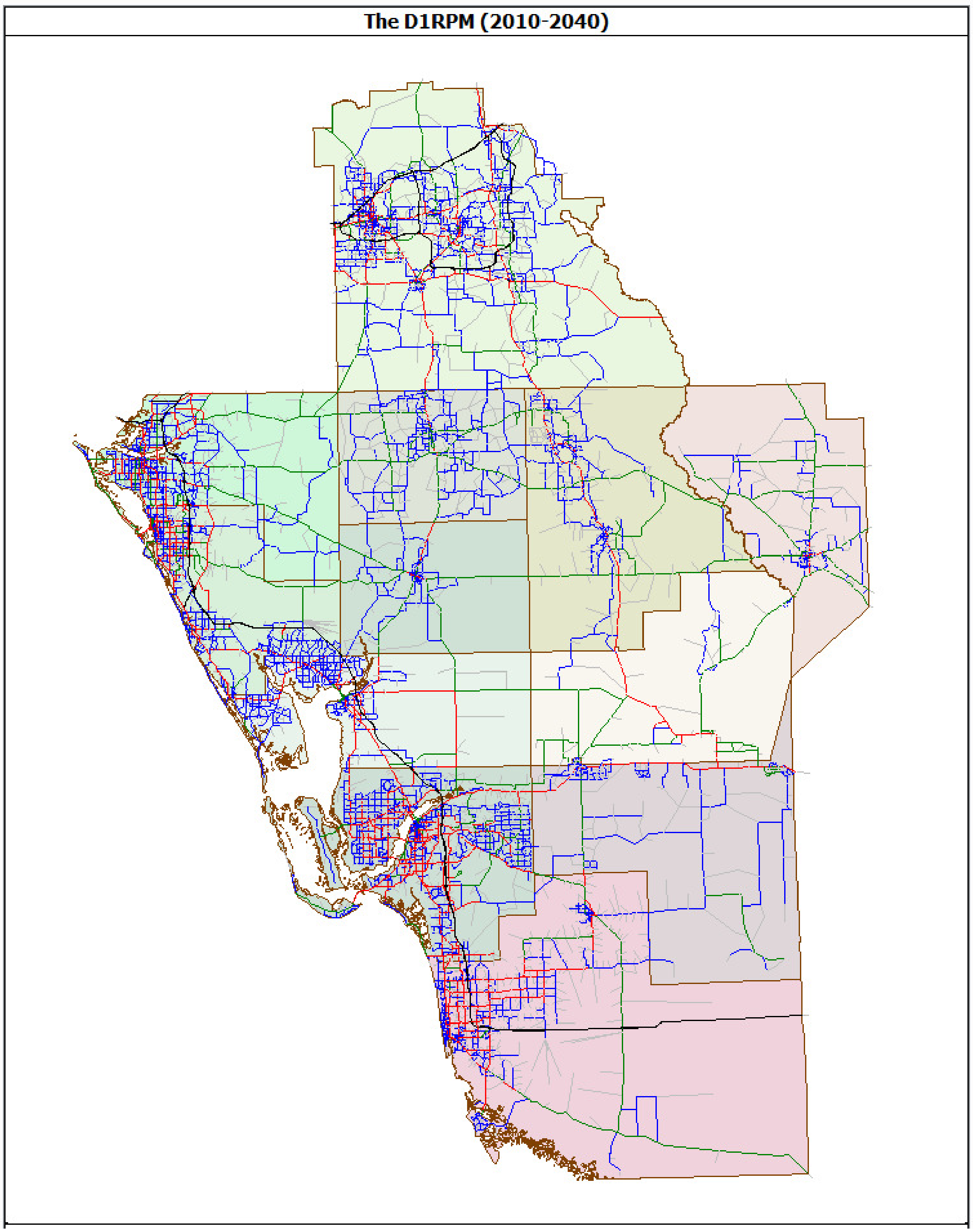
TM-1 Introduction to the
District One Regional Model (2010-2040)
and
Validation Report

February 2016



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This report: *"TM-2 Introduction to the D1RPM and Validation Report"* reviews of the model's development, discusses the structure of the model within CUBE/Voyager environment, and contains summary statistics for the validation year of 2010. Companion reports, *"TM-1 Executive Summary of the D1RPM Validation"* provides an overall review of the model and summary statistics for the validation year of 2010;.and, *"TM-3 D1RPM Technical Resource Guide"* gives technical users / model developers with a more detailed review of certain critical steps (and associated scripts) within the model and discusses mode choice theory and application. These reports are included in the model's \documentation folder..

OVERVIEW

The District One Regional Planning Model (D1RPM), shown on the cover of this report, is one of the larger models in the state of Florida. With 5,628 traffic analysis zones (TAZ) covering 12,400 square miles in a 12 county area, it represents the travel characteristics of a population of approximately 4.1million. And, since all of District One is now represented in one model, it is now possible to forecast *regional* highway and transit alternatives. This is also the first time one model has been used, simultaneously, by all Metropolitan Planning Organizations in District One for their Long Range Transportation Plans (LRTP).

Introduction To The D1RPM

The D1RPM is a 'traditional' Florida Standard Urban Transportation Structure (FSUTMS) four-step, trip-based model that has been updated with many of the recommendations provided by the FDOT Transit Model Update project. Sponsored by FDOT Systems Planning, in 2012: "The purpose of the Transit Modeling Update project is to specify, within FSUTMS and associated support systems, the changes necessary to improve the preparation of transit demand forecasts to a point consistent with federal expectations, and to incorporate state of the practice techniques and tools through a prototype model application.[1]

TMU project recommendations included:

- New (Florida) trip generation rates from 2010 from ACS, NHTS and Census data.
- New trip purposes split trips into 40 "travel markets".
- Diurnal factors split highway assignment into four time periods (AM, MD, PM, NT).
- A travel time feedback loop allows congested speeds from highway assignment to be utilized in trip distribution.
- New CUBE processes to replace the AUTOCON program -- requiring the use of CUBE 6.1, but eliminating the need to customize CUBE resource files.

Initially, The District considered the use of the TMU model as a replacement for the adopted model structure used in 2007. A test of the TMU model was undertaken using the Polk County model as a basis for comparison. This test yielded reasonable traffic volumes to count ratio (V/C 1.04) but required a eight hour run-time, when the original model ran in one hour. An additional test was undertaken with the District-Wide network and data, but this model yielded somewhat higher traffic volumes to count ratio than expected (V/C 1.25) but required a run-time in excess of 10 days. Due to this 'unreasonable' run time, additional tests of the model and it's procedures were undertaken to identify features that were desirable, but which would not detrimentally impact run-time.

It was noted that the existing MPO model transit component already provided Peak and Off-Peak transit assignments (as recommended by the TMU project) as well as a mode choice calibration feature (which was absent from the TMU model). Also, these MPO models utilized a traditional gravity model for destination choice (where trips terminate after a 'lengthily' travel time) resulting in a model run time of about 2 hours, whereas the TMU model used a destination choice sub-model and the mode choice sub-model to determine the *probability* of trips from 40 market segments (with no limit for 'unreasonable travel') resulting in a model run time of about 12 hours, for each process. As mentioned earlier, due to issues with *scalability* (unacceptable run times), the existing MPO transit model was retained.

There are also features included in the D1RPM, which were not included in the TMU model:

- A procedure for generating and distributing vehicle trips at Southwest Florida International Airport, previously incorporated into the LC model, is also used for Sarasota-Bradenton Airport (SRQ).

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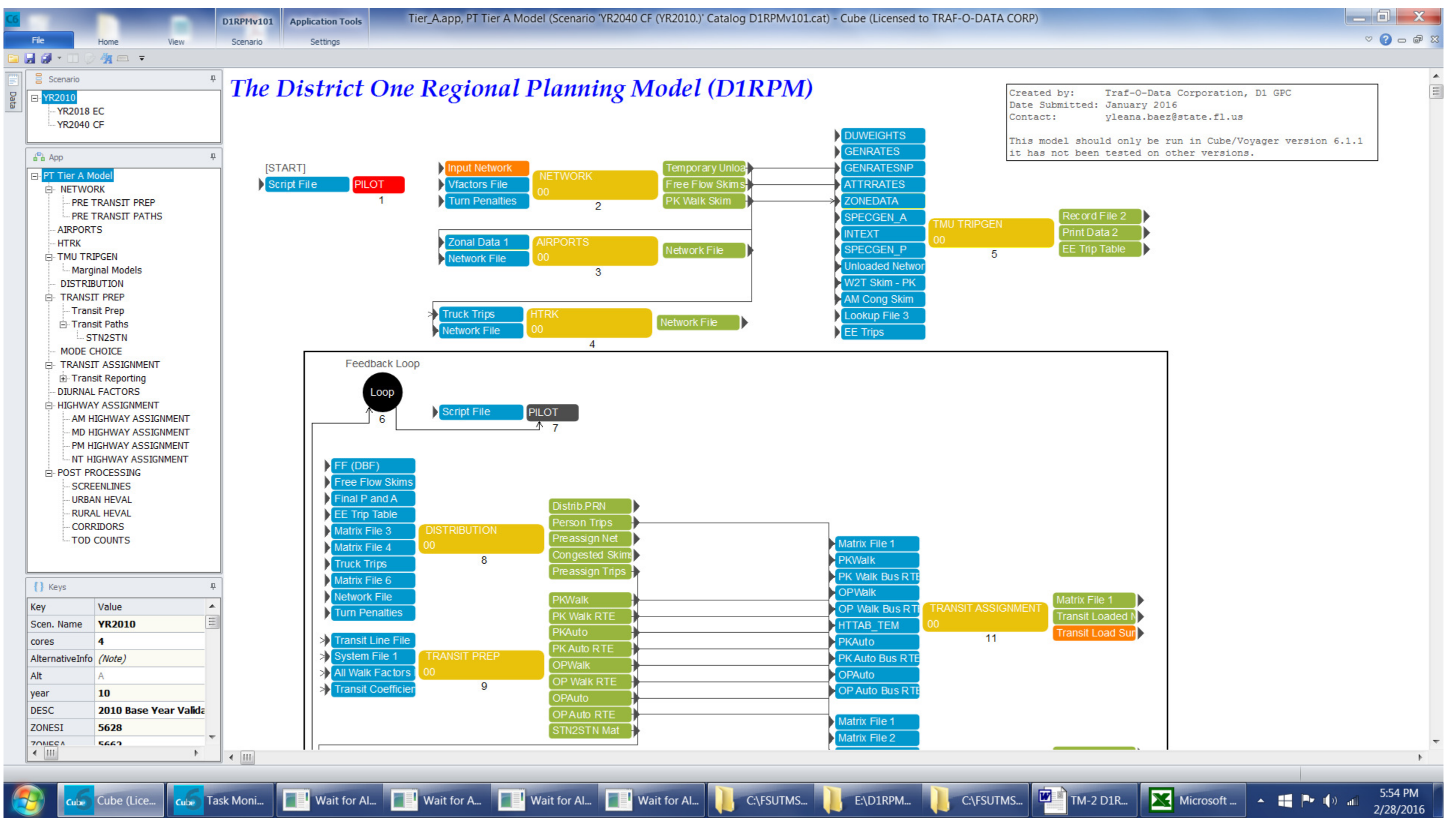
[1] *Trip Generation Review and Recommended Model Development Guidance, Parsons Corp, May, 2012.*

- The D1RPM incorporates heavy-truck trips from the Florida Statewide Model (FLSWMv5124). This model contains procedures for estimating tons of goods movement by water, rail, highway and air to/from Florida, from the United States (and around the world) that are not appropriate for inclusion in a regional model, such as the D1RPM. A matrix of 16 commodities is used with an equivalency table to provide origins-destinations for truck trips within the D1RPM area.
- A procedure for addressing unemployment and correcting for under-estimation of vehicle trips in future years, has been included. Florida's unemployment rate (10.9 percent in 2010) was much higher than Florida's historical long-term unemployment rate of about 5 percent, and the downturn in the economy did result in fewer vehicle trips in 2010 (with no corresponding decrease in employment in InfoUSA database.

About Cube / Voyager

Development of the model was achieved within the CUBE / Voyager transportation planning environment, version 6.1.1 which incorporates a new auto-access-to-transit procedure (the model will NOT run in earlier versions of CUBE). A Windows based program, CUBE uses a graphical user interface (GUI) whereby a mouse-click or a function key, activates a “pop up” menu from which the user chooses options to run the model

The Scenario Manager allow a model to contain many alternatives, but use the same model structure -- allowing the user to compare several different scenario's. For example: the graphic below shows a validation year, a existing + committed year, and a cost feasible future year alternative -- all running in the same model structure. The Application Manager Application Manager provides a graphical view of the model processes. Tasks flow from one process to another, in the order shown.

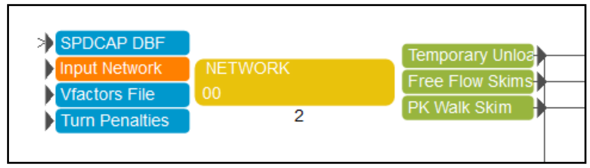


Programs and features are documented within CUBE/Voyager and on-line classes are available at FDOT's internet site: www.fsutmsonline.com.

THE 'FOUR-STEP' MODEL

As mentioned, earlier, The D1RPM is a 'traditional' Florida Standard Urban Transportation Structure (FSUTMS) four-step, trip-based model. The following is a brief overview of these steps.

The NETWORK



This is where the input HWYNET_yya.NET consisting of NODES and LINKS is processed. Nodes provide shape to links by following roadway geometry, or, serve as a loading point for a TAZ. Links contain all of the roadway information required for the model, such as:

- Area Type (urban, residential, rural) or,
- Facility Type (freeway, arterial, collector) or,
- Lanes (number of lanes) and,
- Other attributes, Transit Stations, Toll Links, and Traffic counts.

