	48.48	3.03	33
43	Major Local Undivided Roadway without Turn Bays	0.00	100.00	0.00	6
46	Other Local Undivided Roadway without Turn Bays	100.00	0.00	0.00	6
47	Low Speed Collector	100.00	0.00	0.00	1
63	One-Way Facilities Class II	15.00	85.00	0.00	20
73	Other On/Off Ramp-Urban Interchange	0.00	50.00	50.00	2
91	Toll Facility - Freeway	0.00	89.66	10.34	29
All	All Facility Type	22.73	73.98	3.28	1,157



Comparison of Estimated and Observed Free Flow Speed by Facility Type in Marion County

Facility Type	Facility Type		Percentage of Links with Estimated FF Speed / Observed FF Speed		
Code		< 0.9	Between 0.9-1.1	> 1.1	Links
11	Freeway Non-Toll	0.00	100.00	0.00	33
21	Divided Arterial Unsignalized (Speed 55 & above mph)	5.63	75.00	19.37	284
23	Divided Arterial Class I	12.50	75.60	11.90	336
24	Divided Arterial Class II	15.12	72.67	12.21	172
31	Undivided Arterial Unsignalized with Turn Bays	0.00	71.43	28.57	28
32	Undivided Arterial Class I with Turn Bays	16.71	77.23	6.05	347
33	Undivided Arterial Class II with Turn Bays	43.62	54.36	2.01	149
35	Undivided Arterial Unsignalized without Turn Bays	0.00	100.00	0.00	12
36	Undivided Arterial Class I without Turn Bays	0.00	100.00	0.00	8
41	Major Local Divided Roadway	0.00	66.67	33.33	24
42	Major Local Undivided Roadway with Turn Bays	12.75	71.08	16.18	204
43	Major Local Undivided Roadway without Turn Bays	32.47	66.23	1.30	154
45	Other Local Undivided Roadway with Turn Bays	7.69	84.62	7.69	52
46	Other Local Undivided Roadway without Turn Bays	11.36	88.64	0.00	44
47	Low Speed Collector	0.00	50.00	50.00	4
52	External Station Connector	16.67	83.33	0.00	6
All	All Facility Type	15.78	73.61	10.61	1,857

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Orange County

Facility Type	Facility Type	Percentage of Links with Estimated FF Speed / Observed FF Speed		Estimated FF Speed /		Total No.
Code		< 0.9	Between 0.9-1.1	> 1.1	of Links	
11	Freeway Non-Toll	60.00	39.05	0.95	105	



21	Divided Arterial Unsignalized (Speed 55 & above mph)	9.62	86.54	3.85	52
22	Divided Arterial Unsignalized (Speed 45 & 50 mph)	0.00	54.55	45.45	22
23	Divided Arterial Class I	3.51	58.05	38.44	1,168
24	Divided Arterial Class II	5.54	70.62	23.84	885
32	Undivided Arterial Class I with Turn Bays	1.52	49.24	49.24	132
33	Undivided Arterial Class II with Turn Bays	4.53	58.84	36.64	464
34	Undivided Arterial Class III/IV with Turn Bays	0.00	76.67	23.33	120
38	Undivided Arterial Class III/IV without Turn Bays	100.00	0.00	0.00	1
41	Major Local Divided Roadway	16.94	62.90	20.16	124
42	Major Local Undivided Roadway with Turn Bays	12.89	49.86	37.25	357
43	Major Local Undivided Roadway without Turn Bays	0.00	83.33	16.67	12
44	Other Local Divided Roadway	0.00	100.00	0.00	2
45	Other Local Undivided Roadway with Turn Bays	100.00	0.00	0.00	26
46	Other Local Undivided Roadway without Turn Bays	50.00	0.00	50.00	2
47	Low Speed Collector	1.27	48.95	49.79	237
62	One-Way Facilities Class I	20.00	60.00	20.00	25
64	One-Way Facilities Class III/IV	0.00	27.59	72.41	58
71	Freeway On/Off Ramp-Service Interchange	64.58	18.75	16.67	48
72	Freeway On/Off Loop Ramp-Service Interchange	66.67	33.33	0.00	6
73	Other On/Off Ramp-Urban Interchange	62.50	25.00	12.50	8
75	Freeway-to-Freeway Ramp-System Interchange	25.45	65.45	9.09	55
76	Freeway-Collector/Distributor Ramp	33.33	33.33	33.33	3
91	Toll Facility - Freeway	0.61	90.88	8.51	329
92	Toll Facility - Arterial	0.00	0.00	100.00	4
97	Toll On Ramp	66.67	26.67	6.67	15
98	Toll Off Ramp	71.43	28.57	0.00	14
All	All Facility Type	8.45	60.90	30.65	4,274

