

Tampa Bay Regional
Planning Model v9.0

VALIDATION REPORT

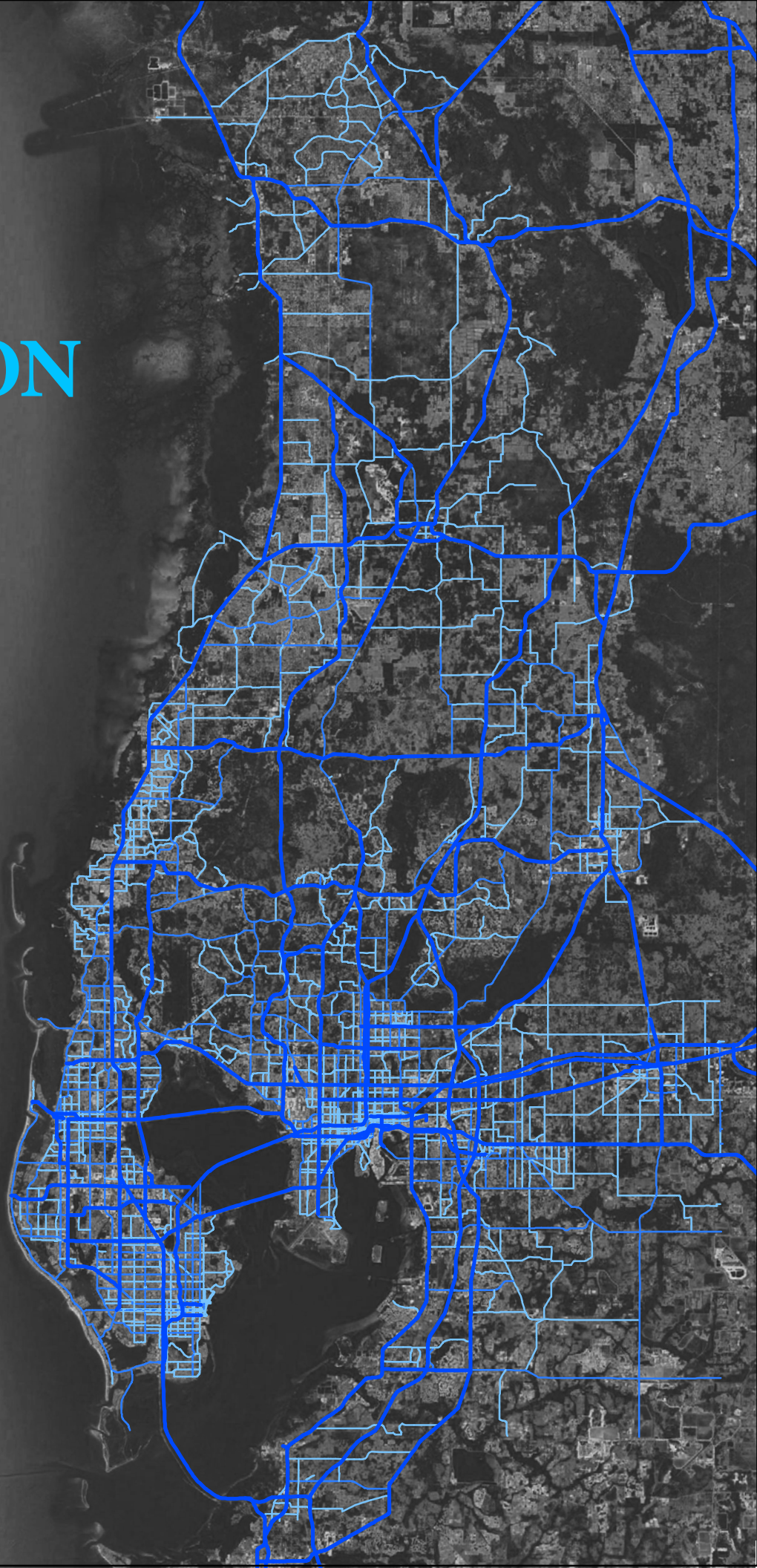


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Chapter 1- OVERVIEW AND INTRODUCTION

This Validation Report documents the base year 2015 model validation of the Tampa Bay Regional Planning Model version 9.0 (TBRPM v9.0). The validation of the TBRPM v9.0 started with the TBRPM v8.2 model and TAZ structure. The TBRPM v8.2 has a Base Year of 2010, and its TAZ structure underwent a series of splits which are incorporated in the v9.0 model. The v9.0 model is based on the Florida Standard Urban Transportation Model Structure (FSUTMS) using the CUBE Voyager software with several enhancements from the basic standard. This chapter, Chapter 1 – Overview and Introduction, explains some of the history of the Regional Transportation Analysis (RTA) process for the Tampa Bay area and how the TBRPM is used to support the planning process. The overview includes a description of the validation of the TBRPM v9.0, together with enhancements and updates related to the travel demand model and the forecasting process.

1.1 TAMPA BAY REGIONAL TRANSPORTATION ANALYSIS (RTA) PROCESS

The RTA process fosters transportation planning both within and among the five counties (Citrus, Hernando, Hillsborough, Pasco, Pinellas), the four Metropolitan Planning Organizations (MPOs) (Forward Pinellas, Hernando/Citrus MPO, Hillsborough MPO, Pasco MPO), the six transit agencies (Hillsborough Area Regional Transit Authority - HART, Pinellas Suncoast Transit Authority - PSTA, Pasco County Public Transportation - PCPT, Hernando County Transit – TheBus, Citrus County Transit Services, Tampa Bay Area Regional Transit Authority - TBARTA), the Tampa Hillsborough Expressway Authority (THEA), and the Florida Department of Transportation (FDOT) District 7. Together, the RTA partners cover the Tampa Bay Area region. The RTA process provides a forum for the coordination of proposed transportation improvements for all modes, that can possibly span multiple jurisdictions. Representation from FDOT, District 7, the individual MPOs, transit agencies and other roadway authorities, as well as consulting staff, meet monthly and form the Technical Review Team (TRT). Through the RTA process, a regional travel demand forecasting model, the TBRPM, was developed to facilitate the analysis of the transportation goals of the different agencies. Below is an outline of the history of the RTA process.

- Phase I (1990), surveys were conducted to determine the specific travel characteristics, needs, and travel demands in the Tampa Bay Region. At this time, the basic structure of the TBRPM was developed.
- Phase IA included the refinement, calibration, and validation of the TBRPM for the Base Year 1990.
- Phase II (1992-1995) involved model application. Forecasts of socio-economic data were developed to model forecasted demand on the transportation system for the Future Year 2015. Long Range Transportation Plans (LRTPs) were developed for the Metropolitan Planning Organizations (MPOs). At this time, only Citrus County was a non-MPO county and was not included in the model.
- Phase III (1996-1997) started another development / validation phase for the Base Year 1995. Citrus County was not yet an MPO, but a portion of the highway network was included in the TBRPM.
- Phase IV (1997-2000) was again a time of application of the model. The TBRPM was used to forecast the Future Year 2020 transportation needs for the Tampa Bay Region. New forecasts of socio-economic data were developed for the Year 2020, and new LRTPs were updated for the RTA MPO members.
- Phase V (1999-2001) started the next development / validation phase to the Base Year 1999.
- Phase VI (2000-2005) was an application of the model to the forecast Year 2025 in support of the MPO's LRTPs.
- Phase VII and VIII (2002-2007) was the next round of development / validation / application for the Base Year 2000, and the TBRPM v4.0. This was an important update to the model due to it coinciding to a Census year. In the middle of these phases, the Cube software from Citilabs was adopted by FDOT Central Office, Systems Planning modeling group after a brief conversion of the model to TransCAD was made. The TBRPM v5.0 was the conversion / model update to the new CUBE software platform, with TranPlan as its modeling engine just as previous model versions had been. The TBRPM v5.0 was based on the same Base Year 2000, and 2030 Forecast Year.
- Phase IX (2004-2008) was a model development / validation phase. Here the TBRPM was further converted using the CUBE VOYAGER software engine. TranPlan was no longer used for this model version. The validation model was again based on the Base Year 2000 network. This model is the TBRPM v6.0.
- Phase X and XI (2006-2010) included model development / validation / application phase for the TBRPM v7.0 which had an improved TrueShape model network, new area type calculations, refinements to the Transit module, and a new Measures-of-Effectiveness (MOE) reporting tool used for scenario analysis during the new LRTP updates. This version of the model included an extension of the study area boundary in the south to take in the Northwestern portion of Manatee County and in particular the Port Manatee area and the I-75 / I-275 loop and interchange. Including this area allowed for the analysis of the trip interchange between southern Hillsborough and Pinellas. The validation Base Year was 2006, and 2035 the forecast year.
- Phase XII and XIII (2010-2015) model development / validation / application for TBRPM v8.0. FDOT, District 7 was now in a five-year LRTP update cycle due to relaxed EPA requirements for non-attainment. FDOT, District 7 now went through new model development for a couple of Alternatives Analysis (AA) studies in the region as well as a series of Express Lane studies.

CHAPTER 1 – OVERVIEW AND INTRODUCTION

Time-of-Day modeling was introduced into this version of the model, as well, with new refinements to the Transit and Mode Choice modules, updated / expanded HTML reporting of model results, and an updated Measures-of-Effectiveness (MOE) reporting tool. The validation Base Year was 2010 with a forecast year of 2040.

RTA Phase XIV (2016-2020) is the current incarnation of the model development and application phases for producing the TBRPM v9.0. This phase has built on the previous successes of the TBRPM development, has refined the TAZ structure and network externals, and is ready for the next development phase for use in the Tampa Bay Region transportation planning process. The TBRPM v9.0 model has a base year of 2015 with a future forecast year of 2045 and was successfully used in support of the year 2045 LRTP updates for the MPOs.

1.2 STUDY AREA

The study area for the TBRPM corresponds with the jurisdiction of FDOT, District 7 which includes Citrus, Hernando, Hillsborough, Pasco, and Pinellas counties, as well as the northwestern portion of Manatee County. The northwestern portion of Manatee County area was added to the model in TBRPM v7.0 to better reflect the travel patterns for the region. The five-county study area and the Manatee portion are depicted in **Figure 1**.

The TBRPM study area encompasses a region of 3,275 square miles and was home to more than 3.05 million total residents with a base of approximately 1.63 million jobs in the year 2015. Hillsborough County with almost 1.30 million residents is the region's most populous county, accounting for 42.4 percent of the region's population. Pinellas, Pasco, Hernando, Citrus, and the northwestern portion of Manatee County have approximately 943,000, 484,000, 177,000, 142,000, and 14,000 residents, respectively. For the TBRPM, there were approximately 1.48 million dwelling units in 2015, and approximately 1.28 million households that were not vacant or seasonal. On average, there are about 2.35 people per household for the study area, and approximately 57,000 people that live in Group Quarters. On the employment side, Hillsborough County has approximately 832,000 jobs, the largest for the region, accounting for 51.1 percent of the region's employment base. The number of jobs for Pinellas, Pasco, Hernando, Citrus, and the northwestern portion of Manatee County are approximately 535,000, 158,000, 56,000, 46,000, and 3,000, respectively.

The 2015 Highway network includes approximately 10,980 total lane miles of roadways comprised of freeways and expressways, divided arterials, undivided arterials, collectors, one-way facilities, ramps, and toll facilities. The 2015 Transit network includes approximately 3,160 transit route miles during peak service levels.