In this step free-flow (distance x speed) travel times are computed which are used in mode choice, and speed, capacity and other attributes are added, or removed, from the network, creating an UNLOADED_ayy.NET in the \output folder, see box below:

SPECIAL NOTICE: The INPUT and UNLOADED Networks Are Different!

- The INPUT networks for the E+C and LRTP models contain ALL proposed roadways from all of the proposed roadway configurations developed during the MPO/TPO long range transportation planning process.
- This allows for quick removal (or addition of) roadways, without having to recode links and nodes, again and again. It is expected this feature may be useful during the life of the model, as projects are advanced or set back, depending on fiscal constraints and other unforeseen developments.
- During the network step of the model processes, any link with a LRTP_key of "99" will be deleted from the unloaded network as speed, capacity, distance, time and BPR data are added.
- For example, managed lanes are coded as interior, express, roadways on both I-4 and I-75 (to the maximum of a 6+4 lane configuration). Managed lanes on I-75, however, were not in the SIS plan and were not considered to be "cost feasible" in the 2040 model network – and as such do not appear in the UNLOADED network used throughout the rest of the model processes.
- Therefore please, do not delete roadways with the LRTP_key of "99"
- The Field SV_LOSSTD is used for capacity evaluation (not model capacity) and should be changed as appropriate.

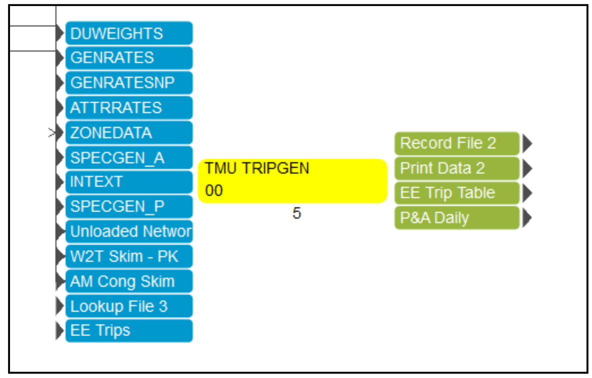
Lastly, the Transit Preparation and Transit Path modules merge transit routes with highway links so that:

1) errors and omissions may be quickly identified and,
2) transit paths/times are saved for subsequent use in the Trip Generation module

You will see two additional processes between NETWORK and TRIP GENERATION, both of these procedures are detailed in TM-3.

- The AIRPORT process provides trip generation, distribution and pre-assignment of Taxi and other vehicle trips from major commercial airports to, what are primarily, tourist destinations within the D1RPM
- The FREIGHT process pre-assigns heavy truck trips from a O-D matrix of truck trips to (from the FLSWMv5124) using a zone-to-

TRIP GENERATION



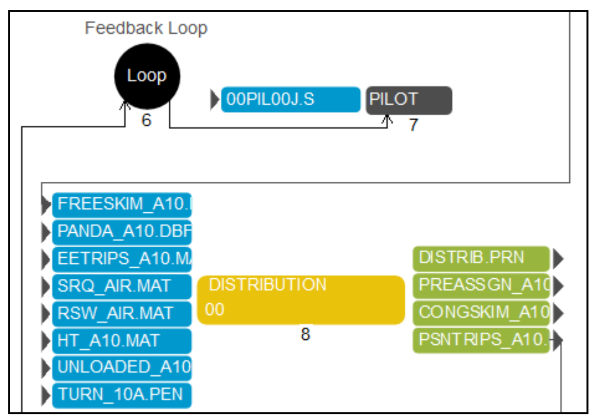
The trip generation model, which was developed for the TMU project[2] uses a combination of techniques to estimate the number of trips bound to, or destined from, each Traffic Analysis Zone. The process factors seasonal and permanent populations by the appropriate trip generation rate, which is determined by a cross-classification lookup table of trip rates, using the number of occupied dwelling units and auto ownership in each market segment.

The trip generation model uses:

- New (Florida) trip generation rates from 2010 from ACS, NHTS and Census data are utilized.
- Trip purposes split trips into 40 "travel markets" using income and auto availability. Also,
- EE and IE trip matrices now contain auto and truck trips.
- New purposes are provided for: college and university trips; there are two classes of home-based work trips (high-income trips travel further); and there is a new purpose for mid-day 'lunch-hour' travel.

A trip's purpose is important in determining trip length during the trip distribution module. For example, people generally do not travel as far on a shopping trip as they would commuting to work. Trip purpose also plays a significant part during the modal choice module. When estimating transit use, the propensity to use public transit and carpools is higher for work trips than for other trip purposes. When converting person-trips to vehicle-trips in the modal choice module, average vehicle occupancies differ by trip purpose. For example, people commonly drive alone to work although they rarely drive alone to the beach or other recreational activities. In the traffic assignment module, trip purpose has been used in some specialized models to help time-of-day travel estimates. Analysis for toll roads and high-occupancy vehicle facilities often focuses on work trips, which predominate during peak hours.

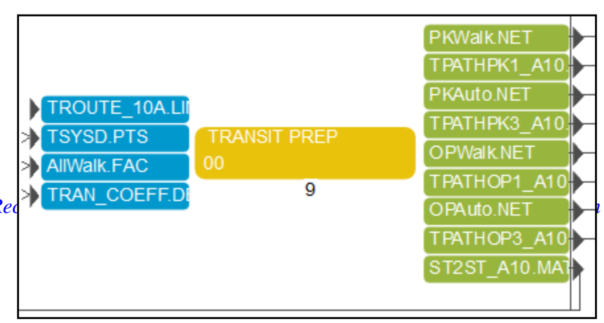
TRIP DISTRIBUTION



Trip Distribution converts trip productions and attractions to trips with a Origin and a Destination. This is accomplished using on a "Gravity Model." All trips starting in a TAZ are attracted to all other TAZ, proportional to the number of attractions and inversely proportional to the distance. Friction factors control the probability of making a certain length trip, for a certain trip purpose. For instance, going to work is relatively insensitive to how long the trip is while shopping depends much more on travel time in selecting possible destinations. These factors are developed based on observed trip lengths for the local population and come from Census and survey data. Also, vehicle trips are loaded onto the highway network, so that congested travel times may be determined, for use in mode choice.

As shown, Trip Distribution is the first step included in the <u>feedback-loop</u> methodology (as recommended by the TMU project) where a weighted average of speeds and travel time from all prior highway assignments are used to minimizes differences in travel time/speed between the last highway assignment and this loop's trip distribution, mode choice, and highway assignment.

The TRANSITMODEL



The "TRANSITMODEL" developed for FDOT in 2008[3] was retained by the TMU project and remains in the D1RPM. It consists of four parts: a *Transit Prep module*, which links transit routes to the model's highway

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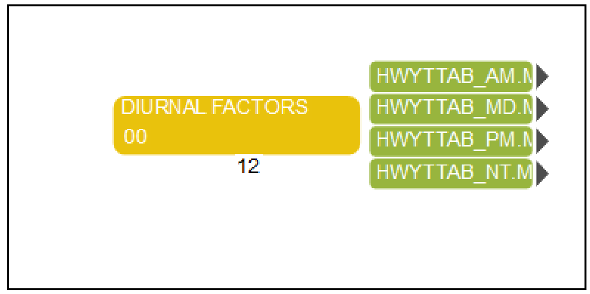
[2] *"Task 06, Transit Modeling Update, Technical Memorandum 1, Trip Generation Review and Re*
Travel Model System, May 2011"

[3] *"FSUTMS Transit Model Application Guide, AECOM, 2008".*

network and prepares auto-access park-n-ride links; A *Transit Path* module, which generates zone-to-zone travel times and costs; a *Mode Choice* module, which is a multi-path/single-period "nested-logit" sub-model which assigns person trips to automobiles or transit services; and a *Transit Assignment* module. Most of the effort in validating the transit accessibility and path building focused on ensuring that the transit network accurately reflected base year conditions. Calibration of Mode Choice insures that auto occupancy rates, by trip purpose compare favorably to household travel time surveys, and, estimated transit system ridership is accurate.

HIGHWAY ASSIGNMENT

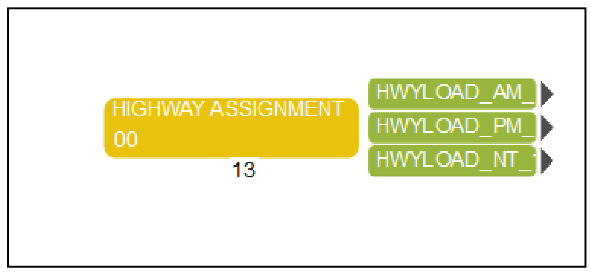
The purpose of highway assignment models is to load auto trips onto the highway network. Highway Assignment makes "route choice" decisions for O-D pairs, resulting in traffic estimates on individual links, a simulation general vehicular travel throughout the study area. Validation of the highway assignment involves the adjustment of the speeds, capacities, penalties and other parameters related to travel time.



Part of Highway Assignment, "Diurnal Factoring" splits daily automobile trips derived in the Mode Choice model, into trips to be assigned in four time-of-day matrices "AM" (6am-9am), "MD" (9am-3 pm), "PM" (3pm-7pm) and "NT" prior to highway assignment.

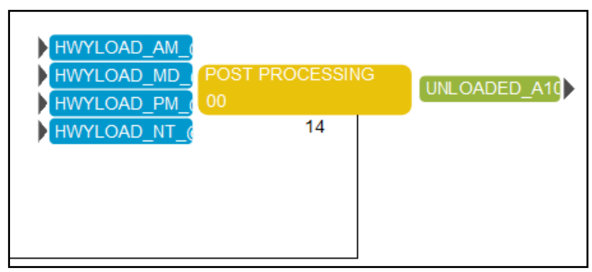
Peak Periods assignments pave the way for a more precise determination of the effects of directional distribution by time of day, which affect link speeds and travel times. This is also where such things as "peak spreading" may be introduced.

Trips are loaded onto the highway network by means of an iterative equilibrium highway load program based on an all or nothing capacity restrained assignment. Note that in the D1RPM a <u>feedback-loop</u> is utilized, whereby, congested speeds from the initial highway assignment are fed back into the next trip distribution-mode-transit & highway processes. This minimize differences in congested speed among all of these modules. Convergence criteria are compared until the differences in travel time and travel distance were minimized.



POST PROCESSES

Post Processing procedures are included to provide overall model performance such as screenline and corridor reports as well as volume to capacity evaluation.



It should be noted, that, as the model runs through its procedures, a number of other reports are generated (and placed in the scenario folder) which may be helpful to the user. Significant reports include:

- Trip Generation Report (TG_REPORT.PRN), person trips, by purpose, before and after trip-balancing.
- Travel Length Frequency Report (DISTRIB.PRN) , trip length, by trip purpose.
- Mode Split (MODESUM.TXT) trips by trip purpose.
- Transit Assignment (TASUM.PRN), trip by transit route, mode, system.
- Screenline Reports by system and by county in (SCREENLINES.PRN).
- Model Performance to Calibration Standards, by system and county in (SUMMARY_D1.PRN).
  as well as,
- ‘runtime.prn’ and ‘keys.prn’ which report on model performance and parameters, respectively.

It should be noted, here, that post processing procedures are continually evolving, depending upon the needs of the users. For example, the FDOT "FITS_EVAL" reporting for ITS evaluations is currently being tested and may be included within the model at a later date.

DATA DEVELOPMENT FOR 2010

Traffic Count Data
The validation of any travel demand model relies upon the existence of traffic count data for the base year. The volume-to-count ratio generated by the model is a measure used to evaluate the ability of the travel demand model to simulate known traffic conditions. Traffic counts for a variety of different roadway categories are distributed throughout the study area in order to validate highway assignment performance among screen-lines and along roadway corridors The FSUTMS standard is for the model to assign trips to the highway network for peak-season weekday average daily traffic (PSWADT). Count sources included are: The 2007 Florida Traffic Information CD from FDOT, County MPOs (for non-state roads) and The Florida Turnpike Enterprise for toll roads.

Count data are retained on link data records. The source, location identifier, the average annual daily traffic (AADT) and the model output conversion factor (MOCF) were used to converted to peak-season weekday average daily traffic (PSWADT). Count data, for 2006-2012 were utilized to fill in for missing 2010 data. The model network contains about 45,500 links with about 4,800 counts, for approximately 10% count coverage, which is considered to be adequate for validation. Count sources included: The 2007 Florida Traffic Information CD from FDOT, County MPOs (for non-state roads) and The Florida Turnpike Enterprise.

This following graphic summarizes count coverage, by type of roadway, within the D1RPM.

Statistic:				
Facility Type		Number of Links	Number of Counts	Percent of Links
Freeway	10	721	97	13%
Major Art	20	10,963	1,850	17%
Minor Art	30	4,855	697	14%
Collector	40	28,305	2,156	8%

Additionally, peak hour counts on the FDOT traffic count CD for 2010 were matched to 1,266 links on the 2010 network and summarized by period: "AM" (6AM-9AM), "MD" (9AM-3PM), "PM" (3PM-6PM) and "NT" (remainder) to guide the adjustment of diurnal factors by time period and by trip type (auto, truck, heavy truck Additional peak hours counts, however, would be needed to be able to confidently validate each of the four peak periods in the model.

Screen-lines and Corridor Volumes
Screen-lines were drawn across a model network to measure travel flows, as an aggregate volume between sub-areas within the model. Key corridors were also identified among all of the U.S, State and County (numbered roads) within the model.

The graphics, below, shows deviation from the expected standard. Note that the D1RPM exceeded performance expectations for all categories of roadways.