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Osceola County



Facility Type	Facility Type		Percentage of Links with Estimated FF Speed / Observed FF Speed		
Code		< 0.9	Between 0.9-1.1	> 1.1	of Links
11	Freeway Non-Toll	3.45	93.10	3.45	29
21	Divided Arterial Unsignalized (Speed 55 & above mph)	16.00	84.00	0.00	50
22	Divided Arterial Unsignalized (Speed 45 & 50 mph)	65.00	35.00	0.00	20
23	Divided Arterial Class I	10.69	58.28	31.03	290
24	Divided Arterial Class II	9.36	68.54	22.10	267
31	Undivided Arterial Unsignalized with Turn Bays	16.67	79.17	4.17	48
32	Undivided Arterial Class I with Turn Bays	9.26	53.70	37.04	54
33	Undivided Arterial Class II with Turn Bays	0.00	81.82	18.18	22
71	Freeway On/Off Ramp-Service Interchange	50.00	16.67	33.33	6
72	Freeway On/Off Loop Ramp-Service Interchange	40.00	0.00	60.00	5
75	Freeway-to-Freeway Ramp-System Interchange	75.00	25.00	0.00	4
91	Toll Facility - Freeway	0.00	94.59	5.41	37
92	Toll Facility - Arterial	0.00	40.00	60.00	10
All	All Facility Type	11.76	65.80	22.45	842

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Polk County

Facility Type	Facility Type	Estin	ntage of Lin nated FF S _I erved FF S	peed/	Total No.
Code		< 0.9	Between 0.9-1.1	> 1.1	of Links
11	Freeway Non-Toll	0.00	100.00	0.00	52
21	Divided Arterial Unsignalized (Speed 55 & above mph)	13.90	66.00	20.10	403
22	Divided Arterial Unsignalized (Speed 45 & 50 mph)	20.00	65.00	15.00	20
23	Divided Arterial Class I	16.99	60.60	22.41	665
24	Divided Arterial Class II	7.69	73.85	18.46	130



31	Undivided Arterial Unsignalized with Turn Bays	36.36	48.05	15.58	77
32	Undivided Arterial Class I with Turn Bays	21.71	55.47	22.82	631
33	Undivided Arterial Class II with Turn Bays	42.50	47.50	10.00	80
41	Major Local Divided Roadway	58.62	37.93	3.45	58
42	Major Local Undivided Roadway with Turn Bays	31.01	47.19	21.81	587
43	Major Local Undivided Roadway without Turn Bays	0.00	54.17	45.83	24
44	Other Local Divided Roadway	0.00	0.00	100.00	1
46	Other Local Undivided Roadway without Turn Bays	100.00	0.00	0.00	2
47	Low Speed Collector	52.66	29.71	17.62	488
62	One-Way Facilities Class I	75.00	25.00	0.00	16
71	Freeway On/Off Ramp-Service Interchange	50.00	30.00	20.00	10
72	Freeway On/Off Loop Ramp-Service Interchange	50.00	0.00	50.00	2
75	Freeway-to-Freeway Ramp-System Interchange	75.00	25.00	0.00	4
91	Toll Facility - Freeway	0.00	94.03	5.97	67
97	Toll On Ramp	100.00	0.00	0.00	2
98	Toll Off Ramp	50.00	50.00	0.00	2
All	All Facility Type	26.53	53.72	19.75	3,321

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Seminole County

Facility Type	Facility Type	Percentage of Links with Estimated FF Speed / Observed FF Speed			Total No.
Code		< 0.9	Between 0.9-1.1	> 1.1	of Links
11	Freeway Non-Toll	5.88	94.12	0.00	34
23	Divided Arterial Class I	2.29	74.43	23.28	481
24	Divided Arterial Class II	0.68	89.08	10.24	293
31	Undivided Arterial Unsignalized with Turn Bays	13.33	86.67	0.00	30
32	Undivided Arterial Class I with Turn Bays	8.45	85.21	6.34	142
33	Undivided Arterial Class II with Turn Bays	37.10	41.94	20.97	62
41	Major Local Divided Roadway	0.00	73.53	26.47	34