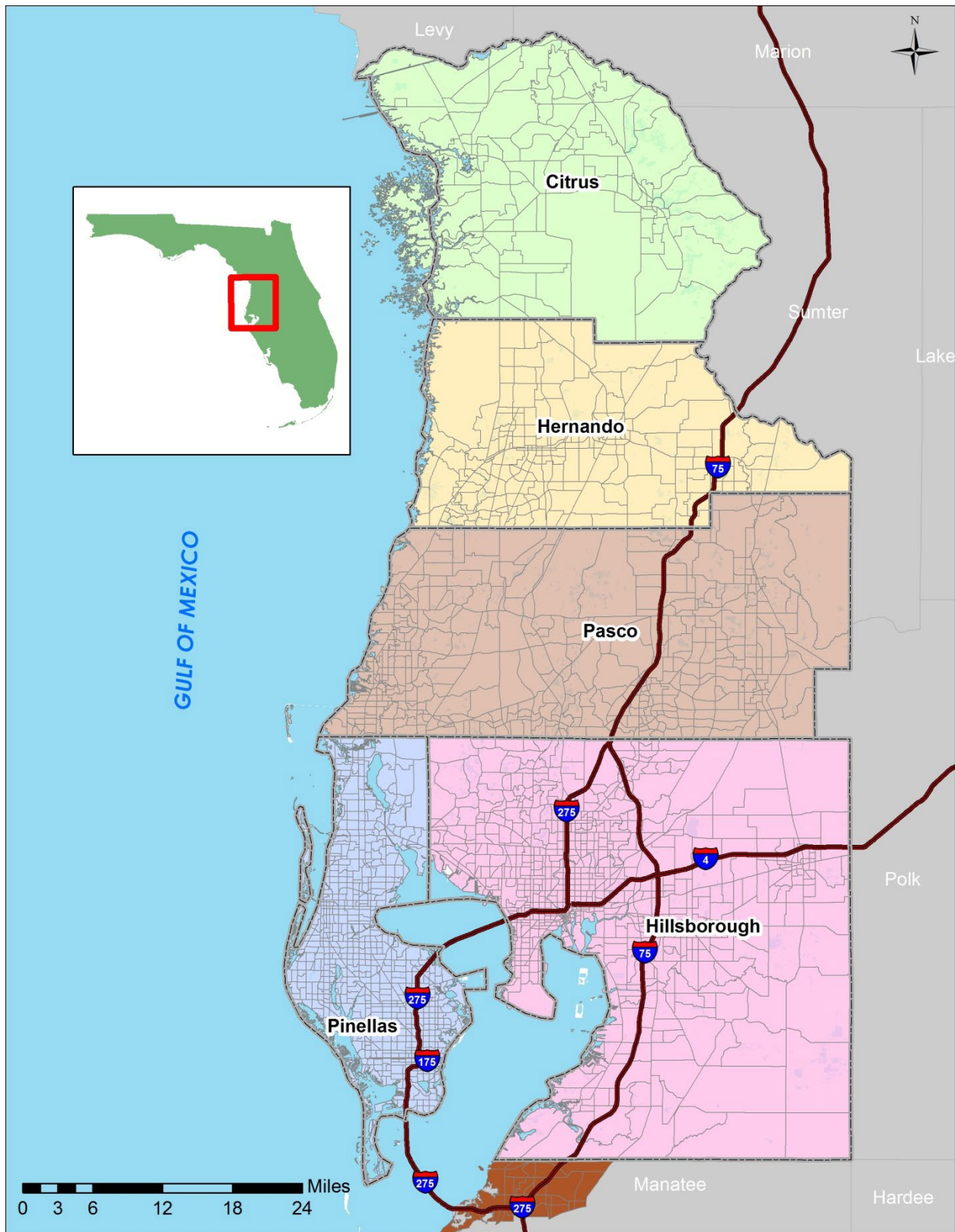


Figure 1: TBRPM v9.0 Study Area

1.3 OVERALL MODELING PROCESS

The TBRPM is the prominent travel demand estimation tool that the RTA process uses to forecast future travel demand for the Tampa Bay area. The following section explains how most 4-step travel demand models operate, including standard FSUTMS models on which the TBRPM is based. The following section also provides a description of how the TBRPM differs from standard FSUTMS models.

There are four basic steps to the process of travel demand forecasting using a “four-step model”, which include:

- Trip Generation
- Trip Distribution
- Mode Choice
- Trip Assignment

These four steps allow the number of trips in a given area to be estimated and then assigned to specific transportation facilities—either on highway or transit systems.

Trip Generation determines the total number of trips produced, called *productions*, for each day by trip purpose in very specific geographic areas which are usually referred to as Traffic Analysis Zones (TAZs or Zones). The Trip Generation step also determines the number of opportunities, called *attractions*, which are available in each geographic area which can satisfy as a destination of each of the production trip-ends. This step determines, for example, the number of work trips generated (productions) in one area, as well as the number of trip-ends at the places of work (attractions) that can satisfy those production trips within the same or surrounding areas.

Once the number of trips to be generated to and from each geographic area is determined, **Trip Distribution** allocates, or connects, the person trip-ends between the geographic zones or TAZs within the model. The most popular means of distributing trips in a “Four-Step” model is through the application of a gravity model, a concept which has been borrowed from the physical sciences. In physics, the Newtonian gravity equation is used to calculate how strongly two objects are attracted to one another based upon the mass of the two objects and their distance apart from each other. Newton’s theory of gravity is commonly used in the distribution of trips (i.e., how attractive one TAZ is to another) based on their distances and each area’s level of activity. As an example, a shopping mall may attract many trips which are inversely proportionate to their origin’s distance from it. Thus, trips generated by households in a given subdivision or geographic area would usually be more attracted to a mall on the same side of town than to one across town or even in another county. By the same token, those same households may want to drive further to go to a mall, which has greater “mass” in terms of trip attractions, or buying opportunities with a larger number of stores, than they would to go to a convenience store, a place with a lesser “mass” in terms of trip attractions. The application of the gravity model equation is used, therefore, to simulate travelers’ choices about their destinations with respect to the distance to or the time it takes to travel to those destinations and the opportunities that they present.

While trip generation determines the number of trips based on trip ends, and trip distribution determines the trips to be taken by matching their origin and destination locations, the **Mode Choice** step determines *how*, or by what means, trips will occur. Through this step the model first determines whether trips occur by automobile or by transit. For highway trips, the Mode Choice step is also used to determine whether the trip maker will drive alone or share-a-ride with someone else making a similar trip. For transit trips, Mode Choice determines by what type of transit mode the trip will be made (local bus, express bus, or fixed guide way transit), as well as whether the trip maker can walk to a transit stop or will have to drive to a park-n-ride / kiss-n-ride location before making the transit portion of the trip.

The last step, **Trip Assignment** is used to determine which route on the highway or transit network the trips will follow. Generally, there are many routes that a trip can take to travel between a given origin and destination. This step involves selecting the best network path that an actual traveler would select. This selection is generally determined by the shortest and / or fastest route between the two locations that define the trip. Multiple iterations of trip assignments are performed within this step to determine the most efficient assignment of all trips to the network.

The four-step process is a very commonly used process in travel demand estimation. It allows for the estimation of the number of trips likely to occur in an area; the selection of the origins and destinations of those trips; the determination of the modal choice; and the assignment of the trips to the highway and / or transit route networks.

1.4 NEW FEATURES AND MODEL ENHANCEMENTS

1.4.1 PAST ENHANCEMENTS

Model enhancements are changes made to the TBRPM that depart from the standard FSUTMS procedures. These enhancements include numerous refinements to the trip generation model, highway and transit network modules, distribution, the mode choice model, and the highway assignment module as well. Enhancements have been made over the course of the RTA Phases I, IA, III, V, VII, VIII, IX, X, XI, XII, XIII, and now XIV. The uniqueness of the travel characteristics of the Tampa Bay Area and the size of the regional model, has made these enhancements necessary to better simulate the observed travel characteristics.

The trip generation model, and in particular the trip attraction model was updated in order to incorporate the results from the trip attraction survey which was conducted in the spring of 2000. The trip generation model improvements included implementation of a “lifestyle” model; the refinement of trip purpose categories; the expansion of employment categories; the expansion of automobile ownership categories; the development of a seasonal resident trip production model; and the development of a hotel / motel unit trip model. Enhancements to truck and taxi trips have also been made, as well as the inclusion of the College / University and Airport trip purposes.

In the same time period, the use of a double-digit facility type and area type coding was implemented in the TBRPM Highway Network module, while the Highway Path module was enhanced through the provision of differentiating between truck, single occupancy vehicle (SOV) and high occupancy vehicle (HOV) trips in the trip assignment.

Using the updated trip generation module, a time-of-day model was also implemented in TBRPM v8.0 and designed to factor the daily trips into peak and off-peak trips by purpose. The factors were based on diurnal factors developed from the year 2009 National Household Travel Survey (NHTS) and locally based household surveys (2000/2007). The parsed trips are distributed using a gravity model for peak and off-peak time periods. The off-peak (midday and evening/overnight) trip distribution uses the free-flow uncongested travel time skims which are derived by “skimming” the travel times across the network to identify the shortest travel path between all TAZ origin-destination (OD) pairs. The free-flow travel times on each link are based on the two-digit Area Type / Facility Type code used in the Highway network module. The peak period trips are distributed using a congested travel skim. The congested travel skim is derived from the distribution of the peak trips starting with the free-flow skim used to assign the AM peak trips to the peak period highway network. The distribution / assignment process is repeated six (6) more times, each time replacing the previous skim with a new congested skim derived from the previous round of assignment of the peak period trips to the network. Each iteration the trip table is weighted together with the previously distributed trip table before the next round of assignment, which is usually referred to as a pre-assignment. This allows the process to reach convergence sooner with less oscillations of the assignment results. The final pre-assignment loop generates the final congested skims which are then used for the mode choice process. This process is in contrast to previous TBRPM versions where only daily home-based work (HBW) trips were distributed based on congested travel times while all other trip purposes were distributed based on free-flow uncongested travel times.

Another change or enhancement which started with the TBRPM v8.0 was the treatment of zero-car (0-car) households (HHs) as an independent market or trip group in the distribution and mode choice steps. Zero-car households are the most likely group to utilize transit as their primary mode of transportation. Based on the survey data, the households with this characteristic were separated in the distribution and mode choice steps. Beyond this, the mode choice model was enhanced to include the adoption of a new nested logit structure, as well as refinements in auto ownership categories. The mode choice nested logit structure has been expanded to include several modes for the region including in-street bus rapid transit (BRT), fixed guideway BRT, and fixed guideway. In the current model structure, 0-car household (HH) trips are blended with the rest of the one-plus car (1+ car) HH trips before the mode choice program executable is run. The mode choice module treats a mixture of the person trips by purpose using two main time periods, peak and off-peak, where the previous TBRPM structure separated only HBW trips for peak transit service and the rest of all other person trips for the off-peak transit service.

The final highway assignment reflects four (4) time periods which are based on the peak and off-peak time periods and refined as AM peak (6:30 AM to 9:00 AM), midday off-Peak (9:00 AM to 3:30 PM), PM peak (3:30 PM to 6:30 PM), and evening/overnight off-peak (6:30 PM to 6:30 AM). The trip distribution is performed on the peak (AM and PM) and off-peak (midday (MD) and evening/overnight (EV)) trip groupings. The peak period trip distribution uses the AM peak congested skims as developed through the pre-assignment

loop series of distribution, mode choice, and assignment of the AM trips as described above to reach the specified equilibrium. The off-peak period trip distribution uses the free-flow skims for its impedance. Highway trips from the mode choice are then assigned to the two (2) different period-based networks (AM and PM peaks), which are later summed with the off-peak period assignments to achieve the full daily assignment. The two period-based networks are only different due to the directional operation of the reversible elevated lanes operated by the Tampa Hillsborough Expressway Authority (THEA) east of downtown Tampa. The PM peak network is also used for the MD and EV off-peak period highway assignments since the reverse elevated lane generally operates in the same direction as it does during the PM peak period. These two networks together more accurately accommodate the daily operation of the reversible elevated lanes for the Lee Roy Selmon Crosstown Expressway (Crosstown Expwy) for both distributional and assignment purposes. In the AM network, which is used to distribute all peak period trips, the reversible elevated lanes flow westbound into downtown Tampa to allow for more inbound traffic during the AM peak period. The rest of the day the reversible elevated lanes are generally reversed eastward from Tampa to allow for outbound traffic flow, except for a few specific times when the lanes are in a mixed configuration. The outbound traffic flow in the eastern direction is reflected in the PM network which is also used for the distribution of the off-peak period trips. To allow for the appropriate directional traffic flow simulation, facility types (FT) 96 and 97 have been reserved for the reversible lane roadway types within the model. In the base highway shapefile/Cube network of a scenario, the reversible elevated lane facilities are coded as two-way facilities in order to avoid having to maintain two independent networks. Scripting in the model addresses the conversion from the two-way facility links to the reversible elevated lane facility links into directional parts to create the two appropriate networks for the two time periods. In the final highway trip assignment, the PM network is used for the off-peak period trip assignments (both MD and EV) for the proper travel flow of the reversible elevated lanes.

Other enhancements made to the highway assignment module include the application of multiple Bureau of Public Roads (BPR) curves. BPR curves reflect the speed-flow relationships that predicts a roadway's speed/delay as a function of congestion which is measured as volume over capacity (V/C). Also introduced in this module, was a variable UROAD factor by facility type which allows for the conversion of absolute capacity values (LOS "E") to practical capacity values (LOS "C") for use in the BPR speed change calculation during highway assignment. Another addition is the truck-only assignment process, together with the inclusion of four time-of-day periods for highway assignment as described earlier. Reporting was added to allow for the reporting of the "daily" assignment volumes. The time-of-day nature of the model requires the need for four separate highway assignments, one for each time period. These four time-of-day assignments are completed in a loop within the highway module and are summed up onto a daily highway network to reference a daily volume forecast. This final "daily" network still retains all of the four time-of-day period volumes as well. For validation purposes, a database of traffic counts by time-of-day and by direction was created using raw and annual average daily traffic counts (AADT) obtained from FDOT, District 7 and the local MPOs. For those links where traffic counts were collected and reported by time-of-day, the assignment volumes were evaluated on two levels, for time-period and by direction. Other adjustments to the highway assignment included changes to truck travel times on links, at the time of assignment, within the central business district and surrounding fringe area types. These travel time adjustments were introduced to discourage trucks from traveling through the local street system in the downtown and fringe area, unless they have a destination there. The adjustment results in the truck trips remaining on more suitable truck routes to their final destination.