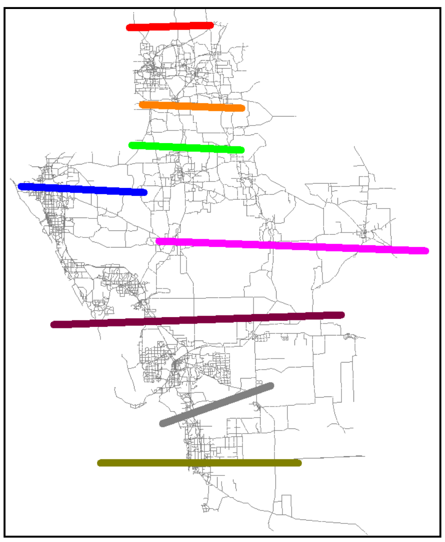
2010 Volume-over-Count Performance:						
Facility		Acceptable		Preferable		D1RPM
Freeway Volume-over-Count	±	6%	±	5%	±	0%
Arterial Volume-over-Count	±	10%	±	7%	±	2%
Collector Volume-over-Count	±	15%	±	10%	±	1%
Frontage Rd Volume-over-Count	±	20%	±	15%	±	3%

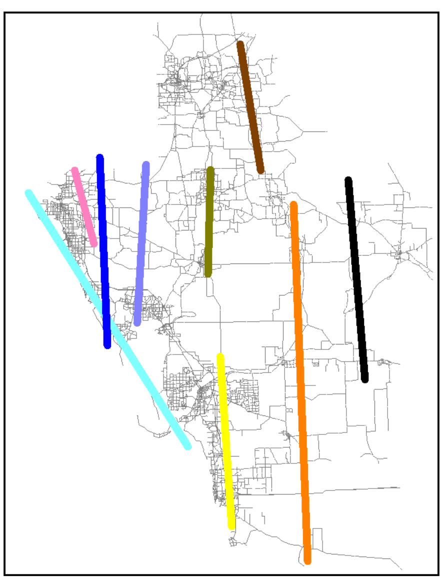
Source:

Presentation to the FDOT Model Task Force, "Model Calibration Standards", CSI, December, 2007

D1RPM 2010 model, "Summary_D1.prn", December 2015

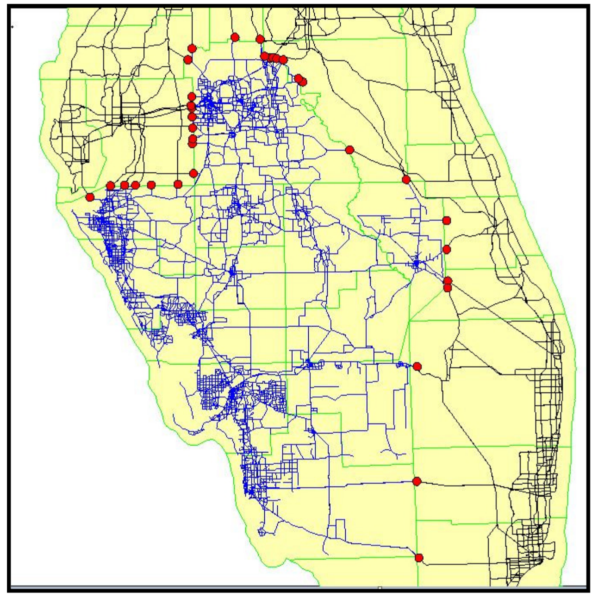
Statistic: 2010			
SL	Location	Links	V/C
1	North of I-4	6	1.15
2	South of SR 60	12	1.16
3	North of Hardee/Highlands	6	1.14
4	South of SR 64	46	0.85
5	South of SR 72 / SR 70	22	1.00
6	North of Lee CL	12	0.92
7	North of Collier CL	12	0.90
8	North of CR 856	12	0.86
9	East Highlands CL	8	1.22
10	East of US 27 (urban)	18	1.14
11	East of US 27 (rural)	27	1.04
12	East of US 17 (urban)	34	0.96
13	East of US 17 (rural)	8	0.72
14	East Manatee CL	18	0.91
15	East of I-75 (SM)	18	0.99
16	Bridge/Causeway	32	1.06
17	East of N River Rd	10	1.09
18	East of I-75 (LC)	24	1.06
	Districtwide		1.01





Statistic: 2010			
CL	Location	Links	V/C
1	I-275	4	0.93
2	I-4	20	1.05
3	I-75 (SM)	30	1.00
4	I-75 (C)	12	0.89
5	I-75 (LC)	28	0.99
6	Polk Pkwy	29	1.03
7	US 17-SR 35 (urban)	38	1.00
8	US 17-SR 35 (rural)	54	0.93
9	US 27-SR 25 (urban)	32	1.12
10	US 27-SR 25 (rural)	56	0.96
11	US 41B	20	1.10
12	US 41B-SR 739	34	1.18
13	US 41-SR 55 (SMC)	78	0.92
14	US 41-SR 45 (C)	28	0.75
15	US 41-SR 45 (LC)	85	0.89
16	US 41-SR 90	30	1.11
17	US 92-SR 546	64	1.00
18	US 98-SR 35	38	1.00
19	US 98-US 441-SR 15	28	0.81
21	US 98-US 441-SR 15	12	0.78
22	US 301-SR 43	42	0.98
23	SR 17 (urban)	36	1.12
24		18	0.80
25	SR 37	40	0.84
26	SR 60	30	0.89
27	SR 62	10	1.22
28	SR 64	56	0.94
29	SR 70 (urban)	20	1.03
30	SR 70 (rural)	44	0.96
31	SR 72	12	0.83
32	SR 78	32	0.98
33	SR 80 (urban)	24	1.15
34	SR 80 (rural)	16	1.26
35	SR 82	46	1.06
36	SR 540	26	0.78
38	SR 776	32	1.10
39	CR 31	24	0.71
40	CR 846	40	0.95
41	CR 851	20	0.83
42	CR 951	22	0.84
99	External	66	1.00
	Districtwide		0.97

External Trips



Development of the model also required that automobile and truck trip volumes be assigned to roadways that exit the study area at “external stations” (shown as red dots, to the right). There are special considerations that are taken into account at these locations. Obviously, for 2010, traffic count data were used to establish external station volumes at these locations.

For the future year, however, the D1RPM was coordinated with the adjacent FDOT district models. Loaded model networks from the latest adopted (YR2040) models for FDOT Districts 4, 5 and 7 were provided for this purpose. Total vehicle trips were identified for: drive-alone and shared-ride auto, as well as for light, medium and heavy trucks.

These data were presented to each of the MPO's in The District, for discussion and to determine of these volumes agree with expectations of development for their area.

Special consideration was given to:

Internal-to-External vehicle trips to attractions near the model area:

- NE Polk County, where about 20% of the home-based trips are attracted to Orange County’s Theme-Parks.
- Manatee County, where HBW trips are attracted to Pinellas and Hillsborough County.
- Trips from Rural Areas head East, towards the Florida Coast on SR 70, US 98 and US 27.

Additionally, discussion and agreement was provided on the status of other type of "external station" trip: through-trips. Special consideration was given to:

External-to-External or "through trips" along the following corridors:

- I-4 east-to-west vehicle trips (autos and trucks),
- I-275-to-I-75 vehicle trips (autos and trucks),
- I-75 north-to-south truck trips from Tampa to Miami.

It was concluded that "external-stations" traffic volumes would grow at a rate of 3% per year, slightly higher than socioeconomic growth within the D1RPM model area. Exceptions were for higher growth were allowed on SR60, and roadways serving NE Polk county in the vicinity of I-4 east.

Transit Setup

The TRANSITMODEL[4] developed by AECOM in 2008, and retained in the TMU process, has been included in all District One FSUTMS models since its initial development. The model includes: Transit Route Preparation, The AUTOCON program for making park-n-ride connections to transit stations, a Transit Path module to calculate time and cost, Mode Choice model, Transit Assignment procedures, and Transit Reporting procedures).

In the D1RPM the AUTOCON program has been replace by CUBE script, which required a new version of the PUBLIC TRANSPORT program (because of this, the D1RPM will not run in earlier versions of this software).

One of the most delicate and time-consuming processes undertaken with any model, transit services must be coded into the model, Park-n-Ride and Transit Station Access requires special coding and mode choice must be calibrated to reflect proper mode share between automobiles, transit services and non-vehicular modes of travel.

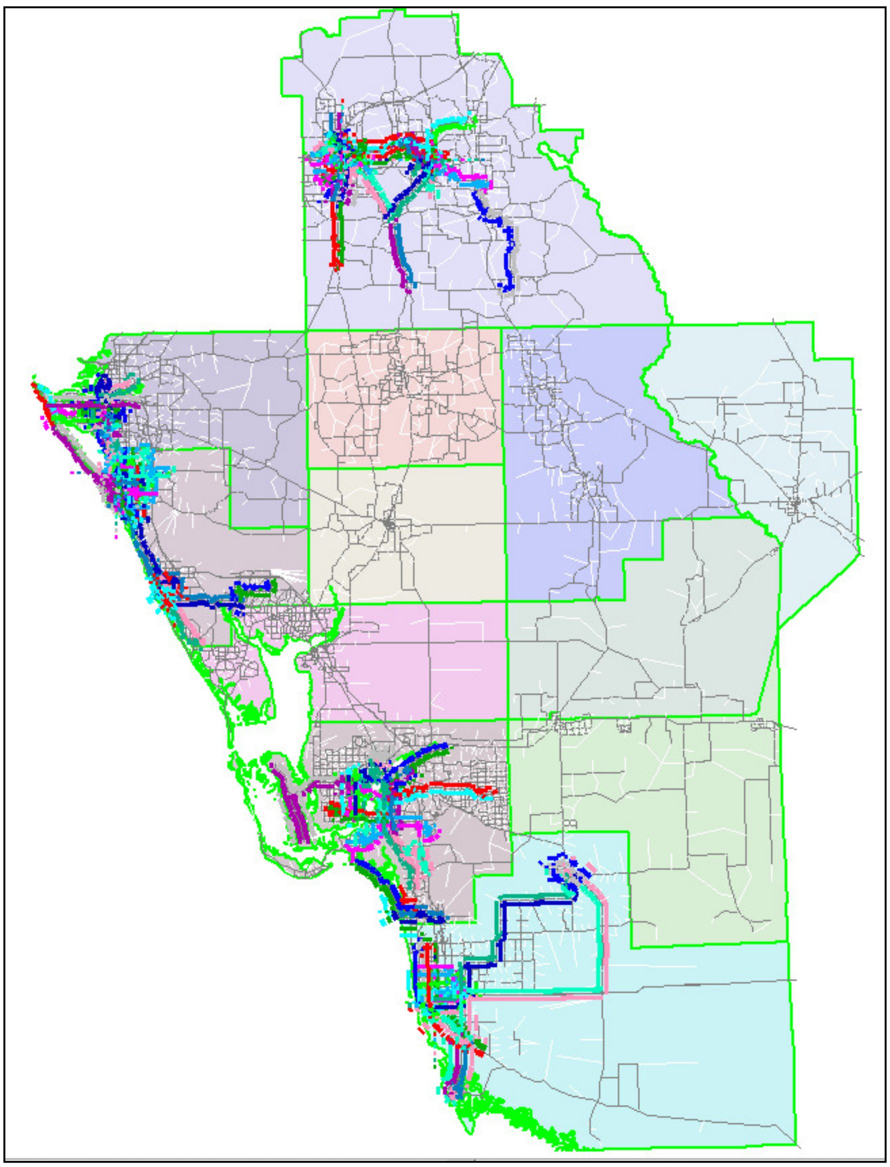
[4] The Tier "A/B/C" transit developed by AECOM/Harris in 2008 became the adopted FSUTMS transit methodology with the adoption of CUBE/Voyager. For more information, please refer to these documents in the \documentation\reference folder.

Transit Route Coding

Transit routes are coded as text, in the TROUTE_yya.LIN file, usually in an “outbound” and “inbound” direction, as shown below.

```
LINE NAME="S01i", LONGNAME="SCAT #01 Fruitville", ONEWAY=T,
     TIMEFAC=1, CIRCULAR=F, HEADWAY[1]=30, HEADWAY[2]=30, MODE=31,
     OPERATOR=2, N=5181, 5176, 5174, 5021, 4984, 4986, 4966, 4956,
     4959, 4963, 4964, 4974, -7126, 4944, 4945, 4946, 4943, 4942,
     4941, 4948, 4955, 4965, 5008, 5132, 5128, 5124, 5121, 5120,
     5119, 5117, 5116, 5114, 5093, 5092, 5091, 5071, 5070, 5069,
     2003, 5066, 5068, 5065, 5058, 5057, 5052, 5051, 5080, 5100,
     7709
LINE NAME="S01o", LONGNAME="SCAT #01 Fruitville", ONEWAY=T,
     TIMEFAC=1, CIRCULAR=F, HEADWAY[1]=30, HEADWAY[2]=30, MODE=31,
     OPERATOR=2, N=7709, 5100, 5080, 5051, 5052, 5057, 5058, 5065,
     5068, 5066, 2003, 5069, 5070, 5071, 5091, 5092, 5093, 7715,
     5116, 5117, 5119, 5120, 5121, 5124, 5128, 5132, 5137, 5138,
     5139, 5140, 5142, 6587, 5160, 5134, 5122, 5099, 5094, 5076,
     5013, 5003, 4991, 4985, 4974, 4964, 4963, 4959, 4956, 4966,
     4986, 4984, 5021, 5174, 5176, 5181
```

The CUBE visual network editor will read the TROUTE file and display the transit routes on the highway network which enables the user to make simultaneously make highway network and transit network edits.