Facility Type Code	Facility Type		Percentage of Links with Estimated FF Speed / Observed FF Speed			
		< 0.9	Between 0.9-1.1	> 1.1	of Links	
42	Major Local Undivided Roadway with Turn Bays	15.07	83.56	1.37	73	
46	Other Local Undivided Roadway without Turn Bays	0.00	50.00	50.00	18	
47	Low Speed Collector	53.49	46.51	0.00	43	
73	Other On/Off Ramp-Urban Interchange	0.00	0.00	100.00	1	
75	Freeway-to-Freeway Ramp-System Interchange	0.00	60.00	40.00	5	
91	Toll Facility - Freeway	11.11	88.89	0.00	36	
All	All Facility Type	7.35	77.80	14.86	1,252	

Comparison of Estimated and Observed Free Flow Speed by Facility Type in Sumter County

Facility Type	Facility Type		Percentage of Links with Estimated FF Speed / Observed FF Speed			
Code		< 0.9	Between 0.9-1.1	> 1.1	of Links	
11	Freeway Non-Toll	0.00	100.00	0.00	20	
21	Divided Arterial Unsignalized (Speed 55 & above mph)	35.71	50.00	14.29	14	
23	Divided Arterial Class I	33.33	63.10	3.57	84	
24	Divided Arterial Class II	0.00	100.00	0.00	8	
31	Undivided Arterial Unsignalized with Turn Bays	40.00	60.00	0.00	10	
32	Undivided Arterial Class I with Turn Bays	37.80	60.37	1.83	164	
33	Undivided Arterial Class II with Turn Bays	22.73	77.27	0.00	22	
42	Major Local Undivided Roadway with Turn Bays	50.00	50.00	0.00	12	
43	Major Local Undivided Roadway without Turn Bays	39.39	60.61	0.00	66	
52	External Station Connector	66.67	33.33	0.00	6	
91	Toll Facility - Freeway	0.00	100.00	0.00	12	
All	All Facility Type	33.49	64.59	1.91	418	



Comparison of Estimated and Observed Free Flow Speed by Facility Type (Volusia)

Facility Type	Facility Type		Percentage of Links with Estimated FF Speed / Observed FF Speed		
Code		< 0.9	Between 0.9-1.1	> 1.1	of Links
11	Freeway Non-Toll	0.00	97.85	2.15	93
21	Divided Arterial Unsignalized (Speed 55 & above mph)	12.73	85.45	1.82	110
22	Divided Arterial Unsignalized (Speed 45 & 50 mph)	26.47	55.88	17.65	34
23	Divided Arterial Class I	16.22	66.63	17.15	968
24	Divided Arterial Class II	19.66	58.51	21.82	417
31	Undivided Arterial Unsignalized with Turn Bays	22.16	74.43	3.41	176
32	Undivided Arterial Class I with Turn Bays	12.65	68.24	19.12	340
33	Undivided Arterial Class II with Turn Bays	16.87	62.55	20.58	243
34	Undivided Arterial Class III/IV with Turn Bays	14.20	76.70	9.09	176
35	Undivided Arterial Unsignalized without Turn Bays	0.00	100.00	0.00	4
42	Major Local Undivided Roadway with Turn Bays	5.66	83.02	11.32	106
43	Major Local Undivided Roadway without Turn Bays	0.00	50.00	50.00	16
44	Other Local Divided Roadway	0.00	0.00	100.00	12
45	Other Local Undivided Roadway with Turn Bays	14.29	85.71	0.00	28
47	Low Speed Collector	42.86	51.19	5.95	84
52	External Station Connector	0.00	100.00	0.00	2
68	Frontage Road Class III/IV	100.00	0.00	0.00	2
71	Freeway On/Off Ramp-Service Interchange	80.00	20.00	0.00	5
72	Freeway On/Off Loop Ramp-Service Interchange	33.33	0.00	66.67	3
73	Other On/Off Ramp-Urban Interchange	100.00	0.00	0.00	1
74	Other On/Off Loop Ramp-Urban Interchange	50.00	50.00	0.00	2
75	Freeway-to-Freeway Ramp-System Interchange	0.00	100.00	0.00	2
76	Freeway-Collector/Distributor Ramp	100.00	0.00	0.00	1
All	All Facility Type	16.50	67.82	15.68	2,825