In the transit network module, an automatic process has been developed to build the transit access connectors and PCWALK parameters. The transit network module computes transit access for both automobile Park-N-Ride (PNR) and Kiss-N-Ride (KNR) trips and pedestrian walk access trips. The module creates the network links necessary to represent the auto-to-transit or walk-to-transit travel paths needed to create the complete transit paths and skims for the mode choice module. The additional process for automatically developing the PCWALK transit access coverage is a GIS process scripted in Python which uses the ArcGIS engine to calculate additional input parameters needed for use in the transit path module. These parameters calculate the distance from the TAZs to transit routes/stops and stations for a given transit network scenario using buffers in GIS. Transit trips resulting from the mode choice are assigned to peak and off-peak transit networks based on two distinct transit service plans which are formed from the frequency of service, routes, and modes as scheduled for each of the transit agencies in the Tampa Bay Region. Transit trips are assigned in a production and attraction format, as opposed to an origin destination format used in the final highway assignment. The daily transit ridership is the sum of the transit trip assignment from the two (2) time periods, peak and off-Peak.

As additional transit modes were being studied in the Tampa Bay area, additional refinements in the transit modules were introduced in the TBRPM. The development of the time-of-day based model and the use of additional transit modes stemmed partially from the need for more refined modeling for Alternatives Analysis (AA) studies within the Tampa Bay region. This need also led to the development of a new mode choice model for the TBRPM. The structure of the mode choice model is provided in **Figure 2**. The latest mode choice model accommodates an extra path for each of the transit access methods. It also provides the option to use a multiple of up to four bias constant sets that can be calibrated for each of the transit agencies or by geography. The updates also introduced a method for modeling "choice riders" vs "captive riders" when modeling new premium transit modes such as fixed guideway and fixed guideway BRT. These topics are covered in greater detail in the *User's Procedural Guide*.

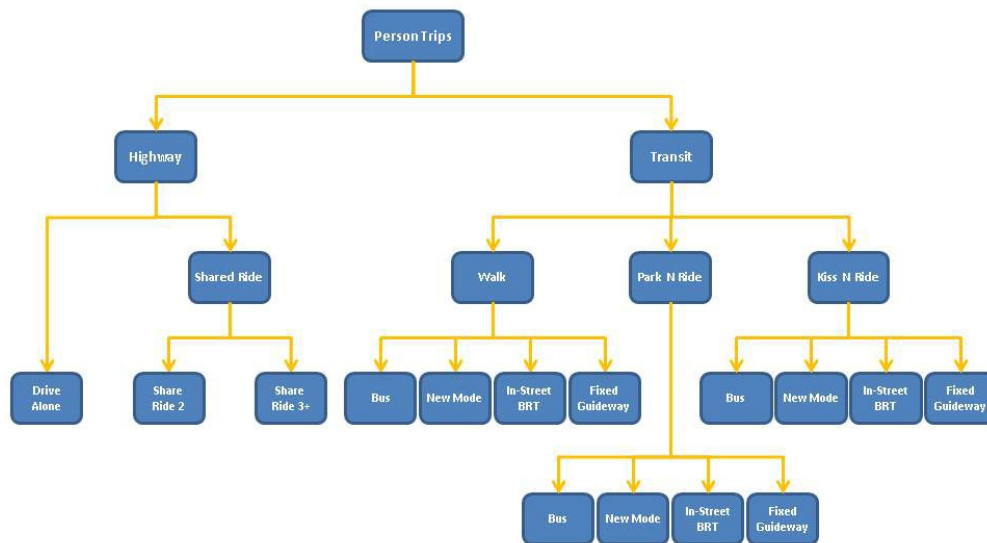


Figure 2: New Mode Choice Structure Diagram

More of the TBRPM v9.0 enhancements, updates, and procedures are described in the following sections.

1.4.2 AUTONOMOUS, CONNECTED, ELECTRIC, AND SHARED VEHICLES (ACES)

In May 2018, the FDOT Central Office, Office of Policy Planning, published “Guidance for assessing planning impacts and opportunities of automated, connected, electric, and share-use vehicles”. Based on this documentation and in close coordination with the MPOs several of the scenarios documented in the guidance were tested for inclusion in the LRTP process. The TBRPM v9.0 was updated to include adjustment factors to consider some of the possible effects of ACES. The adjustment factors focused on changes in highway capacity and trip generation. The adjustment factors were incorporated into the model as programable keys. With these keys, the user can vary the input variables and test different scenario to simulate the possible effects of ACES. Research is ongoing on this topic and as information becomes available, adjustments will be made to the methodology.

1.4.3 MODEL OUTPUT REPORTS UPDATE

The TBRPM provides the users with output summaries in HTML format. In this version, the functionality and the appearance has been updated. An added functionality is the ability to sort the tables in the HTML report for the various columns on each table. Also, data in the report tables can be selected, copied, and pasted to other analysis tools such as Microsoft Excel.

1.5 ORGANIZATION OF THE REPORT

The report contains thirteen chapters. *Chapter 1* provides an introduction and an overview of the enhancements made to TBRPM v9.0. Chapter 2 outlines the regional travel characteristics and input data development process for the TBRPM v9.0. It also summarizes the surveys conducted in support of this model update. Chapters 3 through 12 each focus on one module within the TBRPM model chain and outlines the enhancements made to each module in the TBRPM v9.0, discusses the model validation results, and summarizes the results.

Chapter 2 - REGIONAL TRAVEL CHARACTERISTICS AND MODEL DATA DEVELOPMENT

2.1 2010 US CENSUS DATA

The TBRPM v8.0 model base year data was developed using the 2010 Census data. The TBRPM v9.0's base year is 2015 and the American Community Survey (ACS) data was used to update the base year socio-economic data from 2010 to 2015.

2.2 2011-2015 AMERICAN COMMUNITY SURVEY AND 2010 CENSUS TRANSPORTATION PLANNING PACKAGE DATA

Table 1 provides the average daily county to county movements for Home Based Work (HBW) trips within FDOT, District 7 as provided by the 2011-2015 five-year American Community Survey (ACS).

Table 1: 2011-2015 American Community Survey County to County Movements

County	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Total
Hillsborough	531,000	35,500	10,400	600	200	577,700
Pinellas	43,600	359,600	4,500	300	-	408,000
Pasco	52,500	22,800	99,700	4,100	400	179,500
Hernando	6,200	2,100	8,200	36,400	1,300	54,200
Citrus	600	300	500	1,500	32,000	34,900
Total	633,900	420,300	123,300	42,900	33,900	1,254,300

Table 2 provides the percentage share of each destination county of the HBW trips made by the Origin County. These same percentages can be compared to **Table 3** which provides the county movements as calculated from the 2010 Census Journey to Work Flows for a reference.

Table 2: 2011-2015 American Community Survey County to County Movements

County	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Total
Hillsborough	91.9%	6.2%	1.8%	0.1%	0.0%	100.0%
Pinellas	10.7%	88.2%	1.1%	0.1%	0.0%	100.0%
Pasco	29.2%	12.7%	55.5%	2.3%	0.2%	100.0%
Hernando	11.4%	3.9%	15.1%	67.2%	2.4%	100.0%
Citrus	1.8%	0.9%	1.4%	4.2%	91.7%	100.0%
Total	50.5%	33.5%	9.8%	3.4%	2.7%	100.0%

Table 3: 2010 Model Validation Journey to Workflows to County of Work Destination

County	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Total
Hillsborough	87.8%	9.1%	2.9%	0.2%	0.1%	100.0%
Pinellas	11.7%	86.5%	1.6%	0.1%	0.0%	100.0%
Pasco	25.7%	11.9%	56.8%	5.1%	0.6%	100.0%
Hernando	5.9%	2.1%	13.6%	73.0%	5.4%	100.0%
Citrus	0.7%	0.1%	0.7%	4.2%	94.3%	100.0%
Total	46.4%	35.2%	10.6%	4.5%	3.3%	100.0%

CHAPTER 2 – REGIONAL TRAVEL CHARACTERISTICS

2.3 DEVELOPMENT OF 2015 POPULATION AND DWELLING UNIT AND EMPLOYMENT DATA

The socio-economic input data for the TBRPM v9.0 was jointly developed by FDOT and the MPOs within District 7. Parcel data and the Bureau of Economic and Business Research (BEER) of the University of Florida were used as combined resources for the basis of the Dwelling Unit and population data and InfoGroup provides the basis of the employment data, both of which are stored by TAZ in the ZDATA1 and ZDATA2 files respectively. ACS 2011-2015 data was also used in the development of the Lifestyle and auto ownership level data for ZDATA1. **Table 4** below provides a summary of 2015 population, dwelling unit, and employment totals by county. Further details on the socio-economic data used by the model can be found in *Chapter 4 – Trip Generation*.

Table 4: 2015 Population, Dwelling Unit, and Employment Summary

County	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
Permanent Population	1,271,613	922,187	477,662	174,380	139,141	13,366	2,998,349
Group Quarters	23,702	20,591	6,335	2,439	2,360	1,082	56,509
Total Population	1,295,315	942,778	483,997	176,819	141,501	14,448	3,054,858
Permanently Occupied	508,658	427,667	198,574	73,426	63,654	4,646	1,276,626
Seasonally Occupied	8,096	43,402	17,728	4,633	7,291	902	82,051
Vacant Dwelling Units	45,258	38,325	20,517	7,272	7,611	446	119,429
Total Dwelling Units	562,012	509,394	236,820	85,330	78,556	5,995	1,478,107
Industrial Employment	143,890	86,229	26,470	10,145	7,780	606	275,120
Commercial Employment	140,100	101,300	37,600	14,000	10,200	981	304,181
Service Employment	548,310	347,371	93,430	31,555	27,820	1,192	1,049,678
Total Employment	832,300	534,900	157,500	55,700	45,800	2,779	1,628,979

2.4 COLLECTION AND PROCESSING OF 2015 TRAFFIC COUNTS DATA

For validation of the TBRPM v9.0, 2015 base year scenario, a series of traffic counts were collected from FDOT and the MPOs that ranged across several years around the 2015-time frame as was available. Generally, three types of traffic counts were collected, including classification counts by time-of-day, time of day counts, and AADT counts. Classification counts use 15-minute buckets of raw traffic counts by vehicle weight classes to calculate the percent of vehicles by vehicle type (passenger car, light trucks, heavy trucks) by time-period and direction. Time of Day Counts use 15-minute buckets of raw traffic counts to calculate percent of all vehicles by time-period and direction. AADT counts are traffic counts or count estimates from FDOT without any raw time of day 15-minute buckets associated. A 50/50 percent directional split is assumed for all two-way AADT counts for reporting while one-way counts remain 100% for the direction. **Table 5** below shows the number of count locations by County by AADT, by TOD, and by Classification designation for the traffic counts collected for the TBRPM v9.0.

Table 5: 2015 Traffic Count Locations by Type by County

Count Type	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Grand Total
AADT	480	295	144	154	66	54	1,193
CLASS	418	324	94	43	28		907
TOD	609	56	24	19	9		717
Grand Total	1,507	675	262	216	103	54	2,817

CHAPTER 2 – REGIONAL TRAVEL CHARACTERISTICS

2.5 HOUSEHOLDS TRAVEL CHARACTERISTICS SURVEY DATA

The National Household Travel Survey (NHTS) is a nationwide data collection effort conducted by the Federal Highway Administration (FHWA). In 2009, a national sample was collected and both state and regional planning agencies were given the opportunity to pay for an additional add-on for their respective area. **Table 6** provides a summary of the time-of-day (TOD) travel factors by purpose and county based on the 2009 Florida add-on compared to the current time-of-day factors implemented in TBRPM v9.0.

A 2019 Household Travel Survey was recently conducted in FDOT, District 7 to provide new localized data to support the District7 transportation analysis. This Household Travel Survey is under analysis and will be used for the calibration/validation of the next generation TBRPM v10.x release.

Table 6: Time of Day Factors by 2009 NHTS Data with Florida Add-on

Time Period	TBRPM v9.0	2009 NHTS All Counties	Hillsborough	Pinellas	Pasco	Hernando & Citrus	Pasco, Hernando & Citrus
Home Based Work							
AM	26.69%	31.50%	29.20%	36.00%	31.40%	28.20%	30.30%
PM	29.80%	28.50%	26.00%	29.50%	35.70%	30.80%	33.90%
Peak Total	56.49%	60.00%	55.20%	65.50%	67.10%	59.10%	64.20%
Mid-day	21.63%	23.70%	28.30%	20.00%	14.80%	20.60%	16.90%
Night	21.88%	16.30%	16.50%	14.50%	18.10%	20.30%	18.90%
Off-Peak Total	43.51%	40.00%	44.80%	34.50%	32.90%	40.90%	35.80%
Home Based Shopping							
AM	11.60%	7.10%	6.00%	7.70%	13.50%	3.90%	8.40%
PM	19.14%	25.50%	27.50%	23.90%	27.10%	21.10%	23.90%
Peak Total	30.74%	32.60%	33.50%	31.50%	40.60%	25.00%	32.30%
Mid-day	46.05%	46.20%	40.60%	49.80%	42.80%	61.70%	52.80%
Evening	23.21%	21.20%	25.90%	18.70%	16.60%	13.30%	14.80%
Off-Peak Total	69.26%	67.40%	66.50%	68.50%	59.40%	75.00%	67.70%
Home Based Social Recreation							
AM	12.27%	8.90%	11.10%	7.50%	7.40%	5.60%	6.60%
PM	20.26%	26.20%	26.30%	26.70%	25.90%	24.20%	25.10%
Peak Total	32.53%	35.10%	37.40%	34.10%	33.30%	29.80%	31.70%
Mid-day	44.86%	27.80%	25.30%	29.30%	27.00%	33.70%	30.00%
Night	22.61%	37.20%	37.20%	36.60%	39.70%	36.50%	38.30%
Off-Peak Total	67.47%	64.90%	62.60%	65.90%	66.70%	70.20%	68.30%
Home Based Other							
AM	17.43%	26.70%	27.10%	28.40%	23.80%	19.80%	22.00%
PM	28.76%	23.60%	26.30%	19.50%	27.20%	16.20%	22.40%
Peak Total	46.19%	50.30%	53.40%	47.90%	51.00%	36.00%	44.40%
Mid-day	35.78%	35.10%	31.80%	37.60%	39.60%	43.60%	41.40%
Night	18.03%	14.60%	14.70%	14.50%	9.30%	20.40%	14.20%
Off-Peak Total	53.81%	49.70%	46.60%	52.10%	49.00%	64.00%	55.60%

CHAPTER 2 – REGIONAL TRAVEL CHARACTERISTICS

2.6 EXTERNAL STATION SURVEY DATA

In 2008 a cordon line survey was conducted at 23 locations along the border of the TBRPM study area. The survey involved taking pictures of license plates of vehicles traveling in and out of the TBRPM area, determining the vehicles that were from the State of Florida versus out-of-state and mailing out surveys to a sample of the vehicle owners determined to be in-state. A summary of this survey is provided in **Table 7**.