Transit Fares and Ridership

Each Transit service provider submitted monthly ridership and revenue reports from which weekday passenger ridership was calculated (see TM-3) The following "average fares" were coded into the TFARES_10A.FAR file.

```
FARESYSTEM, NUMBER=1, LONGNAME="REGULAR FARES", NAME="LINEHAUL",
  STRUCTURE="FLAT"  SAME="CUMULATIVE",
  IBOARDFARE=1.00,
  FAREFROMFS=0.00,0.00,0.50,0.50,0.50,0.50
FARESYSTEM, NUMBER=2, LONGNAME="EXPRESS/BRT FARES", NAME="EXPRESS",
  STRUCTURE="FLAT"  SAME="CUMULATIVE",
  IBOARDFARE=1.50,
  FAREFROMFS=0.00,0.00,0.50,0.50,0.50,0.50
FARESYSTEM, NUMBER=3, LONGNAME="FREE FARES", NAME="FREE",
  STRUCTURE="FREE"
```

Transit Service providers for 2010 and daily boarding's are indicated below:

Transit Services:			
Service Area	Operator	Transit Service	Boardings
Lakeland	1	Citrus Connection	4,367
Winter Haven	2	WHAT	860
Polk County	3	PCTS	544
Collier County	4	CAT	3,498
Lee County	5	LeeTran	11,696
Charlotte County	6	CCTS	
Manatee County	7	MCAT	4,147
Sarasota County	8	SCAT	9,011
		total	34,123

In the Transit Prep Module transit routes are processed, matching routes to links, adding fares and service times, so that transit travel time and cost may be developed for the mode choice module

Turn Prohibition's And Turn Penalty's

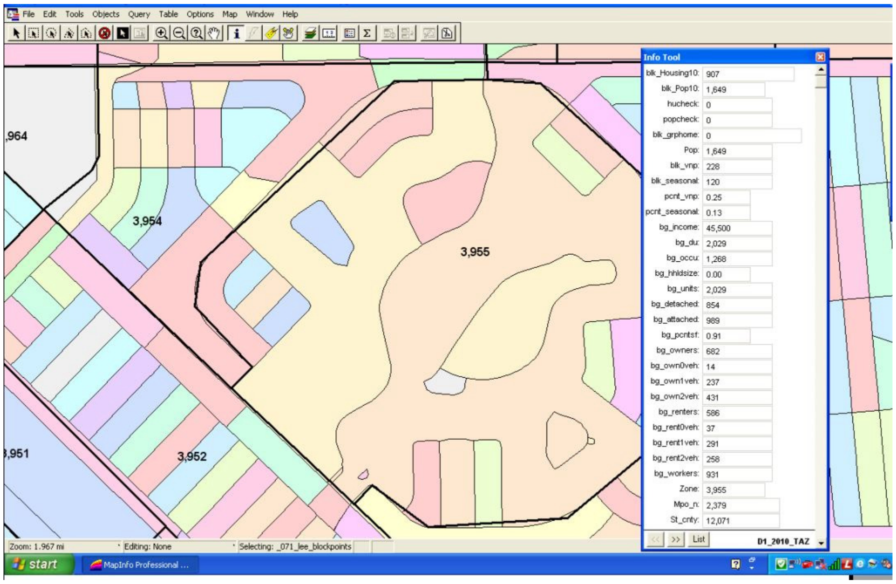
Turn penalties and prohibitions to control the flow of vehicles at intersections. A typical example would be for coding "right-in-right-out vehicle flow into a parking lot. An alternate use is to adjust travel times on specific links, such as accounting for slower speeds over bridges. The TURN_10A.PEN file contains (9) time penalty's, mostly on bridge crossings.

Socioeconomic Data Development

Household data from the 2010 US Census was supplemented with ACS 5 year household surveys and converted into geographic points for (GIS) for processing. Employment data, obtained from FDOT and InfoUSA were similarly processed:

- The D1RPM, traffic analysis zones (TAZ) were created from an aggregation of the nine previous FSUTMS models in The District. TAZ were carefully adjusted to match census block and tract boundaries, resulting in a model with 5,628 internal zones for which data must be prepared.
- Socioeconomic data from all sources were aggregated to the new D1RPM model's TAZ and tabulations prepared.

An example of this process is shown below: This diagram shows 2010 Census block data boundary's (color shapes) underneath the model TAZ shape layer. Data from each block can be viewed and aggregated up to the TAZ database.



In this same 2010 Census block data boundary's (green lines) are shown over an aerial photograph, with employer locations loaded as point data on the top-most layer. Again, data from each employer can be viewed, and moved around, if necessary, and aggregated up to either the Census Block or Model TAZ database as required.

There were several layers of data utilized in this process, which is detailed in TM-3. Additionally, while most Census data is available at the block level, some data was only available for a Census Tract. In those cases, a weighted average aggregation (typically using the relative amount of dwelling units in each block-to-TAZ aggregation, was the weighting factor).

Data were adjusted to match BEBR totals. The process yielded the model's 2010 socioeconomic data file, as indicated:

2010 Socic	2010 Socioeconomic Data Summary:						
County	Census	-grphome	Population	Employment	Hotel	School	University
Charlotte	156,798	156,610	159,978	64,776	2,075	26,412	1,220
Collier	315,030	316,974	321,520	173,832	8,007	73,130	12,220
Desoto	33,915	31,064	34,862	13,504	120	6,770	260
Glades	12,637	11,401	12,884	4,561	10	3,200	40
Hardee	26,753	25,747	27,731	11,260	135	7,060	80
Hendry	37,229	37,198	39,140	18,698	250	12,890	380
Highlands	95,046	98,426	98,786	38,093	940	17,660	12,280
Lee	606,332	610,266	618,754	285,831	12,380	85,526	17,988
Manatee	319,923	318,016	322,833	154,595	3,193	57,330	34,100
Okeechob	34,959	39,996	39,996	14,102	415	8,520	200
Polk	586,882	589,834	602,095	256,795	5,684	97,395	31,008
Sarasota	374,086	374,040	379,448	213,156	4,845	55,452	12,311
District 1	2,599,590	2,609,572	2,658,027	1,249,203	38,054	451,345	122,087

2010 MODEL PERFORMANCE

Trip Generation

The trip generation model, was developed for the TMU project[5] uses a combination of techniques to estimate the number of trips bound to, or destined from, each Traffic Analysis Zone. The process factors seasonal and permanent populations by the appropriate trip generation rate, which is related to the number of occupied dwelling units, auto ownership and household income. Each grouping is what will be referred to as "market segments". A trip is composed of two trip ends: a production end and an attraction end.

- A production is usually a home-based trip origin.
- An attraction is usually a home-based trip destination.
- Non-home-based trips have both trip ends at locations other than a residence.

Trips produced at homes are attracted to areas of employment, education, recreation, shopping and other activities to satisfy the reason for making the trip. An example of a non-home-based trip is a person traveling from an office to a restaurant for lunch.

The Trip Generation Report TG_REPORT.TXT for 2010 is shown below. Most trips from 40 'market shares' are home-based.

HHLD MKT	HBWP	HBSHP	HBSRP	HBOP	HBSCP	HBCUP	NHBWP	NHBOP	IEP	TTP	AIR	HT	
1	42226	91050	52747	85749	0	24731	1252691	1814125	228536	855575	25200	52083	
2	37030	55807	32370	59523	37258	36249							
3	63358	43312	28854	51905	123584	75994							
4	64742	27129	28975	46118	439438	111559							
5	243847	365610	279564	412068									
6	505742	362627	263023	440922									
7	1310434	750601	661891	1165110									
	2,267,379	1,696,136	1,347,424	2,261,395	600,280	248,533	1,252,691	1,814,125	228,536	855,575	25,200	52,083	**12,649,357**
PCNT	**17.92**	**13.41**	**10.65**	**17.88**	**4.75**	**1.96**	**9.90**	**14.34**	**1.81**	**6.76**	**0.20**	**0.41**	

[5] *"Task 06, Transit Modeling Update, Technical Memorandum 1, Trip Generation Review and Recommended Model Development Guidance, Florida Standard Urban Travel Model System, May 2011"*

The desired end product in trip generation analysis is an accurate identification and quantification of trip ends beginning and ending in each traffic analysis zone within a transportation study area. Thus, two sets of trip ends are identified: those produced by each zone and those attracted to each zone. Later in the FSUTMS model chain during the trip distribution module, these trip ends are paired. Each production-attraction pair forms one trip.

Trip generation modeling would be easier to grasp if the models were simply required to estimate the total number of trip ends. The Institute of Transportation Engineers (ITE) Trip Generation manual, for example, provides rates and equations to estimate total trip ends by land use category. Trip generation in a modeling context, however, must estimate the number of trip ends within several trip purpose categories. This complication is necessary because trip purpose is critical to the accurate prediction of travel behavior in steps following trip generation. The D1RPM estimates are shown in the following table:

A trip's purpose is important in determining trip length during the trip distribution module. For example, people generally do not travel as far on a shopping trip as they would commuting to work. Trip purpose also plays a significant part during the modal choice module. When estimating transit use, the propensity to use public transit and carpools is higher for work trips than for other trip purposes. When converting person-trips to vehicle-trips in the modal choice module, average vehicle occupancies differ by trip purpose. For example, people commonly drive alone to work although they rarely drive alone to the beach or other recreational activities. In the traffic assignment module, trip purpose has been used in some specialized models to help time-of-day travel estimates. Analysis for toll roads and high-occupancy vehicle facilities often focuses on work trips, which predominate during peak hours. Additionally, the D1RPM uses different trip rates for seasonal and permanent populations.

At this point it is useful to summarize data and compare to 'standards' presented to the FDOT Model Task Force, "Model Calibration Standards", CSI, December, 2007.

As shown in the following Trip Generation summary, it can be seen that the D1RPM model area, Autos per household is slightly, but not significantly, lower than expected, all other categories are within expected ranges.

2010 Household Rates:				
	Area	Low	High	D1RPM
Pop/HH	Model	2.00	2.70	2.42
Emp/HH	Model	0.45	0.75	0.47
Autos/HH	Model	1.75	2.10	1.72
Pop/TAZ	Model		3,000	587

As shown in the following Trip Generation summary, it can be seen that the D1RPM model area, person trips are slightly higher than expected.

2010 Statistic:			
	Low	High	D1RPM
Person Trips / TAZ	-	15,000	1,405
Person Trips / Person	3.30	4.00	4.34
Person Trips / HH	8.00	10.00	10.50
HBW Trips / Employee	1.20	1.55	1.69

As shown in the following Trip Generation Summary, it can be seen that the D1RPM model area, the percent of person trips is within expected parameters.

2010 Statistic:			
Trip Purpose	Low	High	D1RPM
% HBW	12	24	18
% HBSH	10	20	13
% HBSR	9	12	11
% HBSC	5	8	5
% HBO	14	28	16
% HBNW	45	60	49
% NHB	20	33	24

Source:

"Model Calibration Standards", CSI, December, 2007

Trip Distribution

Trip distribution relies on a "Gravity Model" (which parallels Newton's gravitational law) to distribute trips. All trips starting in a TAZ are attracted to all other TAZ, proportional to the number of attractions and inversely proportional to the distance. In travel demand forecast models, the measure of separation is generally accepted as the zone-to-zone travel time via the model highway and transit networks. However, because people as social beings do not order their lives according to exact physical laws, optional adjustments may be employed to adjust the gravitational concept to fit the travel characteristics of the urban area being studied.

Friction factors control the probability of making a certain trip length for a certain trip purpose. For instance, going to work is relatively insensitive to how long the trip is while shopping depends much more on travel time in selecting possible destinations. These factors are developed based on observed trip lengths for the local population and come from Census and survey data. Friction factors from the Polk County 2007 model were used initially. The D1RPM uses K-factors decrease travel from rural areas to urban areas within Polk County.

As shown below, Trip Distribution calibration yielded average trip lengths which compare favorably with data from household travel time surveys.

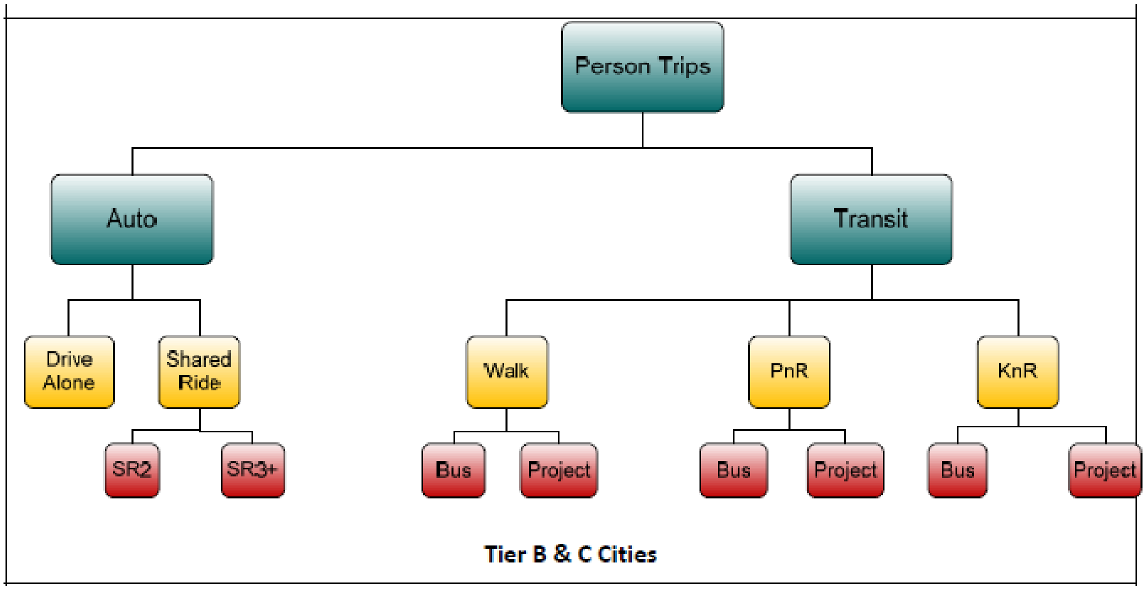
2010 Statistic:			
Avg Trip Length	Low	High	D1RPM
% HBW	12	35	14
% HBSH	9	19	13
% HBSR	11	19	15
% HBSC	7	16	10
% HBO	8	20	13
% NHB	6	19	12
% IE	26	58	42

Source:

"Model Calibration Standards", CSI, December, 2007

Mode Choice

The 'Tier A Transit' mode choice model is a behavioral model that is used to predict a traveler's mode of transportation from all forms of transportation available. As shown on the next page, the 'nested-logit model' structure choices at the top level are: AUTO and TRANSIT; choices at the second level are: Drive-Alone, Shared-Ride, and walk-to-transit, park-n-ride to transit (PNR) and kiss-n-ride to transit (KNR), whereas choices at the third level are: 1-passenger, 2+passengers, local bus or special bus i.e.'Project'.



Calibration of Mode Choice is twofold: First, auto occupancy rates are compared with other household travel time surveys, and, as can be seen in this table, the D1RPM is within expected parameters.

Auto Occupancy:	Benchmark			
Purpose	1988 FLSWM	2001 NHTS FL	2001 NHTS US	D1RPM
HBW	1.30	1.06	1.10	1.15
HBSH	1.55	1.57	1.80	-
HBSR	2.27	1.79	1.94	-
HBO	1.50	1.90	1.70	1.60
NHB	1.58	1.82	1.71	1.44

Estimates of transit ridership are compared to actual reported ridership for each service provider.

2010 Transit Services:				
Service Area	Operator	Transit Service	Actual	Estimate
Lakeland	1	Citrus Connection	4,367	4,361
Winter Haven	2	WHAT	860	1,308
Polk County	3	PCTS	544	357
Collier County	4	CAT	3,498	3,331
Lee County	5	LeeTran	11,696	8,355
Charlotte County	6	CCTS		
Manatee County	7	MCAT	4,147	6,240
Sarasota County	8	SCAT	9,011	7,770
		total	34,123	31,720

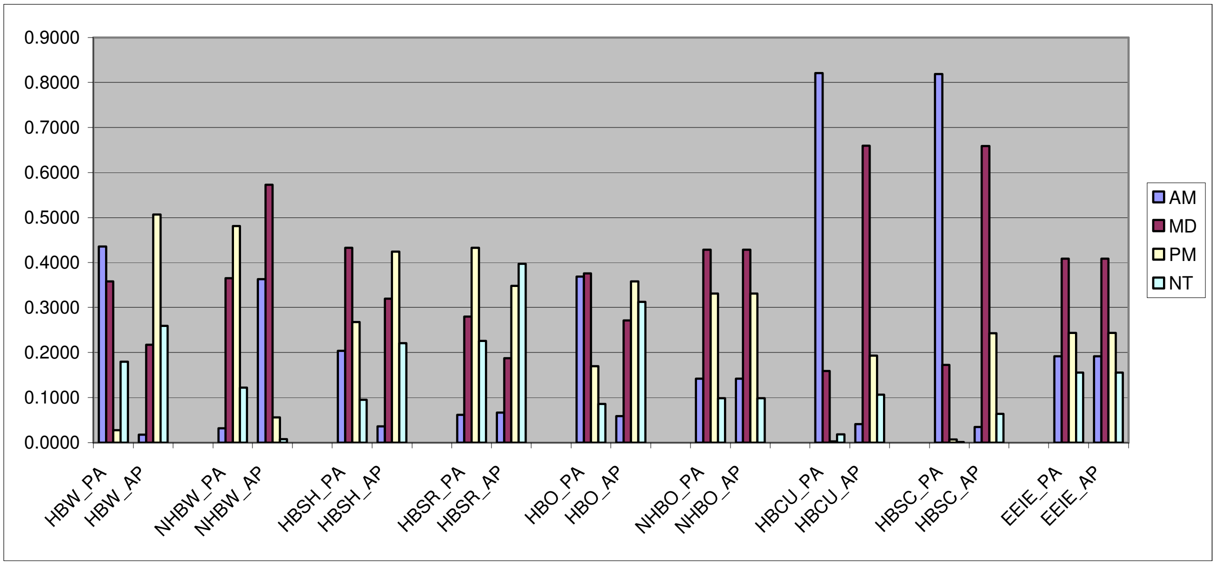
Other reports are provided which are used for calibration. Below we show an example for HBW trips:

Percent of Trips	Benchmark	HBW		
Mode	Zero-Vehicle Households	One-Vehicle Households	Two-Vehicle Households	Three-Vehicle Households
Walk	5,000	6,000	4,000	3,000
Bike	2,000	1,000	500	200
Drive Alone	-	130,000	350,000	200,000
Shared Ride 2 Persons	6,000	15,000	20,000	10,000
Shared Ride 3 Persons	1,000	2,000	4,000	2,000
Local Bus, Walk	6,000	7,000	4,000	1,000
Local Bus, PNR	-	500	2,000	500
Local Bus, KNR	-	200		
Express Bus, Walk	1,000	1,000	1,000	500
Express Bus, PNR	-	2,000	4,000	2,000
Express Bus, KNR	-	200	500	
LRT, Walk	500	1,000	400	
LRT, PNR	-	300	500	
LRT, KNR	-			
				797,800

Percent of Trips	Benchmark	HBW		
Mode	Zero-Vehicle Households	One-Vehicle Households	Two-Vehicle Households	Three-Vehicle Households
Walk	0.63	0.75	0.50	0.38
Bike	0.25	0.13	0.06	0.03
Drive Alone	-	16.29	43.87	25.07
Shared Ride 2 Persons	0.75	1.88	2.51	1.25
Shared Ride 3 Persons	0.13	0.25	0.50	0.25
Local Bus, Walk	0.75	0.88	0.50	0.13
Local Bus, PNR	-	0.06	0.25	0.06
Local Bus, KNR	-	0.03	0.00	0.00
Express Bus, Walk	0.13	0.13	0.13	0.06
Express Bus, PNR	-	0.25	0.50	0.25
Express Bus, KNR	-	0.03	0.06	0.00
LRT, Walk	0.06	0.13	0.05	0.00
LRT, PNR	-	0.04	0.06	0.00
LRT, KNR	-	0.00	0.00	0.00
	3	21	49	100

Highway Assignment

Diurnal Factors split vehicle trips into four time-of-day matrices AM (6am-9am), MD (9am-3 pm), PM (3pm-6pm) and NT   It is best to explain the application of Diurnal Factors by looking at an example. The first four columns, in the graphic below, show HBW trips leaving from home-going to work. As you would expect, the highest bar is for the AM (6am-9am) period (0.4356% to be exact). Next, looking at the second group of four columns, HBW trips return home-from work, as you would expect, the lowest bar is for the AM (6am-9am) period (0.0175% to be exact). Factors are provided for all of the trip purposes shown. Once all trips are apportioned to each of the four time periods (AM, MD, PM, NT) auto occupancy factors are applied, if needed, and aggregated into four trip purposes for highway assignment: (DA, SR2, SR3, TRK). D1RPM model calibration began with the diurnal factors from the TMU project, and these were refined with ACS household travel surveys and FDOT traffic counts.



The Highway Assignment script in the D1RPM (from the Olympus Model) contains toll methodology prescribed by the FDOT Turnpike Enterprise District. .The purpose of highway assignment models is to load auto trips onto the highway network. This results in traffic estimates on individual links to simulate general vehicular travel throughout the study area. Validation of the highway assignment involved the adjustment of the speeds, capacities, penalties and other parameters related to travel time. Trips are loaded onto the network by means of an iterative equilibrium highway load program based on an all-or-nothing capacity-restrained assignment. A feedback loop is utilized, so that congested speeds from the initial highway assignment are fed back into the next *'trip distribution-transitmodel-highway'* processes. This minimize differences in congested speed between Trip Distribution and Highway Assignment. Convergence criteria were compared until the differences in travel time and travel distance were minimized.

Assignment reports are created to measure model performance, as shown below. The D1RPM performance is within expected standards for all categories listed (the benchmarks are in terms of deviation from 100% -- A zero equals 100% accuracy).

2010 Volume-over-Count Performance:						
Facility		**Acceptable**		**Preferable**		**D1RPM**
Freeway Volume-over-Count	±	7%	±	6%	±	0%
Arterial Volume-over-Count	±	15%	±	10%	±	2%
Collector Volume-over-Count	±	25%	±	20%	±	1%
Frontage Road Volume-over-Count	±	25%	±	25%	±	3%
Freeway Peak Volume-over-Count	±	20%	±	10%	±	7%
Major Arterial Peak Volume-over-Count	±	30%	±	15%	±	24%
Assigned VMT-over-Count Areawide	±	5%	±	2%	±	1%
Assigned VHT-over-Count Areawide	±	5%	±	2%	±	0%
Assigned VMT-over-Count by FT/AT/NL	±	25%	±	15%	±	1%
Assigned VHT-over-Count by FT/AT/NL	±	25%	±	15%	±	0%

Source:

Presentation to the FDOT Model Task Force, "Model Calibration Standards", CSI, December, 2007

D1RPM 2010 model, "Summary_D1.prn", December 2015

As shown in the following RMSE error summary report, it can be seen that the D1RPM model is within expected parameters.

2010 Root Mean Squared Error			
Facility	**Acceptable**	**Preferable**	**D1RPM**
RMSE – LT 5,000 AADT	150%	45%	69%
RMSE – 5,000-9,999 AADT	45%	35%	38%
RMSE – 10,000-14,999 AADT	35%	27%	25%
RMSE – 15,000-19,999 AADT	35%	25%	20%
RMSE – 20,000-29,999 AADT	27%	15%	16%
RMSE – 30,000-49,999 AADT	25%	15%	13%
RMSE – 50,000-59,999 AADT	20%	10%	10%
RMSE – 60,000+ AADT	19%	10%	2%
RMSE Areawide	45%	35%	34%

Source:

Presentation to the FDOT Model Task Force, "Model Calibration Standards", CSI, December, 2007

D1RPM 2010 model, "Summary_D1.prn", December 2015

The following table reports vehicle miles traveled (VMT) by volume category.

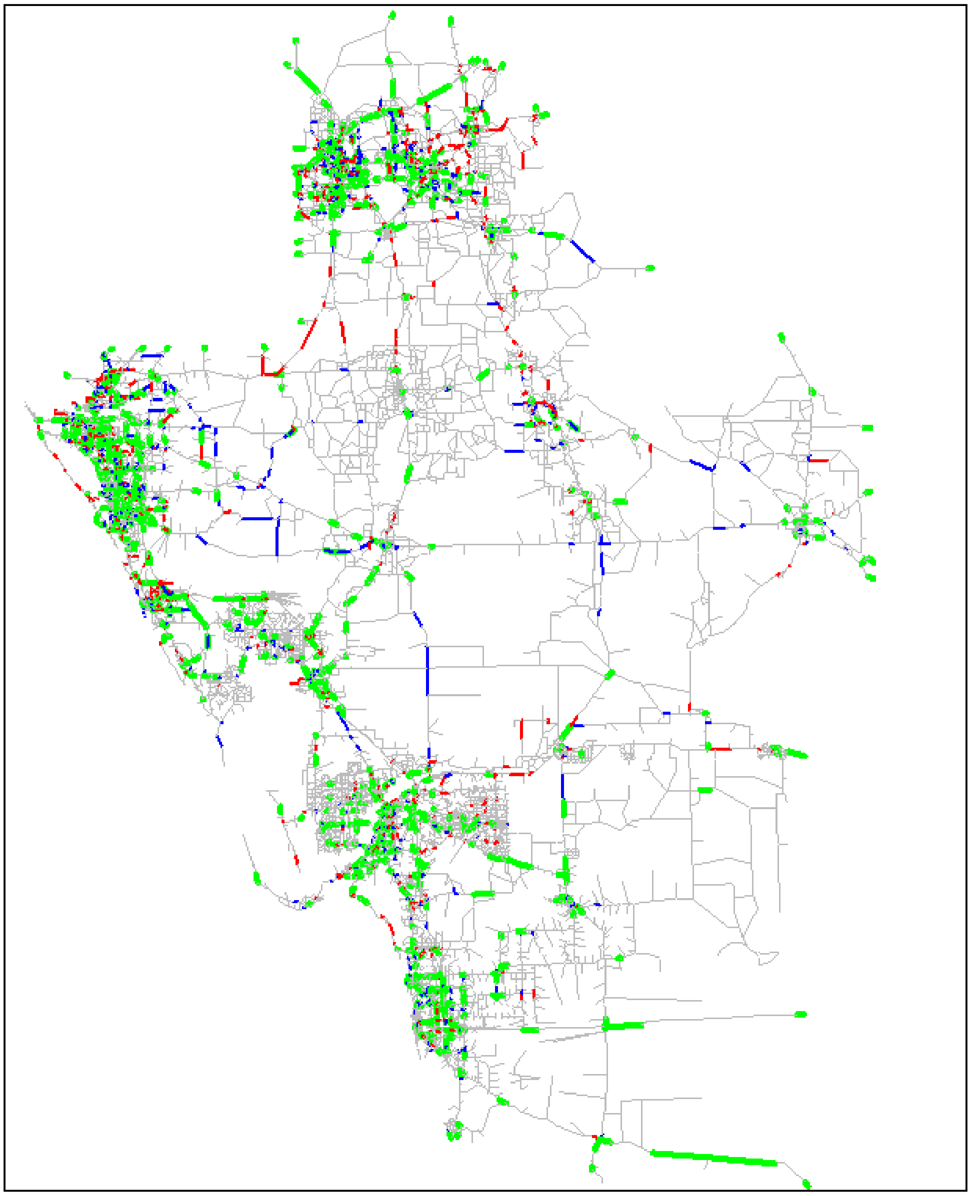
2010 Percent Error VMT:			
Facility	**Acceptable**	**Preferable**	**D1RPM**
Percent Error VMT – LT 10,000 volume (2L road)	50%	25%	37%
Percent Error VMT – 10,000-30,000 (4L road)	30%	20%	22%
Percent Error VMT – 30,000-50,000 (6L road)	25%	15%	15%
Percent Error VMT – 50,000-65,000 (4-6L freeway)	20%	10%	10%
Percent Error VMT – 65,000-75,000 (6L freeway)	15%	5%	2%
Percent Error VMT – GT 75,000 (8+L freeway)	10%	5%	NA