Table 7: Expanded Survey Split and Frequency of In-State Vehicles by External-External (E-E), External-Internal (E-I) Occasional, and External-Internal (E-I) Routine Travel

Site Description	Frequency				% of Total			
	E-E	E-I Occasional	E-I Routine	Total	E-E	E-I Occasional	E-I Routine	Total
Citrus < 15K	1,153	10,504	10,621	22,278	5%	47%	48%	100%
Citrus > 15K	898	6,879	14,279	22,056	4%	31%	65%	100%
Hernando / Pasco Interstate	4,398	8,802	2,971	16,171	27%	54%	18%	100%
Hernando / Pasco < 15K	806	4,243	3,398	8,447	10%	50%	40%	100%
Hillsborough / Polk I-4	15,252	36,331	29,206	80,789	19%	45%	36%	100%
Hillsborough / Manatee I-75	9,795	25,402	15,616	50,813	19%	50%	31%	100%
Hillsborough / Manatee < 15K	1,488	7,518	13,321	22,327	7%	34%	60%	100%
Hillsborough / Manatee > 15K	3,928	16,850	21,898	42,676	9%	39%	51%	100%

The split results from this survey are the basis for percentage splits for all 33 external stations used for the TBRPM v9.0. EE trip percentages are stored in ZDATA4 along with the count/forecast volume of the external stations. An EE Trip table was formulated to show the interactions of the EE trips amongst the external stations based on travel flows presented in the Externals Survey. Percentages for EI Occasional and EI Routine trip travel are stored in ZDATA5, where EI Routine trips are further refined to percentages of trips for use in the Trip Generation model using the standard trip purposes. These refined percentages were also formed from the survey results. These inputs are further explained in the Trip Generation section.

2.7 TRIP ATTRACTION SURVEY DATA

During 2013, a telephone-based attraction survey was conducted of employers in the TBRPM study area to verify how accurate attraction rates currently used in the TBRPM model were, which allowed for modifications/refinements to these rates as necessary. **Table 8** below provides the surveyed rates from the 2013 Attraction Survey as a comparison to the attraction rates previously used in the TBRPM, as developed from the previous attraction surveys. A total of 190 surveys were collected across the three major employment categories used by the model.

Table 8: 2013 Attraction Survey Attraction Rate Comparison by TBRPM Employment Categories

TBRPM Employment Category	2013 Attraction Survey Number of Observations	Home Based & Non-Home Based		Medium Truck		Heavy Truck	
		TBRPM	2013 Survey	TBRPM	2013 Survey	TBRPM	2013 Survey
Industrial	63	1.691	1.192	0.110	0.05	0.061	0.011
Commercial	63	20.073	17.610	0.107	0.09	0.025	0.038
Service	64	4.002	6.582	0.046	0.14	0.003	0.002

Notes:

- 1) Home Based attraction rates do not include school trip attractions
- 2) Commercial attraction rates are weighted based on employment within Comparative Retail, Convenience Retail, and Food Service categories.
- 3) Service attraction rates are weighted based on employment within Health Services, Information, Other, Postal Service, and Public Administration categories.

CHAPTER 2 – REGIONAL TRAVEL CHARACTERISTICS

- 4) The model attraction rates shown above are for the Urban/Suburban area type number 2

Table 9 provides further analysis of the attraction rates by providing the number of trips generated by purpose using both the existing TBRPM and 2013 Attraction Survey rates. Based on the scope of the survey, the surveyed attraction rates were consistent with the TBRPM attraction rates and therefore no changes were made to the model.

Table 9: Aggregate Trip Purpose Attractions – TBRPM Vs. 2013 Survey Analysis

Trip Purpose	Attraction		
	TBRPM (Year 2015)	2013 Survey	Ratio
Home Based & Non-Home Based	10,444,600	11,854,800	1.14
Medium Truck	174,900	172,100	0.98
Heavy Truck	60,300	17,400	0.29
Subtotal Truck Trips	235,200	189,500	0.81

Notes:

- 1) Home Based attraction rates do not include school trip attractions

Chapter 3 - EXTERNAL TRIPS

External trips are vehicle trips having at least one trip end (origin or destination) outside of the study area boundary. Trips with both ends outside of the study area are called **External-to-External (EE)** or “through” trips. Trips with one end outside of the study area boundary are referred to as External-to-Internal (EI) trips or Internal-to-External (IE) trips, depending on which trip end is the production. For Home-Based trips the production trip end is where the traveler’s home is, either inside the study area, an IE trip, or outside, an EI trip.

Modeling EE trips is the first step in the Florida Standard Urban Transportation Model Structure (FSUTMS). The external trip module requires an EE trip table that contains EE vehicle trips between external stations. These trips are already balanced, i.e. trips between individual Origin and Destination external zone pairs are equal and are reported in the EE trip table by these pairs. The remaining EI or IE trip volumes are handled in the Trip Generation module as discussed in the next chapter. **Figure 4** below shows the general breakdown of the External Traffic Counts into the component trips that are processed in the model. The rest of this chapter describes the development of an EE trip table for the External Trip module.

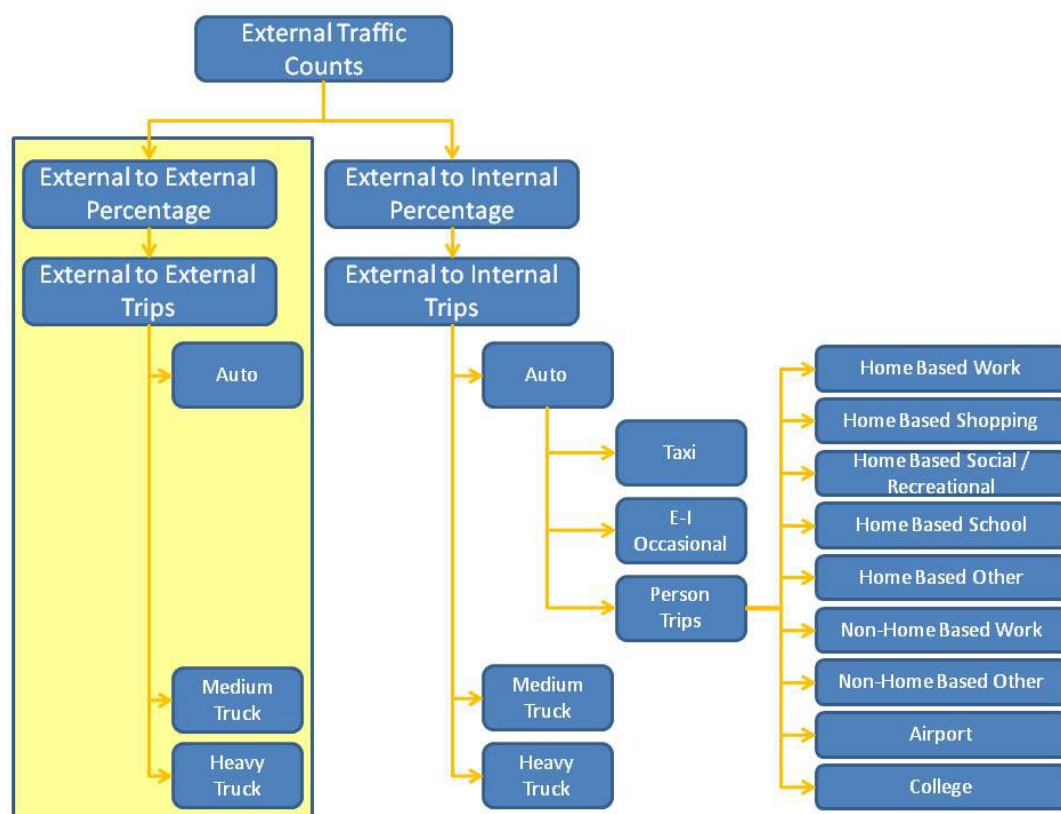


Figure 3: Breakdown of External Trip Ends into Model Trip Purposes

3.1 MODEL ENHANCEMENTS

Many of the previous enhancements made to the External Trips model focused on the EI and IE trips. These and other enhancements will be discussed in detail in *Chapter 4 - Trip Generation*. Several enhancements were also made to the EE process in previous RTA phases. These EE processes are still being used in this current model validation. All enhancements were intended to improve model performance and provide the ability to better analyze specific trip markets.

Previous enhancements made to the EE trip process include the simplification of the EE input file format and the introduction of three distinct EE trip types which are listed as follows:

- Passenger Vehicles
- Medium Trucks
- Heavy Trucks

This allows the user to input these three types of vehicle trips separately, enabling further analysis of EE trips in subsequent model steps. Another enhancement to the EE trip process is the expansion of data used to estimate the EE trips. For passenger cars, total EE trips were obtained by applying cordon line survey results to determine EE trip percentages at each external station. Total EE trips for both medium and heavy trucks were estimated from data collected by the Tampa Bay Regional Goods Movement Study, data supplied by Reebie and Associates, and by estimated truck percentage splits from raw traffic count observations.

As stated previously, the study area of the TBRPM v9.0 consists of Hillsborough, Pinellas, Pasco, Hernando, and Citrus counties, along with a representative portion of northwest Manatee County to accommodate the I-275 / I-75 southern freeway interchange. External stations are the intersections between the cordon line and the highway network of the study area. These stations serve as points of entry or exit, to or from the study area. The model area has been expanded to a total of thirty-two (32) external stations. Each station was coded with a traffic analysis zone (TAZ) number between 3001 and 3032, as depicted in **Figure 5**.

The last Cordon Line Survey was conducted in 2008 to record the travel characteristics of motorists entering or leaving the study area. The data collected through this survey effort was used to provide a better understanding of both EE trips (ZDATA 4) and EI trips (ZDATA 5) for travel corridors coming into and going out of FDOT, District 7. Peak Season Weekday Average Daily Traffic (PSWADT) counts for 2015 were used in conjunction with the 2008 survey results to develop the ZDATA4.DBF file, shown in **Table 10**, to better distribute the EE, “through” trips, across the network. The EETRIPS table provided in **Table 10** shows the EE percentage of trips at those stations by trip type. The calculation of EE trips at each External Station is also presented in this table for reference to the number of trips being generated.

The EETRIPS table provided in **Table 11** shows the EE percentage of trips at those stations by trip type. A gravity model was used to distribute the EE trips of each External Station into trip interchanges among all other External Stations. Restrictions were placed on the movements between select pairs of external sites that are next to each other and those trip interchanges that have a trip length of less than 15 minutes.

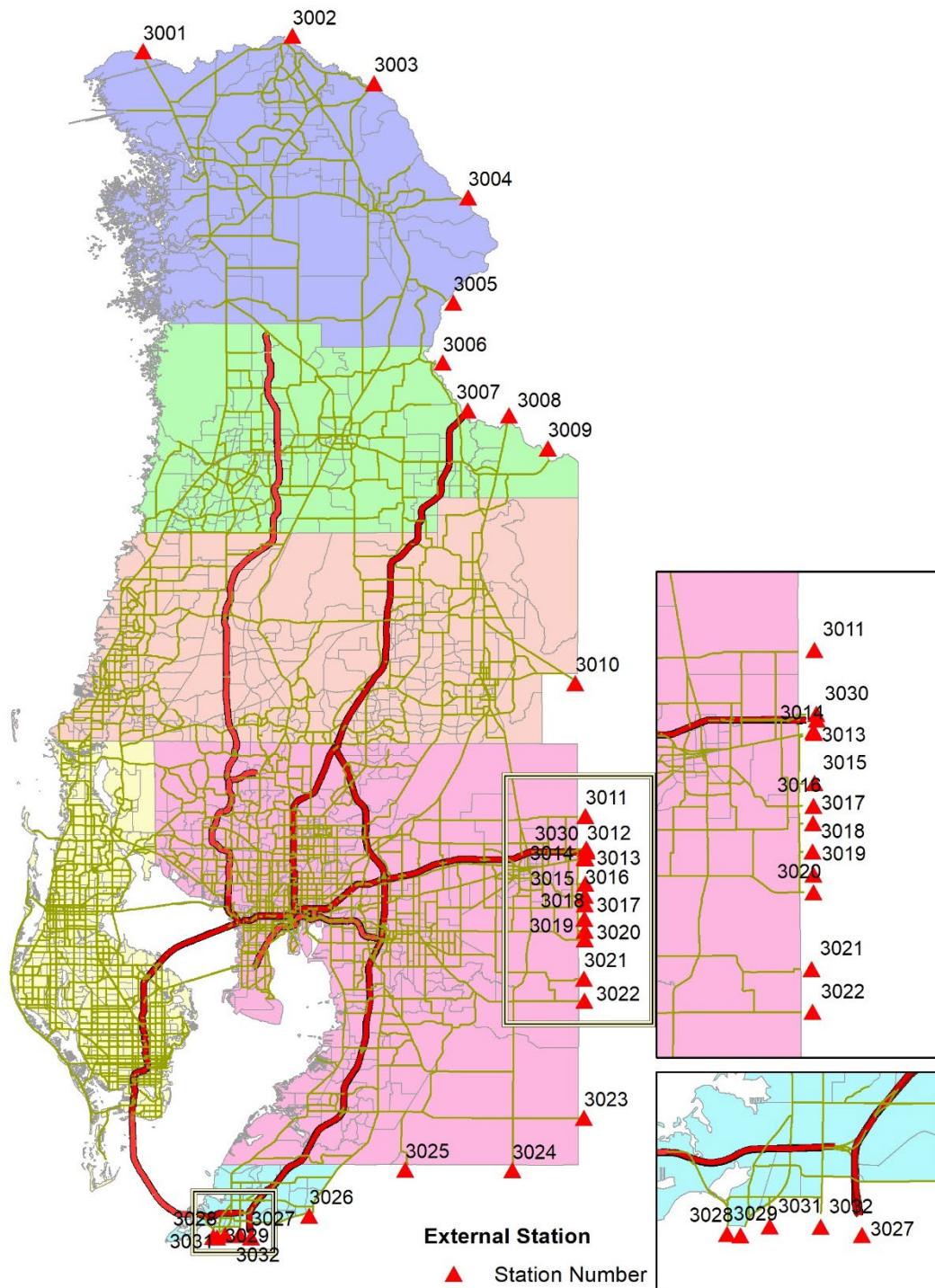


Figure 4: 2015 Base Year External Station Location Map

CHAPTER 3 – EXTERNAL TRIPS

Table 10: 2015 Base Year External Trip Ends Input File (ZDATA4_15A.DBF)

External to External (EE)				
Zone	Description	Trip End Totals	Percent EE	EE Trip Ends
3001	US 19 @ Citrus / Levy County Line	7,500	6%	450
3002	US 41 @ Citrus / Marion County Line	19,600	5%	980
3003	SR 200 @ Citrus / Marion County Line	14,200	6%	852
3004	SR 44 @ Citrus / Sumter County Line	10,200	6%	612
3005	CR 48 @ Citrus / Sumter County Line	4,100	6%	246
3006	CR 476 @ Hernando / Sumter County Line	2,300	10%	230
3007	I-75 @ Hernando / Sumter County Line	37,500	28%	10,500
3008	US 301 @ Hernando / Sumter County Line	3,900	10%	390
3009	SR 50 @ Hernando / Sumter County Line	5,800	10%	580
3010	US 98 @ Pasco / Polk County Line (S of CR 54)	7,900	10%	790
3011	CR 582 / Knights-Griffin Rd @ Hillsborough / Polk	8,200	7%	574
3012	I-4 @ Hillsborough / Polk CL (W of CR 570 Polk Pk)	125,500	19%	23,845
3013	US 92 @ Hillsborough / Polk County Line	10,700	7%	749
3014	CR 542 / Allen K Breed Hwy @ Hillsborough / Polk	2,800	7%	196
3015	Rice Rd / Drane Field Rd @ Hillsborough / Polk	7,500	7%	525
3016	Medulla Rd @ Hillsborough / Polk County Line	1,450	7%	102
3017	W Pipkin Rd @ Hillsborough / Polk County Line	4,800	7%	336
3018	Ewell Rd / Coronet Rd @ Hillsborough / Polk County	9,700	7%	679
3019	Shepherd Rd @ Hillsborough / Polk County Line	15,400	7%	1,078
3020	SR 60 E of County Line Rd @ Hillsborough / Polk	18,200	10%	1,820
3021	CR 676 / Nichols Rd @ Hillsborough / Polk County	2,200	7%	154
3022	CR 640 / Lithia Pinecrest Rd @ Hillsborough / Polk	6,200	7%	434
3023	SR 674 @ Hillsborough / Polk County Line	1,950	7%	137
3024	CR 39 / Kickliter Rd @ Hillsborough / Manatee	2,300	7%	161
3025	CR 579 / Saffold Rd @ Hillsborough / Manatee	550	7%	39
3026	US 301 S of Moccasin Wallow Rd / SR 62 Manatee	8,200	7%	574
3027	I-75 S of I-275 (S of Manatee County Line)	88,500	20%	17,700
3028	US 41 S of I-275 (S of Manatee County Line)	30,000	10%	3,000
3029	US 19 S of I-275 (S of Manatee County Line)	22,500	10%	2,250
3030	Swindell Rd at Hillsborough/Polk Countyline	500	7%	35
3031	16th Ave Manatee	1,050	0%	0
3032	30th Ave Manatee	5,500	0%	0

Table 11: 2015 Base Year External to External Input Trip Table (EETRIPS_15A.DBF)

Origin Station	Destination Station	Trip Mode	TRIPS
3001	3002	1	48
3001	3002	2	3
3001	3002	3	1
3001	3003	1	9
3001	3003	2	1
3001	3004	1	9
3001	3004	2	1
3001	3005	1	4
3001	3006	1	4
3001	3008	1	4
3001	3009	1	9
3001	3009	2	1
3001	3010	1	13
3001	3010	2	1
3001	3012	1	70
...	...	...	...
3029	3001	1	13
3029	3001	2	1
3029	3007	1	122
3029	3007	2	8
3029	3007	3	43
3029	3012	1	911
3029	3012	2	9
3029	3015	1	14
3029	3017	1	12
3029	3024	2	1
3029	3024	3	7
3030	3012	1	20

Note: Only a portion of the input file is displayed. Trip Mode 1=Auto, 2=Medium Truck, 3=Heavy Truck

3.1.1 TIME-OF-DAY EXTERNAL TRIPS

The introduction of time-of-day modeling in the TBRPM v9.0 requires that the EE trips be distributed for both peak and off-peak periods. **Table 12** provides a summary of these EE trips by both periods. Finally, these trips are further split for the final highway assignment to represent the number of EE trips that are performed in each time period. These trips are added to the final vehicle trip table after Mode Choice for the final assignment by TOD period. The Auto EE trips are treated as HOV trips.

Table 12: 2015 Base Year EE Trip Summary by Period

Purpose	Trip-Minutes	Trip-Miles	Total Trips	Average Trip Length (Min)	Average Trip Length (Miles)
Peak Period					
Auto	4,168,760	1,071,482	20,844	200	51.41
Light Truck	180,060	48,957	900	200	54.38
Heavy Truck	449,704	139,674	2,249	200	62.12
Total	4,798,524	1,260,112	23,993	200	52.52
Off-Peak Period					
Auto	4,168,760	1,077,495	20,844	200	51.69
Light Truck	180,060	49,225	900	200	54.68
Heavy Truck	449,704	140,079	2,249	200	62.30
Total	4,798,524	1,266,798	23,993	200	52.80

3.2 MODEL VALIDATION PROCESS

EE vehicle trip volumes in the EE trip table are categorized into three groups by vehicle type: Auto, Light duty trucks, and Heavy duty trucks. Auto, or passenger vehicles, are further divided into two groups by tag registration: in-state and out-of-state. The volumes and characteristics of EE vehicle trips by in-state passenger vehicles and non-passenger vehicle volumes were estimated based upon the cordon line survey.

3.3 RESULTS AND COMPARISONS

Figure 7 shows the EE trip ends at all external stations by EE vehicle type. The three most traveled external stations for EE trips are Station 3007 (I-75 at the Hernando/Sumter County Line), Station 3012 (I-4 at the Hillsborough/Polk County Line), and Station 3027 (I-75 in Manatee County).

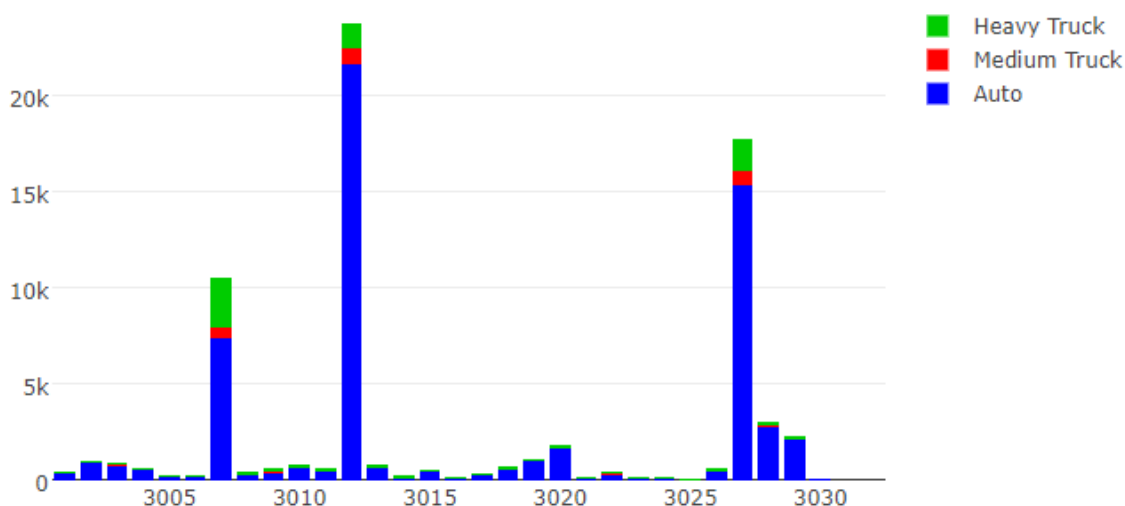


Figure 5: 2015 Base Year Auto External to External (EE) Trip Ends by External Station

3.4 SUMMARY

External-External (EE) trips are vehicle trips having both trip ends outside the study area boundary. Developing an EE trip table is the first step in the FSUTMS model chain. For the validation of the Base Year 2015 network in the TBRPM v9.0, an EE trip table was estimated by applying the EE trip percentages developed from Cordon Line Surveys and vehicle split percentages from traffic counts at the external stations to estimate the number of EE trips by vehicle type at these external stations. These trips were then distributed across the system among the external stations using a restricted gravity model.

Chapter 4- TRIP GENERATION

Trip Generation is the process that determines the number of trip-ends that originate (called productions) and terminate (called attractions) within each Traffic Analysis Zone (TAZ). The TAZ is the smallest geography at which the model estimates traffic. The TAZ can be considered as a cluster of parcels which is treated as homogenous in nature for the estimation and forecasting of traffic. Each TAZ is represented in the model by records in the zonal data (ZDATA) files as described later in this chapter.

Efforts undertaken by FDOT, District 7, as part of the Regional Transportation Analysis (RTA) have reexamined many of the tenets of the Florida Standard Urban Transportation Model Structure (FSUTMS) approach to trip generation. Data collected during earlier RTA Phases suggested that revisions to the Trip Generation model might improve the overall performance of the TBRPM. Travel characteristic data were collected to support the review of almost every aspect of the Trip Generation module. These data were based on several different surveys, which have been documented in separate reports. These surveys include but are not limited to the following:

- Trip Attraction Surveys (1997, 2000, and 2013)
- Employer Survey (2000 and 2013)
- Truck Attraction Survey (1991 and 2013)
- Household Surveys (1991, 1996, 2000, 2007/2008, and 2019(pending))
- Seasonal Resident Surveys (1996, 2000, and 2007/2008)
- Cordon Line Surveys (1991, 1996, 2003, and 2008)
- Rest Area Survey (1996)
- Truck Trip Survey (2003)
- Taxi Survey (1991)
- Hotel / Motel Surveys (1991, 2000, and 2007/2008)
- Employee Survey (2000)

As a result of these surveys, changes were made to the calculations that serve as the foundation for the Trip Generation module. For the two largest categories of trips considered in the TBRPM, Internal-to-Internal (II) trips and External-to-Internal (EI) trips, trip generation methodologies were changed to reflect the characteristics of the Tampa Bay Region.

The RTA process promotes the development of enhancements to the TBRPM from the FSUTMS process. The Trip Generation module improvements implemented so far in the TBRPM fall under several broad classifications as defined by the following sections:

4.1 MODELING PROCESS

The TBRPM v9.0 uses five user-supplied socioeconomic (SE or ZDATA) datasets as inputs into the Lifestyle Trip Generation module. These are the zonal trip production data (ZDATA1), attraction data (ZDATA2), Special Generators (ZDATA3), total external trips (ZDATA4), and External-Internal (EI) and Internal-External (IE) trip percentages by purpose and auto occupancy (ZDATA5). Variables contained in each ZDATA file is listed in **Table 13**. The attribute names and descriptions used in these SE Data files are described in the *User's Procedural Guide*.