Source:

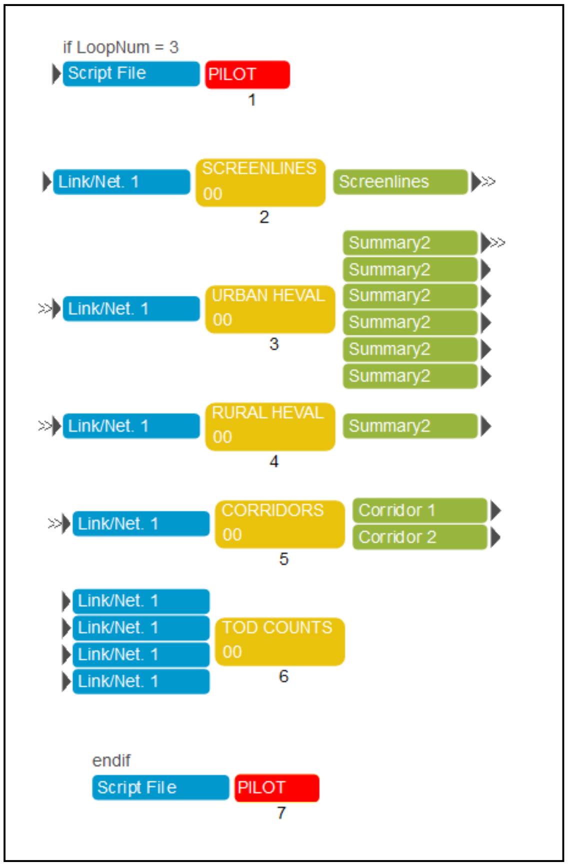
Presentation to the FDOT Model Task Force, "Model Calibration Standards", CSI, December, 2007

D1RPM 2010 model, "Summary_D1.prn", December 2015

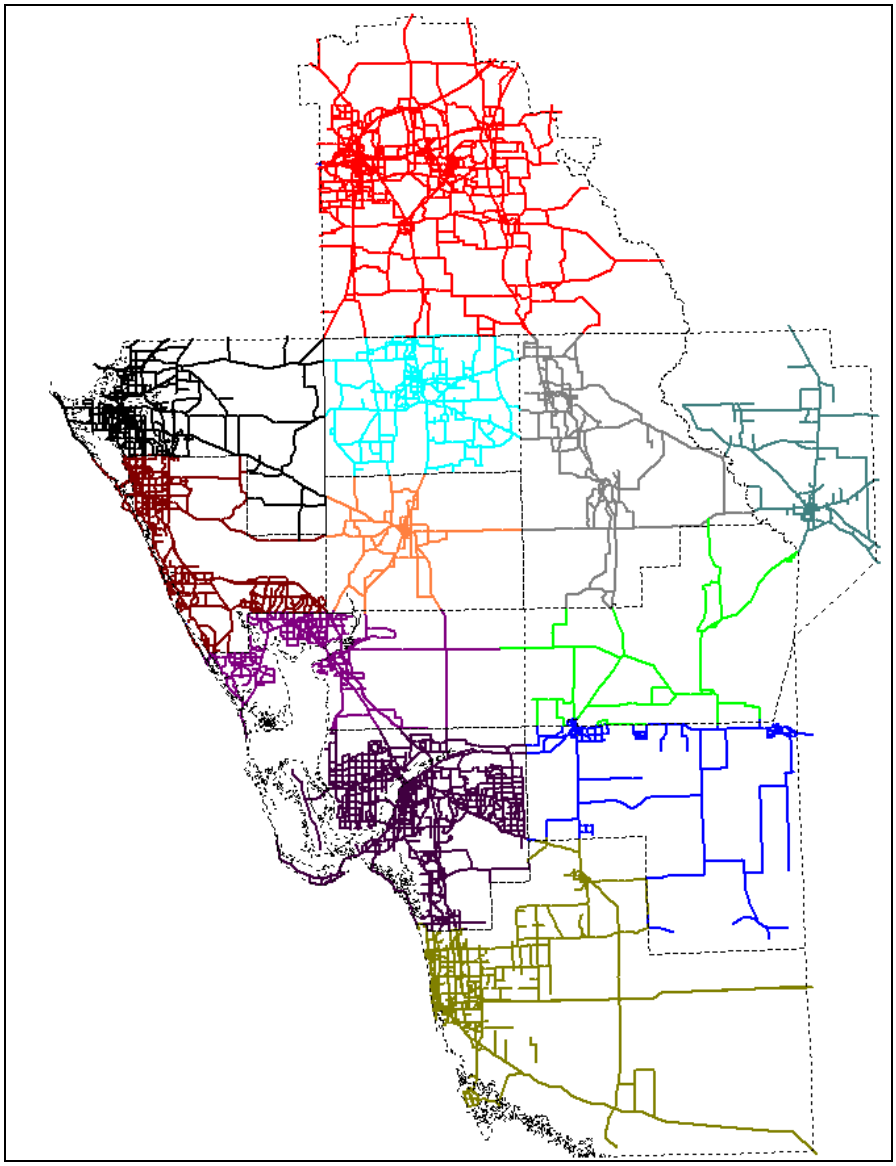
It is also useful to plot counts graphically, as shown, to confirms that VC ratios are uniform throughout the model study area. Here, counts within 10% are green, low are blue high are red.



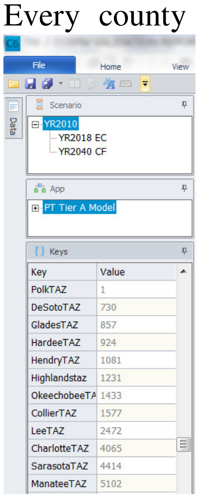
Post Processing
Post Processing procedures are included to provide overall model performance such as screenline and corridor reports as well as volume to capacity evaluation.



Some reporting functions are dependent on County Codes. (the "CC" field on links). Each county is assigned a unique number 1-12, as indicated in the graphic to the right.



Some other procedures, such as the Airport Trip Generation and Distribution Feature are dependent on proper use of TAZ numbers. As shown in the following graphic, there is a numerical sequence to TAZ numbers that relates to each county. Every county has a number of unused zone numbers for use when adding zones for projects. For example, Collier County's first TAZ number is: 1577, the last TAZ number used is: 2350. Potential TAZ numbers (dummy zones) are 2351 to 2471 as TAZ 2472 is the first TAZ number used in Lee County. TAZ number ranges are "Keys" in the scenario manager, as shown below:



CONCLUSION

A review of the D1RPM model's performance, compared to model calibration standards has determined that the 2010 model's socioeconomic data and travel demand forecast is within expected ranges and suitable for use in forecast year models used for the development of Long Range Transportation Plans.

FUTURE MODEL ENHANCEMENTS

Travel demand models in Florida are continuously evolving. Due, in part, to the influence of the Florida Model Task Force; in part to advances in computing power; and in part to what planners are asking of our models; it seems that we can no longer can we say, "we're done, put-it-on-the-shelf." For example, many MPO's in Florida have transitioned from "trip-based" models to "activity-based" (ABM) models. It is said that ABM models provide more explanatory variables about the trip making characteristics of the population.

In FDOT District One, and for the MPO's within the district, model advancements which are already in process follow:

FITSEVAL implementation

FITSEVAL is a sketch-planning tool that evaluates the benefits and costs of Intelligent Transportation Systems (ITS) deployments within the Cube/Florida Standard Urban Transportation Model Structure (FSUTMS) travel demand forecasting software environment. As such, it provides additional measures of effectiveness (MOEs) for evaluation of the transportation policy related to each MPO's Long Range Transportation Plan (LRTP). The tool was developed by the Lehman Center for Transportation Research at Florida International University (FIU) and was later refined by Citilabs as part of a project to implement an updated version of the tool as a Cube Base utility program.

FITSEVAL currently allows for the evaluation of the following ITS deployments:

- Advanced Public Transit (APT)
- Emergency Vehicle Preemption (EVP)
- Incident Management (IM)
- Bus Priority (BP)
- Smart Work Zone (SWZ)
- Road Weather Information (RWI)
- Signal Timing Improving (STI)
- Ramp Metering (RM)
- Managed Lanes (ML)
- Advanced Traveler Information (ATI)

Connected Vehicles and Autonomous Vehicles

A procedure related to changes in future travel behavior as these vehicles become available will need to be addressed as-soon-as-possible. This is because Connected Vehicles (CV) which have features such as lane-centering and automatic-spacing (following distance) where cars 'talk' to each other on an exclusive cell phone frequency, will be widely available by 2017. Traffic impacts of autonomous vehicles (AV) will begin to be realized as ownership levels (saturation rates) rise to significant levels, with most experts agreeing that this will be sometime well before 2040 -- our forecast year. CV and AV implementation, which is currently underway for automobiles, will be delayed for Heavy Trucks (HT) due to a myriad of state regulations affecting interstate truck movements.

A procedure for addressing potential changes in roadway capacity and trip-making due to autonomous vehicles (AV) was demonstrated, by Traf-O-Data at the FDOT Model Task Force meeting, December 2015. Studies of AV operating characteristics and travel behavior conclude that

1. Roadway capacity will increase with closer vehicle spacing, and;
2. More trips will be made, with an increase in easy-access one-way trips in urban areas.

One of the features of the AV application is to allow for testing of exclusive-use autonomous vehicle lanes (formerly special-use lanes) on Interstate facilities. A secondary feature of the application could be to test impact on all roadways via a user supplied "saturation rate" lookup table inserted into the highway assignment process. Using the highway network, trip matrices and mode choice factors from the aforementioned model, the basic assumption is that the benefit from connected-vehicles and/or autonomous-vehicles will be that closer following distances are possible, yielding a higher capacity per lane. Related to this is the assumption that as the saturation rate increases, some benefit will be seen on all roadways. Lastly, due to the high cost of new AV's, the AV ownership will be weighted by income, with high-income neighborhoods seeing higher AV ownership, at least at first.

There are also three steps to this process:

1) in the NETWORK step, capacity values are assigned depending on one of the three scenario's above, and;

2) In the DIURNAL FACTOR step, trip tables for all trip purposes are split into AV and NON-AV trips using household income as weighting factors for home-based trips.

3) In the HASSIGN step, the "EXCLUDE" parameter is used to determines which vehicle type is allowed in which of the lane configuration, listed above.

UBER car services (Ride-sourcing)

In one vision of the future you don't pay for the car. You pay for the miles. And only the miles. Need a car to take mom to the doctor's, or fetch a spouse from the airport? Services will compete for the privilege of sending consumers vehicles a la carte, for a one-way trip, an afternoon, a weekend, a month. These cash-less transactions will move through the internet and be affordable.

It has been suggested that this "non-auto-ownership model" will serve the needs of the "Gen Now" generation and "Digital Natives", which comprise 133 million current and future drivers, or more than 43 percent of the U.S. population as well as the needs of older adults, the 47 million Americans aged 66 and over, who face different mobility challenges. While they still cherish their autonomy, they are prone to develop age-related impairments to their driving ability.

So, while personal-vehicle ownership isn't going away -- some people will own and cherish cars, rates of ownership will decline, and everyone else will be happy to share. After all, when Henry Ford introduced the Model T, you were not prohibited from riding your horse--it just became more convenient to own an automobile.

For example, UBER, founded in 2009, is basically a referral service. A smart phone app connects riders with drivers using their phone's GPS capabilities, letting both parties know one another's location and removing the question of when the ride will actually arrive. In addition, UBER also processes all payments involved, charging the passenger's credit card, taking a cut for itself, and direct depositing the remaining money into the driver's account, all in the background and completely cashless.

These services are in demand because of the convenience of requesting a ride by a mobile app, the satisfaction of being able to have experience monitored by the company as a third party, and because of competitive pricing for services. By May 2015, the service was available in 58 countries and 300 cities worldwide. By late-2015, Uber was estimated to be worth $62.5B. In Florida UBER provides services in The Central Atlantic Coast, Fort Myers, Naples, Gainesville, Florida Keys, Jacksonville, Tampa Bay, Ocala, Pensacola, Sarasota, Miami, Orlando and Tallahassee.

With respect to trip-based models... In the Olympus training model (a FSUTMS standard?) taxi trips are combined with "light truck" trips as PURPOSE 6 -- usually denoted as "TT" trips, meaning "Truck - Taxi." The number of trips is determined by an attraction rate of 0.30 per household and 0.45 per employee for each TAZ. Perhaps as the number of "ridesourced" trips increases to significant numbers, this can be improved.

Another possibility would be to expand the existing AIRPORT procedure to include 'taxi' and 'ride-sourced' trips from more than just airports. Include other attractions, and distribute, as we do now, based on a weighted value of: hotel/motels, seasonal population, core-area employment, and general population.