The ZDATA files are read into the Lifestyle Trip Generation module FORTRAN executable as ASCII formatted files. These files contain all of the area type variables used in trip generation for the Tampa Bay area. The ZDATA files are in dBase (.DBF) file format to ease user changes to the inputs through the Cube Base environment. These files are accessible through the Cube flow chart interface for easy access and edit. Parameters for the Lifestyle Trip Generation, production cross-classification matrix, as well as the linear trip attraction equations, are input via the GRATES.SYN file which is in ASCII format because of its particular record order and structure.

CHAPTER 4 – TRIP GENERATION

Table 13: Socioeconomic Files Attributes

Socioeconomic File	Attributes
ZDATA1	County, District, TAZ index Dwelling Units, Vacancy and Seasonal Rates, Lifestyle Percentages Permanent Population, Group Quarter Population Hotel Units, Environmental Justice Flag, Urban Area Flag
ZDATA2	County, District, TAZ index Employment for Industrial, Commercial, and Service K-12 School Enrollment, Higher Education Enrollment Parking Costs, Activity Center
ZDATA3	TAZ Index, Special Generator
ZDATA4	TAZ Index, External Station Number and Description External Station Vehicle Trip Ends and EE Trip Percentages
ZDATA5	TAZ Index, External Trip Percentages by Purpose

The local planning departments, in consultation with the MPOs and FDOT, District 7, worked to develop a ZDATA set that contains accurate and thoroughly reviewed data. The work of the MPOs provided not only reliable 2015 data, but also a strong foundation for the development of future year data projections.

Consistent with previous versions of the TBRPM, all occupied dwelling units are classified into four categories based upon lifestyle characteristics of their residents:

- **Retired Households:** Households that include at least one retired household member and no full-time employed household members.
- **Working Households with No Children:** Households, other than retired households, with no household members under the age of 16.
- **Working Households with Children:** Households, other than retired households, with at least one household member under the age of 16.
- **Seasonal Households:** Households whose residents live in the region for more than one month, but less than 6 months per year.

4.1.1 TRIP PURPOSE

The TBRPM includes a refined set of trip purposes from the standard FSUTMS. Trip purposes were reclassified into the following categories:

- Home-Based Work (HBW)
- Home-Based Shopping (HBSH)
- Home-Based Social / Recreation (HBSR)
- Home-Based K-12 School (HBSC)
- Home-Based Other (HBO)
- Non-Home-Based Work (NHBW)
- Non-Home-Based Other (NHBO)
- Light Truck (LTRK)
- Heavy Truck (HTRK)
- Taxi (TAXI)
- External-Internal (EI)
- Airport (AIRP)
- College / University (COL/UNIV)

CHAPTER 4 – TRIP GENERATION

A comparison of TBRPM v9.0 trip purposes with those in the standard FSUTMS trip generation model is presented in **Table 14**. The TBRPM trip generation model has the capacity to produce forecasts for up to a total of twenty user-defined trip purposes simply by inputting the appropriate trip production and attraction rates in the Generation Rates input file, GRATES.SYN, described earlier.

Table 14: TBRPM v9.0 – Selected Trip Purpose Descriptions

Purpose	Abbreviation	Description	Percent of Total Trips Range *
Home Based Work	HBW	Home (P) to work (A)	12 - 24
Home Based Shopping	HBSH	Home (P) to shopping/retail (A)	10 - 20
Home Based Social / Recreational	HBSR	Home (P) to Social/Recreational (A)	9 - 12
Home Based School	HBSC	Home (P) to School (A)	5 - 8
Home Based Other	HBO	Home (P) to Other (A)	14 - 28
Non-Home Based Work	NHBW	Other (P) to Work (A)	45 - 60
Non-Home Based Other	NHBO	Other (P) to Other (A)	20 - 33

**Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee, 2012*

4.1.2 AREA TYPE MODULE

Based on the results of the 2000 trip attraction surveys, it was concluded that area type plays an important role in trip generation. The area type module, as part of previous validation work, was subjected to rigorous statistical tests to measure the “goodness of fit” for various model structures.

To help identify possible area types to use for trip generation purposes, a Discriminant Model was adopted in the context of defining area types. That is, start with an initial area type definition such as CBD, CBD Fringe and Urban, Suburban, Suburban Fringe, and Rural. This was accomplished using a Delphi Technique with various planning professionals familiar with the Tampa Bay Region. The next step was to collect data from establishments in all of these area types and then use the data to help identify homogeneous groups. These homogeneous groups were then used to define the final set of area types.

The Discriminant Model identified a linear combination of quantitative predictor variables that best characterized the differences among known groups. The linear combination of variables (a Discriminant function) is represented by the following Regression equation:

$$D = \alpha + \beta_1 * X_1 + \beta_2 * X_2 + \dots$$

The value D (Discriminant scores) in the above equation will differ by group classification. Classification Function Coefficients, estimated by the model, were used to assign TAZs into groups, in this case Area Types. Each TAZ is predicted as being a member of a group in which the value, or discriminant score, of its classification function is the largest.

Area Type was pre-established for the initial area type definitions, which was then used as the dependent, or grouping, variable in the model. After extensive testing of alternate combinations, the use of three (3) established area types were found to provide the best estimate for trip attraction potential as follows:

- Central Business District (CBD)
- Urban & Suburban
- Suburban Fringe & Rural

The results of the area type analysis are presented in **Figure 7**. The Independent variables used in the model is the average value of the four (4) surrounding TAZs for each TAZ and was applied for each independent variable as follows:

- Land Use Variables: % Residential, % Commercial / Industrial, % Agricultural / Vacant
- Density Variables: Dwelling Unit Density, Employment Density
- Ratio Variable: Ratio of Employment Density to Dwelling Unit Density

CHAPTER 4 – TRIP GENERATION

Together, these variables were found to be able to accurately predict area type. This allows area type to be a variable used with confidence in long range applications. **Table 15** depicts the equations and parameters used in the model for the Attraction Area Types.

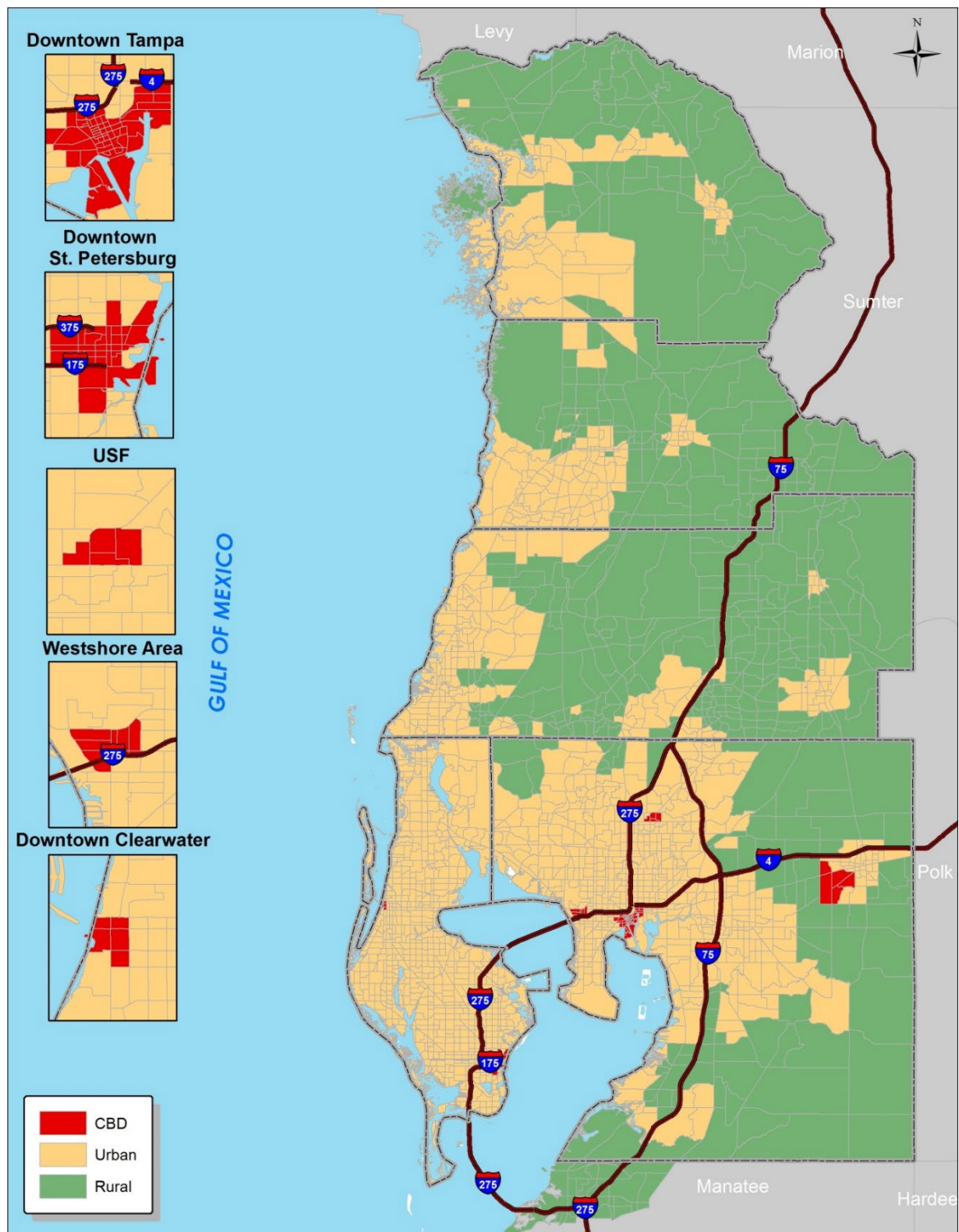


Figure 6: 2015 Base Year Trip Attraction Area Types Map

CHAPTER 4 – TRIP GENERATION

Table 15: Traffic Analysis Zone Attraction Area Type Equations and Variables

Area Type Variable		Rates	Variable Description *
Area Type CBD	=	-27.515000	
	+	1.713000 x	AVERAGE DU DENSITY
	+	0.237000 x	AVERAGE EMP DENSITY
	+	0.373000 x	AVERAGE %RES LU
	+	0.605000 x	AVERAGE %COM/IND LU
	+	0.353000 x	AVERAGE %AGR LU
	+	-0.001473 x	AVERAGE EMP DEN / DU DEN
Area Type Urban & Suburban	=	-23.483000	
	+	0.675000 x	AVERAGE DU DENSITY
	+	-0.001578 x	AVERAGE EMP DENSITY
	+	0.619000 x	AVERAGE %RES LU
	+	0.681000 x	AVERAGE %COM/IND LU
	+	0.427000 x	AVERAGE %AGR LU
	+	0.002462 x	AVERAGE EMP DEN / DU DEN
Area Type Suburban Fringe & Rural	=	-19.178000	
	+	0.121000 x	AVERAGE DU DENSITY
	+	-0.005988 x	AVERAGE EMP DENSITY
	+	0.555000 x	AVERAGE %RES LU
	+	0.577000 x	AVERAGE %COM/IND LU
	+	0.495000 x	AVERAGE %AGR LU
	+	0.001352 x	AVERAGE EMP DEN / DU DEN

* DU = Dwelling Unit

EMP = Employment

%RES LU = Percent of Residential Land Use

%COM/IND LU = Percent of Commercial and/or Industrial Land Use

%AGR LU = Percent of Agricultural Land Use

EMP DEN / DU DEN = Ratio of Employment Density to Dwelling Unit Density

4.1.3 TRIP PRODUCTION RATES

The total number of home-based trips produced for a given zone is determined by applying the appropriate trip production rate to the number of occupied dwelling units in each household classification and then by summing these trips for all classes of dwelling units in the zone. **Table 16** provides the trip production variables currently being used by the TBRPM v9.0 trip generation equations. The complete Trip Production model for TBRPM v9.0 is presented in **Table 83**, available in *Appendix B – Trip Generation*.

Table 16: Independent Production Variables

Variable Name	Variable Description
DUT	TOTAL DWELLING UNITS
PCVT	% VACANT & NON-PERMANENT DU'S
PCV	% VACANT
POPR	TOTAL POPULATION (PERMANENT RES)
PC(1,1)	% 0 AUTOS DU'S - RETIRED
PC(1,2)	% 0 AUTOS DU'S - WORKERS W/O CHILDREN
PC(1,3)	% 0 AUTOS DU'S - WORKERS W/ CHILDREN
PC(2,1)	% 1 AUTO DU'S - RETIRED
PC(2,2)	% 1 AUTO DU'S - WORKERS W/O CHILDREN
PC(2,3)	% 1 AUTO DU'S - WORKERS W/ CHILDREN
PC(3,1)	% 2 AUTOS DU'S - RETIRED
PC(3,2)	% 2 AUTOS DU'S - WORKERS W/O CHILDREN
PC(3,3)	% 2 AUTOS DU'S - WORKERS W/ CHILDREN
PC(4,1)	% 3+ AUTOS DU'S - RETIRED
PC(4,2)	% 3+ AUTOS DU'S - WORKERS W/O CHILDREN
PC(4,3)	% 3+ AUTOS DU'S - WORKERS W/ CHILDREN
HCON	NUMBER OF BUSINESS TYPE HOTEL UNITS
HECO	NUMBER OF ECONOMY TYPE HOTEL UNITS
HRES	NUMBER OF RESORT TYPE HOTEL UNITS
GQPOP	GROUP QUARTER POPULATION
DDUT	NUMBER OF DISADVANTAGED DU'S
OSDUT	SEASONAL HOUSEHOLDS
DUA(1,1)	# 0 AUTO DU'S - RETIRED
DUA(1,2)	# 0 AUTO DU'S - WORKERS W/O CHILDREN
DUA(1,3)	# 0 AUTO DU'S - WORKERS W/ CHILDREN
DUA(2,1)	# 1 AUTO DU'S - RETIRED
DUA(2,2)	# 1 AUTO DU'S - WORKERS W/O CHILDREN
DUA(2,3)	# 1 AUTO DU'S - WORKERS W/ CHILDREN
DUA(3,1)	# 2 AUTO DU'S - RETIRED
DUA(3,2)	# 2 AUTO DU'S - WORKERS W/O CHILDREN
DUA(3,3)	# 2 AUTO DU'S - WORKERS W/ CHILDREN
DUA(4,1)	# 3+ AUTO DU'S - RETIRED
DUA(4,2)	# 3+ AUTO DU'S - WORKERS W/O CHILDREN
DUA(4,3)	# 3+ AUTO DU'S - WORKERS W/ CHILDREN

4.1.4 TRIP ATTRACTION RATES

For the TBRPM v9.0, Employee and Area Type coefficients for all person trip purposes and trip attraction equations were maintained based on the West Central Florida Trip Attraction Survey conducted in 2000 and were verified and adjusted as necessary by the 2013 Trip Attraction Survey. **Table 17** shows the employment categories used in the Trip Attraction model.

CHAPTER 4 – TRIP GENERATION

Table 17: Independent Attraction Variables

Variable Name	Variable Description
INDEMP	TOTAL INDUSTRIAL EMPLOYMENT
COMEMP	TOTAL COMMERCIAL EMPLOYMENT
SEREMP	TOTAL SERVICE EMPLOYMENT
TOTEMP	TOTAL EMPLOYMENT
SCHENRK	K-12 SCHOOL ENROLLMENT
SCHENRH	HIGHER EDUCATION ENROLLMENT
LTR	NUMBER OF LIGHT TRUCKS
HTR	NUMBER OF HEAVY TRUCKS
COMM	COMMERCIAL
SERV	SERVICE

The Trip Attraction model that is used to calculate total trip attraction potential, by trip purpose, for each zone uses the resulting equation as follows:

$$TA = \sum_j \sum_k (b_j \times EMP_j \times c_k \times AT_k)$$

where,

TA = Trip Attractions;

b_j = Coefficients for Employment Type;

EMP_j = Number of Employees by Employment Types ($j = 1, 2, \dots, J$);

c_k = Coefficients for Area Type;

AT_k = Area Types ($k = 1, 2, \dots, K$).

The theory of this model is that employment coefficients (by employment types) as well as area type coefficients (by area types) capture the effect of not only the major industry to which an employee belongs, but also any other characteristics specific to its land use (area type), which would be better at explaining trip making behavior.

The current validation of the TBRPM v9.0, Base Year 2015 network, uses three categories of employment type when determining trip attractions. These employment categories include industrial, commercial and service employment types. **Table 18** shows the definition of these employment types using the North American Industry Classification System (NAICS) codes of 2007. The codes shown are generally high-level groupings within the NAICS. The NAICS code system has up to six-digit codes that define the employment types into as many sub-categories as needed. So only the first few digits, up to four, are needed for the TBRPM employment definitions. As shown in **Table 18**, the employment categories for the TBRPM include any of the NAICS groups that start with these digits.

Table 18: Employment Types by NAICS Code

Employment Category	Description	NAICS Codes Included
Industrial	Agriculture, Mining and Extraction, Construction, Manufacturing, Freight and Warehousing, and Wholesale Trade	11, 21, 22, 23, 31-33, 42, 482-487, 4882-4885, 4889, 492, 493, 562
Commercial	Comparative Retail and Convenience Retail	4411, 4412, 4413, 442-448, 4511, 4512, 4521, 4529, 4531-4533, 4539, 454, 722
Service	Air Transport, Office/Professional, Health, Government, Hotels, Other, Postal, Banking, Personal, Educational, and Private Households	481, 4881, 491, 51, 521, 522, 523, 525, 53-55, 5611, 5612, 5614-5619, 61, 62, 71, 721, 813, 811, 812, 814, 92, 99

The complete Trip Attraction model for TBRPM v9.0 is presented in **Table 84** available in *Appendix B – Trip Generation*. By multiplying the area type coefficients and the employment rate coefficients, the effective trip rate for each combination of employment category and area type can be evaluated.

Several major conclusions for the Trip Attraction model implementation include the following:

- Trip attraction potential can vary significantly by employment category and by area type.
- All Employment Categories produce trips for each purpose. This is realized through mixed uses within each employment category. For example, some industrial sites have retail store fronts associated with them even though the primary NAICS code of the employer would be classified as “industrial.”
- Home-Based Work trip attraction rates vary depending on employment category and area type. This was consistent with expectations that the number of weekday trips made within each employment type would vary, since each employment category has its own mix of full-time and part-time employees, as well as the specific days of the week in which employees work.

The final step of the trip attraction model is to examine the Non-Home Base attractions. As the Home-Based attractions in a market increase or decrease due to overall activity, Non-Home Based trips should increase or decrease as well, respectively. To reflect this in the TBRPM, Non-Home Based attractions, and therefore productions, are increased or decreased for each sub-area based upon the aggregate adjustment applied for all Home-Based trip attractions in the sub-area balancing process.

4.1.5 SPECIAL GENERATORS

To replicate trip generation for zones with unusual trip rates, the TBRPM uses the "Special Generator" concept. Special Generators are activity centers that have a rate of activity significantly different from the standard trip generation rate utilized in the trip generation module. Typically, these activities are concentrated on the attraction side for both Home-Based and Non-Home Based trip purposes. Special Generators are then used to adjust the productions or attractions of a zone by purpose to a desired volume.

To adjust for loss of attractions within a Special Generator zone during the balancing of attractions to productions, or vice versa, the TBRPM Trip Generation module holds Special Generator adjustments constant for TAZs. The benefit of this approach is that the Special Generator adjustments can be applied with a much higher degree of accuracy than under the conventional FSUTMS approach. Most other balancing methods mix Special Generator adjusted attractions, or productions, together with the rest of the unadjusted attractions, or productions, and then balances them all together. This can lose the desired effect of change to that zone's attractions, or productions, because the net effect is spread-out over all zones. In particular, this is more apparent when the total attractions for a trip purpose are greater than the total productions in which the attractions are being balanced to the productions. Even if the Special Generator adjustment needed is particularly large, it may have to be overly exaggerated in order to achieve the full desired effect. This is not the case for the TBRPM balancing method.

Significant additions or deletions of trip attractions for the Special Generators will impact trip attraction rates used in the model for zones without special generators. Caution should always be applied when working with Special Generators, but these adjustments may still be needed to correct any other short comings in the trip production and trip attraction equations for certain zones. The goal of a good working trip generation module is to keep Special Generators to a minimum.

Where the traditional special generator model only accepts absolute numbers of trips as input, the lifestyle model includes two other functions, one to increase and one to decrease the number of productions or attractions of a zone by percentage and purpose. A typical application of this is the ability to reduce the percentage of trips that occur in a CBD to account for pedestrian travel.

A special generators list was obtained from FDOT (as developed by each of the MPOs and FDOT, District 7) which included activities such as airports, theme parks, mines, ports, shopping centers, parks/beaches, and other major attractors. Driveway counts at each special generator were included in this list along with a percent split of entering and exiting traffic. A TAZ association was made for each special generator in order to compare the data with the model productions and attractions.

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The special generator trips were then separated by purpose and aggregated by TAZ. Each purpose was then compared to the model production and attractions by TAZ. This comparison helped in determining which zones were deficient in producing or attracting trips. TAZs that adequately represented special generator activity were dropped, while TAZs deficient in trip-making were retained. This analysis led to a final list of special generators that was input into the model in the ZDATA3 file. For a complete list of special generators used in the TBRPM v9.0, Base Year 2015 network, refer to **Table 19**.

Special Generator adjustments to trip purposes like NHB and Truck trips should apply to both attractions and productions at the same time. This helps with trip end balancing since for any TAZ these purposes have their productions set equal to their attractions. Using this option, a zone can be adjusted to a specific traffic volume, such as for the Light Truck trip purpose. The volume entered in the Special Generator file for the TAZ would be split by the trip generation model as 50 percent productions and 50 percent attractions and would be added to the sum total of productions and attractions for that purpose without needs for further balancing. The flag “T” is therefore used in the P/A column to represent the “Total” volume adjustment for that zone and purpose. See the **User’s Procedural Guide** for further explanation of all of the file options.

Table 19: 2015 Base Year Special Generators by Purpose

ZONE	Description	HBW	HBSH	HBSR	HBSC	HBO	NHBW	NHBO	LTRK	HTRK	TAXI	EI	Airport
140	ANDERSON ROAD CAR YARD									X			
194	BUSCH GARDENS			X									
195	ADVENTURE ISLAND			X									
413	Save A Lot Warehouse								X	X			
421	Gordon Foods Distribution Center								X	X			
426	Winn-Dixie Distribution Center								X	X			
454	TIA								X	X			X
536	Port of Tampa								X	X			
537	Port of Tampa								X	X			
614	Port Ybor								X	X			
633	Port Ybor								X	X			
650	HARBOR ISLAND					X							
651	Hookers Point								X	X			
658	Hard Rock Casino			X									
672	INTERMODAL RAIL YARD									X			
674	Ace Hardware Distribution Center								X	X			
729	East Bay								X	X			
755	Port Sutton								X	X			
821	Big Bend Port Redwing								X	X			
856	Amazon Distribution Center								X	X			
884	Ft Lonesome Mine								X	X			
1370	ST PETE-CLRWTR AIRPORT												X
1533	FT DESOTO PARK			X									
2524	Brocco Quarry								X	X			
2534	Gregg Mine								X	X			
2583	Ridge Manor Quarry									X			
2738	WalMart Distribution Center								X	X			
2801	Crystal River Limestone Quarry								X	X			
2802	Red Level Mine								X	X			
2810	Crystal River Power Plant								X	X			
2894	Crystal River Quarry								X	X			

4.1.6 SUB-AREA BALANCING

After the productions and attractions are calculated for each zone, the total productions and attractions for the entire study area are summed by purpose. Ratios of total productions to total attractions are computed for each trip purpose. These ratios are then used to adjust the sum of either the productions or attractions depending on the purpose.

The Non-Home Based Work (NHBW) / Other (NHBO), Light Truck, Heavy Truck and Taxi trip purposes are all based on trip attraction equations developed from the attraction survey conducted in 2000 and verified by the Attraction Verification Survey in 2013. Productions for TAZs by each of these purposes are set to be equal to their attraction equation calculations. This is because the zonal productions for these trips are assumed to be the same as the zonal attractions calculated by the trip attraction equations, since each trip into each TAZ for these purposes should also produce a trip coming out of each TAZ. No adjustments to these purposes are then required for balancing. Productions and Attractions are balanced uniformly to ensure that the study area total trip productions and trip attractions are equal.

As part of validating the trip generation model, many different markets were examined as candidates for sub-area balancing. Based on local knowledge and observed travel patterns, major markets were identified for each of the five counties in the region: Hillsborough, Pinellas, Pasco, Hernando and Citrus. Variations ranging from established markets to newly developing markets were also identified. The contrast of the established, developed areas with a higher proportion of employment oriented to “office work,” to the newer, developing areas that are dominated by “customer service” employment was evident in these pairings.

The result of the generation process is an estimate of trip attraction potential for each zone in the network based upon regional production and attraction rates that is sensitive to the phenomena of local markets and types of services provided. This data is the foundation of the travel demand model and plays an important role in the later steps of the modeling process.

One of the major innovations of the TBRPM is the sub-area balancing of productions and attractions. Founded on the concept of local markets and regional variations, sub-area balancing allows attractions to be balanced to productions in smaller and more logical sub-areas rather than on just a region wide basis. These sub-areas are based upon the geographic areas and travel distances within which most trip makers are willing to travel for various trip purposes. Sub-areas may vary depending upon the trip purpose. Currently for the TBRPM, productions and attractions are balanced through the use of three different sub-area classifications for Home-Based trips. The BALZ.SYN file lists the TAZs with their corresponding balancing group by purpose.