ADDITIONAL REPORTS

Run Time

Two report files are created during the running of the model that may be of interest to users. The first of these is the Run Time report: runtime.txt.

```
FSUMTS Model Run - YR2010
Input Directory C:\FSUTMS\D1\D1RPM_2040CF_Alt5\YR2010\input
================================================================
Begin Run Sun 06/14/2015 17:17:12.10
================================================================
       HNET: 17:17:12.15
   AIRPORTS: 17:18:54.66
   HVY TRKS: 17:19:33.45
    TRIPGEN: 17:19:55.66
LoopNum= 1
TRIPDISTRIB: 17:23:02.89
TRANSITPREP: 17:53:30.90
 MODECHOICE: 18:07:26.33
    TASSIGN: 19:02:13.08
 DIURNALFAC: 19:04:27.19
 AM HASSIGN: 19:12:55.01
 MD HASSIGN: 19:19:57.75
 PM HASSIGN: 19:23:11.85
 NT HASSIGN: 19:34:10.11
POSTPROCESS: 19:35:25.58
LoopNum= 2
TRIPDISTRIB: 19:43:39.89
TRANSITPREP: 20:14:25.75
 MODECHOICE: 20:28:40.69
    TASSIGN: 21:23:33.22
 DIURNALFAC: 21:25:47.65
 AM HASSIGN: 21:36:46.32
 MD HASSIGN: 21:41:16.85
 PM HASSIGN: 21:44:29.41
 NT HASSIGN: 21:47:02.25
POSTPROCESS: 21:48:19.20
LoopNum= 3
TRIPDISTRIB: 21:56:35.59
TRANSITPREP: 22:26:27.80
 MODECHOICE: 22:40:43.00
    TASSIGN: 23:35:52.78
 DIURNALFAC: 23:38:10.29
 AM HASSIGN: 23:47:33.74
 MD HASSIGN: 23:52:10.60
 PM HASSIGN: 23:53:27.06
 NT HASSIGN:  0:02:37.16
POSTPROCESS:  0:03:56.29
================================================================
End Run Mon 06/15/2015  0:06:03.48
================================================================
The model ran for a total of:      409 Minutes ( 6 Hr 49 Min)
```

The second is a report of model parameters or 'keys' used when the model ran. A portion of the \output\keys.prn file is shown below

```
C:\FSUTMS\D1\D1RPM_v1.0.1\YR2010
MEMORY
-------------------
MODELENGINE          ,2
SOFTWAREVERSION      ,60101

KEYS
-------------------
ABORTONERR             1
Airports               (Note)
Alt                    A
AlternativeInfo        (Note)
aofac_hbo              0.522
aofac_hbsh             0.522
aofac_hbsr             0.522
aofac_hbw              0.733
aofac_nhb              0.699
atiter                 24
avezone                1
avgwalk                .25
avgwlkspd              2.5
Base_Yr_unemp          0.0419
Alt_Yr_unemp           0.109
capfac_am              3
capfac_md              7
capfac_pm              4
capfac_nt              8
cbdzone                352
charlotteTAZ           4065
collierTAZ             1577
cores                  4
csort1                 CR 865
csort2                 CR 951
ctoll                  0.1
ctollscale             60
dampingfactor          0.5
debugMC                0
desc                   2010 Base Year Validation
desotoTAZ              730
FBtimeconv             0.20
FBvolconv              0.20
fromnode               117
GladesTAZ              857
HardeeTAZ              924
hbo3p                  3.49
hbw3p                  3.37
header4distrib         (Note)
header4hassign         (Note)
header4miscellaneous   (Note)
header4transit         (Note)
header4tripgen         (Note)
header4heval           (Note)
HendryTAZ              1081
HHIPFITER              15
HighlandsTAZ           1231
hovmin                 3
hwyopcost              9.5
inflationAOC           1
```

2010 Transit Route Reports

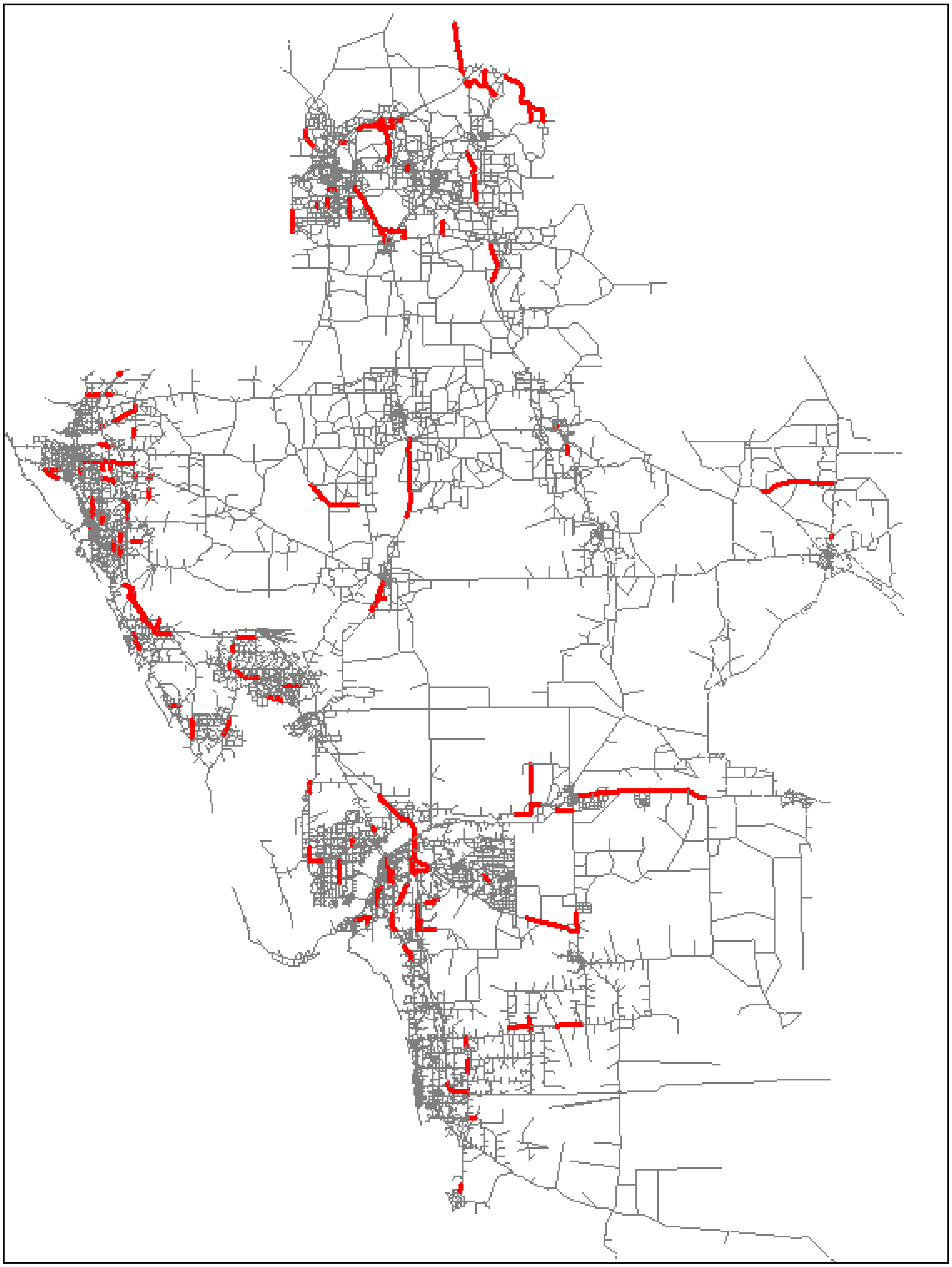
2010 Transit Assignment Report								
			Peak		Off-peak		Daily	
Route Name	Mode	Oper	Freq	Pax	Freq	Pax	Pax	Route LongName
C.011.nb	21	4	90	66.1	90	159.2	225.3	RED US41 / Creekside
C.011.sb	21	4	90	4.7	90	41.6	46.3	RED US41 / Creekside
C.012.nb	21	4	90	33.9	90	112.7	146.6	GOLD Airport Rd / Creekside
C.012.sb	21	4	90	4.8	90	39	43.8	GOLD Airport Rd / Creekside
C.013	21	4	60	114.2	60	198.4	312.6	ORANGE NCH / Coastland Mall (cw)
C.014	21	4	60	125.8	60	231.7	357.5	TEAL NCH / Coastland Mall (ccw)
C.015	21	4	90	45.4	90	186.2	231.6	PURPLE Golden Gate
C.016	21	4	90	4.6	90	51.9	56.5	GREY Golden Gate
C.017	21	4	90	42	90	143.6	185.6	GREEN Edison
C.018	21	4	90	42	90	143.6	185.6	YELLOW Edison
C.019.ib	21	4	90	6.2	90	37.6	43.8	BLUE Immokalee
C.019.ob	21	4	90	20.7	90	81.1	101.8	BLUE Immokalee
C.021.nb	21	4	90	4.2	90	15.9	20.1	CYAN Marco Island Circulator
C.021.sb	21	4	90	7.5	90	25.7	33.2	CYAN Marco Island Circulator
C.022	21	4	90	74.9	90	370.4	445.3	PINK Immokalee Circulator
C.023	21	4	90	74.9	90	370.4	445.3	BURGANDY Immokalee Circulator
C.024.ib	21	4	90	2.5	90	14.2	16.7	BROWN Charlee Estates
C.024.ob	21	4	90	24.7	90	66.6	91.2	BROWN Charlee Estates
C.025.ib	21	4	90	1.8	90	26.4	28.3	LIME Golden Gate Pkwy
C.025.ob	21	4	90	5.7	90	52.3	58	LIME Golden Gate Pkwy
C.026.nb	21	4	90	1.5	90	36.4	37.9	BLACK Clam Pass
C.026.sb	21	4	90	0.5	90	23.1	23.7	BLACK Clam Pass
C.121am	21	4	90	20.2	90	96.4	116.6	Immokalee / Marco Island
C.121pm	21	4	90	13.6	90	63.8	77.4	Immokalee / Marco Island
L.010.nb	21	5	60	71.5	60	180.1	251.6	Edison Mall Dunbar
L.010.sb	21	5	60	2.3	60	10.9	13.1	Edison Mall Dunbar
L.015.ib	21	5	60	6	60	27.4	33.4	Tice/Ortiz Edison Mall
L.015.ob	21	5	60	35.7	60	89.9	125.6	Tice/Ortiz Edison Mall
L.020.ib	21	5	30	13.4	30	44.2	57.6	Dunbar Downtown FM
L.020.ob	21	5	30	49.6	30	136.5	186	Dunbar Downtown FM
L.030.eb	21	5	60	15.9	60	58.7	74.6	Cape Coral S Ft Myers
L.030.wb	21	5	60	76.3	60	249.3	325.6	Cape Coral S Ft Myers
L.040.ib	21	5	120	1.2	120	21.8	23	Cape Coral S Ft Myers
L.040.ob	21	5	120	1.9	120	23.5	25.5	Cape Coral S Ft Myers
L.050.eb	21	5	50	26.4	50	117.9	144.3	SWFIA Summerlin Sq
L.050.wb	21	5	50	20	50	150.6	170.6	SWFIA Summerlin Sq
L.060.ib	21	5	120	0.4	120	10.3	10.7	San Carlos Park / FGCU
L.060.ob	21	5	120	1.3	120	43.2	44.6	San Carlos Park / FGCU
L.070.ib	21	5	60	23.4	60	114.4	137.8	Cape Coral Ft Myers
L.070.ob	21	5	60	129.4	60	372.2	501.6	Cape Coral Ft Myers
L.080.nb	21	5	90	9.3	90	25.7	35	Bell Tower/Edison Mall
L.080.sb	21	5	90	2.4	90	12.5	14.9	Bell Tower/Edison Mall
L.090	23	5	60	33.4	60	147.7	181.1	Circulator
L.100.ib	21	5	30	16.3	30	83	99.3	Riverdale Downtown Ft Myers
L.100.ob	21	5	30	157.3	30	371.6	528.9	Riverdale Downtown Ft Myers
L.110.ib	21	5	60	28.6	60	128.1	156.6	Lehigh Acres
L.110.ob	21	5	60	30.1	60	165.7	195.7	Lehigh Acres
L.120.eb	21	5	120	1.4	120	14.3	15.7	Edison Mall Cape Coral
L.120.wb	21	5	120	1.6	120	10.7	12.3	Edison Mall Cape Coral
L.130.nb	21	5	60	47.6	60	262.7	310.3	Edison Mall Summerlin Square
L.130.sb	21	5	60	29	60	198	227	Edison Mall Summerlin Square
L.140.nb	21	5	20	387.7	20	1110.8	1498.5	Merchants Crossing Coconut Point
L.140.sb	21	5	20	576.4	20	1379.1	1955.5	Merchants Crossing Coconut Point
L.150.eb	21	5	90	13.4	90	56.8	70.2	Bonita Springs
L.150.wb	21	5	90	10.9	90	60.2	71.1	Bonita Springs
L.160.eb	21	5	50	4.1	50	27.6	31.6	Pine Island
L.160.wb	21	5	50	7.6	50	41.5	49.1	Pine Island
L.410.nb	23	5	20	23	15	98.3	121.3	Beach Trolley
L.410.sb	23	5	20	60.7	15	209.4	270.1	Beach Trolley
L.450.nb	21	5	15	0.6	30	0	0.6	Beach Trolley
L.450.sb	21	5	15	0.6	30	0	0.6	Beach Trolley
L.490.nb	21	5	20	41.9	15	180.5	222.4	Beach Trolley
L.490.sb	21	5	20	25.7	15	135.8	161.5	Beach Trolley
M.001.eb	21	6	60	9.2	60	44	53.2	Ellenton / US 301
M.001.wb	21	6	60	31.7	60	126.2	157.9	Ellenton / US 301
M.002.nb	21	6	60	0.2	60	3.1	3.2	East Bradenton
M.002.sb	21	6	60	185.6	60	549.9	735.4	East Bradenton
M.003.eb	21	6	60	270.9	60	757.6	1028.5	Manatee Ave
M.003.wb	21	6	60	58	60	218.9	276.9	Manatee Ave
M.004.eb	21	6	60	82.8	60	301.2	384	WalMart / Blake Hospital
M.004.wb	21	6	60	176.5	60	462	638.5	WalMart / Blake Hospital
M.005.nb	23	6	20	49.8	20	182.6	232.4	AMI Trolly
M.005.sb	23	6	20	60.1	20	181.4	241.5	AMI Trolley
M.006.eb	21	6	60	48.9	60	181.9	230.8	Cortez Road
M.006.wb	21	6	60	27.4	60	119.7	147.2	Cortez Road
M.008.nb	21	6	60	6.5	60	46.2	52.7	Oneco / Bayshore
M.008.sb	21	6	60	9.8	60	79.5	89.2	Oneco / Bayshore

2010 Transit Assignment Report								
			Peak		Off-peak		Daily	
Route Name	Mode	Oper	Freq	Pax	Freq	Pax	Pax	Route LongName
M.009.nb	21	6	60	9.8	60	46.3	56.1	26th St West
M.009.sb	21	6	60	49.1	60	231.7	280.7	26th St West
M.013	21	6	60	19	60	108.7	127.6	Palmetto Circulator
M.016.nb	21	6	60	9.6	60	60	69.6	15th St East / Tallevast
M.016.sb	21	6	60	20.1	60	70.6	90.7	15th St East / Tallevast
M.099.nb	21	6	60	156.4	60	590	746.4	Palmetto / Sarasota
M.099.sb	21	6	60	103.9	60	492.8	596.7	Palmetto / Sarasota
P.CIT10	21	1	60	29.3	60	63.5	92.8	Shuttle
P.CIT11	21	1	60	47.5	60	271	318.6	Main/Combee
P.CIT12.eb	21	1	60	36.1	60	106.1	142.1	Lakeland / Winter Haven
P.CIT12.wb	21	1	60	57.8	60	158	215.8	Lakeland / Winter Haven
P.CIT20.ib	21	1	60	13.2	60	108.9	122.1	Grove Park/Crystal Lake
P.CIT20.ob	21	1	60	24.7	60	86	110.7	Grove Park/Crystal Lake
P.CIT21.ib	21	1	60	2.5	60	18.9	21.4	Edgewood
P.CIT21.ob	21	1	60	50.9	60	168.6	219.5	Edgewood
P.CIT30.ib	21	1	60	0.1	60	4.3	4.4	Cleveland Hts
P.CIT30.ob	21	1	60	14.7	60	50	64.8	Cleveland Hts
P.CIT31.ib	21	1	30	4.3	30	31.9	36.2	South Florida Ave
P.CIT31.ob	21	1	30	134.7	30	376.2	511	South Florida Ave
P.CIT32	21	1	60	2.9	60	27.3	30.3	Medulla Loop
P.CIT33.nb	21	1	60	0.3	60	4.6	4.9	S Florida / Carter Rd
P.CIT33.sb	21	1	60	0.9	60	7.8	8.7	S Florida / Carter Rd
P.CIT37.nb	21	1	60	0.1	60	3.8	3.9	South
P.CIT37.sb	21	1	60	0.4	60	7.8	8.2	South
P.CIT40.ib	21	1	60	0	60	0	0	Ariana/Beacon
P.CIT40.ob	21	1	60	34.5	60	96	130.5	Ariana/Beacon
P.CIT41.ib	21	1	60	0.6	60	9.8	10.4	Central Ave
P.CIT41.ob	21	1	60	52.1	60	168.8	220.9	Central Ave
P.CIT42.ib	21	1	30	12.8	30	71.2	84.1	W Memorial
P.CIT42.ob	21	1	30	46.6	30	179.1	225.7	W Memorial
P.CIT50.ib	21	1	30	53.1	30	261.8	314.9	Kathleen/Providence
P.CIT50.ob	21	1	30	74.4	30	400.7	475.1	Kathleen/Providence
P.CIT51.ib	21	1	60	0	60	0.6	0.7	North US98/Duff Rd
P.CIT51.ob	21	1	60	11.7	60	50.4	62.1	North US98/Duff Rd
P.CIT52.ib	21	1	30	6.8	30	14.9	21.7	N Florida Ave
P.CIT52.ob	21	1	30	77.7	30	173.8	251.5	N Florida Ave
P.CIT53.ib	21	1	60	0.2	60	1.4	1.6	Lakeside Village
P.CIT53.ob	21	1	60	54.9	60	199.4	254.3	Lakeside Village
P.CIT56.ib	21	1	60	20.7	60	97.7	118.4	Kathleen/Mall Hill Rd
P.CIT56.ob	21	1	60	27.1	60	160.6	187.8	Kathleen/Mall Hill Rd
P.CIT57.ib	21	1	60	0.2	60	3.2	3.4	Kidron/Fightline
P.CIT57.ob	21	1	60	23.5	60	58.5	82	Kidron/Fightline
P.PC22XL.nb	21	3	90	5.1	90	27	32.2	22XL Bartow Express / Lakeland
P.PC22XL.sb	21	3	90	34.9	90	122.3	157.1	22XL Bartow Express / Lakeland
P.PC22XWH.nb	21	3	60	8.4	60	39.1	47.5	Bartow Express / Winter Haven
P.PC22XWH.sb	21	3	90	15.1	90	57.7	72.8	Bartow Express / Winter Haven
P.PC25.nb	21	3	60	0.6	60	4.6	5.2	Bartow / Fort Meade
P.PC25.sb	21	3	60	0.3	60	2.7	3	Bartow / Fort Meade
P.PC35.nb	21	3	60	1.8	60	15.5	17.3	Froproof / Eagle Ridge Mall
P.PC35.sb	21	3	60	4.7	60	16.9	21.6	Froproof / Eagle Ridge Mall
P.WH12.eb	21	2	60	36.1	60	106.1	142.1	Winter Haven / Lakeland
P.WH12.wb	21	2	60	57.8	60	158	215.8	Winter Haven / Lakeland
P.WH15.ib	21	2	60	6.9	60	24.9	31.8	Haines City
P.WH15.ob	21	2	60	20.6	60	68.5	89.1	Haines City
P.WH30.ib	21	2	60	5.6	60	36.2	41.8	Eagle Ridge/Winter Haven
P.WH30.ob	21	2	60	71.7	60	190.4	262	Eagle Ridge/Winter Haven
P.WH40.ib	21	2	90	3.7	90	40.6	44.3	Southside
P.WH40.ob	21	2	90	27.7	90	78.9	106.6	Southside
P.WH44.ib	21	2	90	2.9	90	19	21.8	Southwest
P.WH44.ob	21	2	90	28.6	90	91.8	120.4	Southwest
P.WH50.ib	21	2	90	7.6	90	62.6	70.2	Weside
P.WH50.ob	21	2	90	27.8	90	134.1	162	Weside
S.001.ib	21	7	30	46.8	30	136.2	183	Fruitville
S.001.ob	21	7	30	102.9	30	198.6	301.5	Fruitville
S.002.ib	21	7	60	4.4	60	14.6	18.9	Cocoanut
S.002.ob	21	7	60	9.6	60	20.8	30.5	Cocoanut
S.003.ib	21	7	60	15.7	60	49.8	65.5	Pinecraft
S.003.ob	21	7	60	48.4	60	106.8	155.2	Pinecraft
S.004.ib	21	7	60	10.9	60	28.4	39.4	Lido
S.004.ob	21	7	60	19	60	33.4	52.4	Lido
S.005.ib	21	7	60	50.5	60	163	213.5	Ospry Swift
S.005.ob	21	7	60	84.4	60	185.4	269.8	Ospry Swift
S.006.ib	21	7	30	136.2	30	383.4	519.6	Beneva
S.006.ob	21	7	30	181.3	30	414.7	596.1	Beneva
S.007.ib	21	7	0	0	60	86.3	86.3	Newton
S.007.ob	21	7	0	0	60	57.2	57.2	Newton
S.007L.ib	21	7	60	27.2	0	0	27.2	Newton/Goodrich

2010 Transit Assignment Report								
			Peak		Off-peak		Daily	
Route Name	Mode	Oper	Freq	Pax	Freq	Pax	Pax	Route LongName
S.007L.ob	21	7	60	26.3	0	0	26.3	Newton/Goodrich
S.008.ib	21	7	60	30.6	60	98.9	129.5	Newtown US 301
S.008.ob	21	7	60	40.6	60	95.1	135.8	Newtown US 301
S.009.eb	21	7	120	11	120	75.5	86.5	North Port via Jacaranda
S.009.wb	21	7	120	27	120	129.3	156.3	North Port via Jacaranda
S.011.nb	21	7	60	31.8	60	120.1	151.9	Siesta Key
S.011.sb	21	7	60	72.4	60	176.5	248.9	Siesta Key
S.012.ib	21	7	30	24.9	30	82.8	107.7	North Lockwood
S.012.ob	21	7	30	69.5	30	144.5	214	North Lockwood
S.013.ib	21	7	60	11.1	60	65.5	76.6	Venice
S.013.ob	21	7	60	110.1	60	414.9	524.9	Venice
S.014.ib	21	7	60	12.3	60	72.8	85	Bee Ridge
S.014.ob	21	7	60	13.8	60	78.1	91.9	Bee Ridge
S.015.nb	21	7	60	27.8	60	156.9	184.7	Cattleman
S.015.sb	21	7	60	17.6	60	116.6	134.3	Cattleman
S.016.nb	21	7	60	11.5	60	68.9	80.4	Englewood
S.016.sb	21	7	60	47.7	60	165.6	213.3	Englewood
S.017.nb	21	7	60	159.3	60	495.4	654.8	Trail
S.017.sb	21	7	60	149.4	60	400.3	549.7	Trail
S.018.ib	21	7	60	19.4	60	103.9	123.3	Longboat Key
S.018.ob	21	7	60	48.6	60	142.5	191.2	Longboat Key
S.020.ib	21	7	120	0	120	0.5	0.5	Toledo /Glen Allen
S.020.ob	21	7	120	5.7	120	52	57.7	Toledo Glen Allen
S.026.ib	21	7	60	3.3	60	20.8	24.1	Venice Connector
S.026.ob	21	7	60	28.8	60	104.6	133.5	Venice Conector
S.040.nb	21	7	60	33.2	60	88.4	121.6	webber
S.040.sb	21	7	60	72.6	60	131.7	204.3	webber
S.099.nb	21	7	30	31.7	30	143.9	175.6	Palmetto / Sarasota
S.099.sb	21	7	30	77.1	30	192.8	269.9	Palmetto / Sarasota

Preparation For The 2018 (E+C) Model

Existing plus Committed roadway projects, received from each MPO were added to the model network, as shown in example below. The E+C model is run with 2040 model data to create a "worse case" scenario, for the development of LRTP alternatives. Six alternative development scenario's were scheduled to be tested in 2015, eight scenario's were developed and delivered to each MPO.



Preparation For The 2040 Model

A review of the socioeconomic data forecast for 2040 indicates that these data area within expected ranges and suitable for use in the forecast models.

Socioeconomic Data:															
	Population			Employment			Hotel			School			University		
	2010	2040	rate	2010	2040	rate	2010	2040	rate	2010	2040	rate	2010	2040	rate
Charlotte	156,595	208,188	1.1%	64,729	86,227	1.1%	2,075	3,247	1.9%	26,412	35,001	1.1%	1,220	1,614	1.1%
Collier	316,739	492,532	1.9%	173,678	237,747	1.2%	8,007	15,375	3.1%	73,130	109,997	1.7%	12,220	19,063	1.9%
Desoto	33,510	41,676	0.8%	13,486	17,564	1.0%	120	273	4.3%	6,770	9,142	1.2%	260	260	0.0%
Glades	11,432	17,825	1.9%	4,542	5,404	0.6%	10	216	68.7%	3,200	4,872	1.7%	40	40	0.0%
Hardee	25,856	30,358	0.6%	11,210	14,135	0.9%	135	126	-0.2%	7,060	8,377	0.6%	80	80	0.0%
Hendry	37,414	45,107	0.7%	18,659	25,973	1.3%	250	453	2.7%	12,890	15,957	0.8%	380	380	0.0%
Highlands	97,665	134,966	1.3%	38,036	55,987	1.6%	940	1,807	3.1%	17,660	19,063	0.3%	12,280	12,280	0.0%
Lee	609,173	1,070,727	2.5%	283,431	488,328	2.4%	12,380	14,720	0.6%	85,526	136,352	2.0%	17,988	37,926	3.7%
Manatee	318,769	474,518	1.6%	154,759	231,446	1.7%	3,193	6,198	3.1%	57,330	82,580	1.5%	34,100	48,970	1.5%
Okeechobee	37,103	49,970	1.2%	14,002	21,406	1.8%	415	723	2.5%	8,520	11,588	1.2%	200	200	0.0%
Polk	589,811	985,794	2.2%	255,593	435,666	2.3%	5,684	20,374	8.6%	97,395	193,408	3.3%	31,008	53,444	2.4%
Sarasota	374,018	519,913	1.3%	212,623	267,713	0.9%	4,845	6,316	1.0%	55,452	79,630	1.5%	12,311	17,675	1.5%
District 1	2,608,085	4,071,574	1.9%	1,244,748	1,887,596	1.7%	27,457	50,138	2.8%	321,883	522,621	2.1%	107,887	170,495	1.9%

In the following graphics, "Person Trips / TAZ" is an old standard which is interpreted to mean: "the number of trips on a centroid connector". What we are looking for here is a large number of vehicles loading onto the highway network at a single location may indicate that SOCIOECONOMIC DATA was added to the model, i.e. a new development -- but additional, expected, highway access was never coded into the model.

In this case the D1RPM has one centroid connector loading 2.342 trips onto the highway -- well below the "high" standard. The graphic also indicates that, related to 2040 socioeconomic data, the D1RPM model remains within expected standards.

2010 Statistic:			
	Low	High	D1RPM
Person Trips / TAZ	-	15,000	1,405
Person Trips / Person	3.30	4.00	3.01
Person Trips / HH	8.00	10.00	5.53
HBW Trips / Employee	1.20	1.55	1.69

2040 Statistic:	Benchmark		
	Low	High	D1RPM
Person Trips / TAZ	-	15,000	2,342
Person Trips / Person	3.30	4.00	3.22
Person Trips / HH	8.00	10.00	5.90
HBW Trips / Employee	1.20	1.55	1.89