Figure 8 shows the sub-areas for Home-based Work (HBW) trips and are listed as follows:

- Area 1 – East Pinellas, Hillsborough, and south and southeast Pasco
- Area 2 – West Pinellas and southwest Pasco
- Area 3 – North Pasco and Hernando
- Area 4 – Citrus

Figure 9 shows the sub-areas for Home-Based Shopping (HBSH) trips and are listed as follows:

- Area 1 – Hillsborough and south Pasco
- Area 2 – Pinellas and southwest Pasco
- Area 3 – Rest of Pasco, Hernando, and Citrus

Figure 10 shows the sub-areas for Home-Based Social / Recreational (HBSR) trips and are listed as follows:

- Area 1 – Hillsborough
- Area 2 – Pinellas and southwest Pasco
- Area 3 – South and southeast Pasco
- Area 4 – North Pasco, Hernando, and Citrus

Figure 11 shows the sub-areas for Home-Based School (HBSC) trips and are listed as follows:

- Area 1 – Hillsborough

- Area 2 – Pinellas
- Area 3 – Pasco
- Area 4 – Hernando
- Area 5 – Citrus

Figure 12 shows the sub-areas for Home-Based Other (HBO) trips and are listed as follows:

- Area 1 – Hillsborough
- Area 2 – Pinellas and southwest Pasco
- Area 3 – South and southeast Pasco
- Area 4 – North Pasco and Hernando
- Area 5 – Citrus

Trip attractions for the other purposes such as Airport and College / University trips are regional in nature and are balanced regionally without any application of sub-area balancing, so all TAZs are listed in Area 1.

One impact of sub-area balancing is that the model is somewhat insulated against variations in employment forecasts that result from different methodologies being used throughout the region to estimate future year employment. This is an important aspect of the sub-area balancing feature for the TBRPM in that it prevents one county's employment forecasts from impacting its neighbors too strongly.

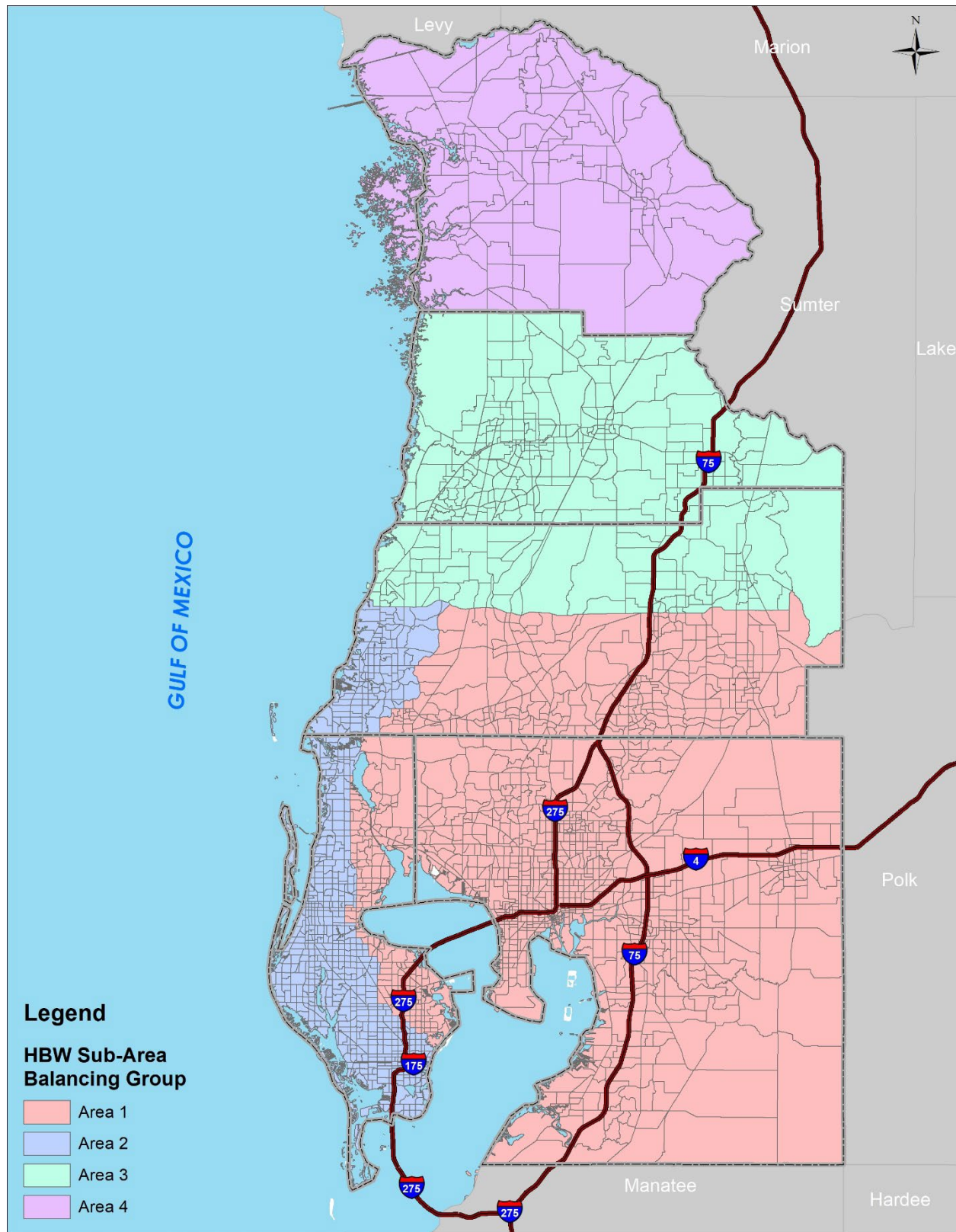


Figure 7: 2015 Base Year Home-Based Work (HBW) Trip Attraction Sub-Area Balancing Map

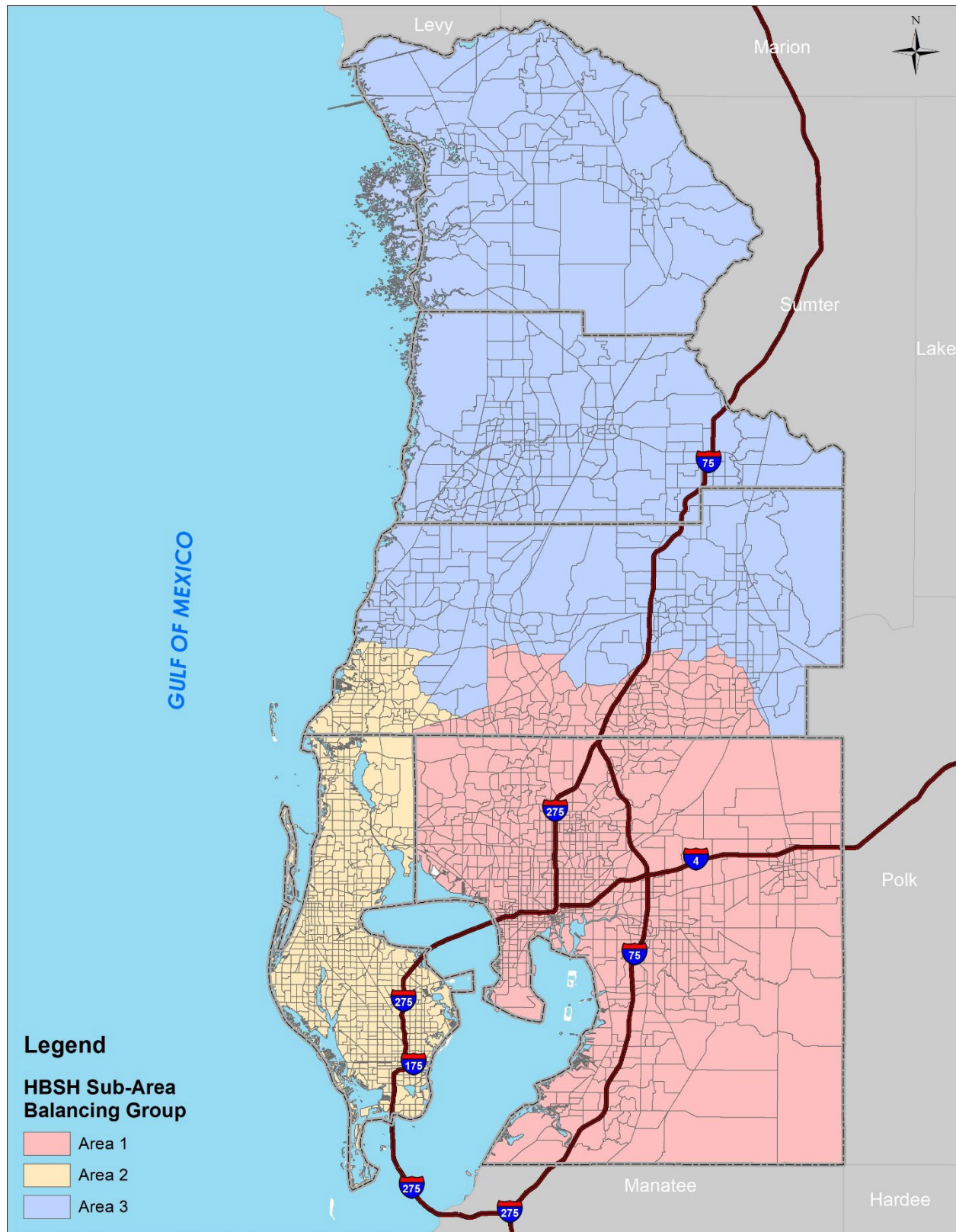


Figure 8: 2015 Base Year Home-Based Shopping (HBSH) Trip Attraction Sub-Area Balancing Map

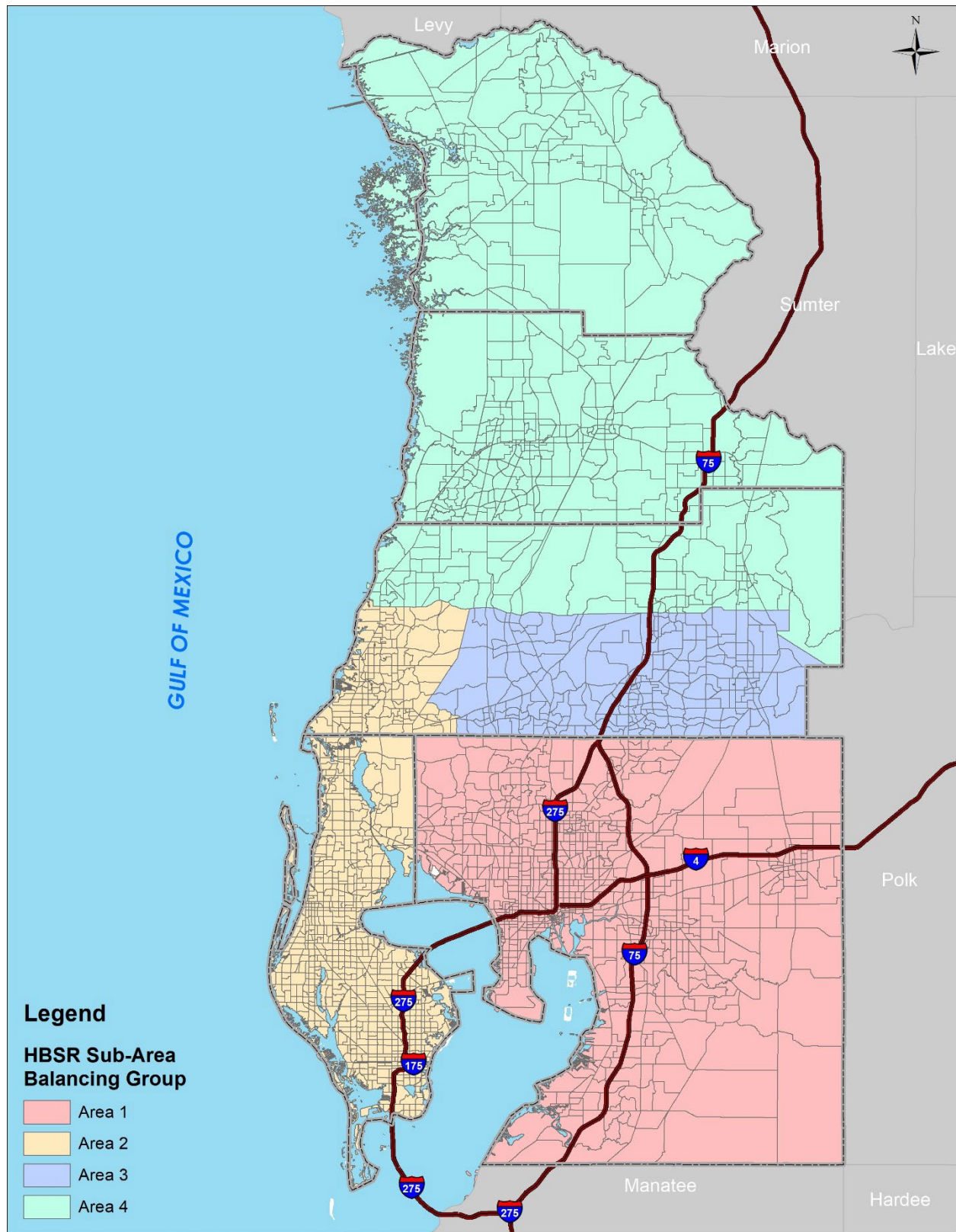


Figure 9: 2015 Base Year Home-Based Social/Recreational (HBSR) Trip Attraction Sub-Area Balancing Map

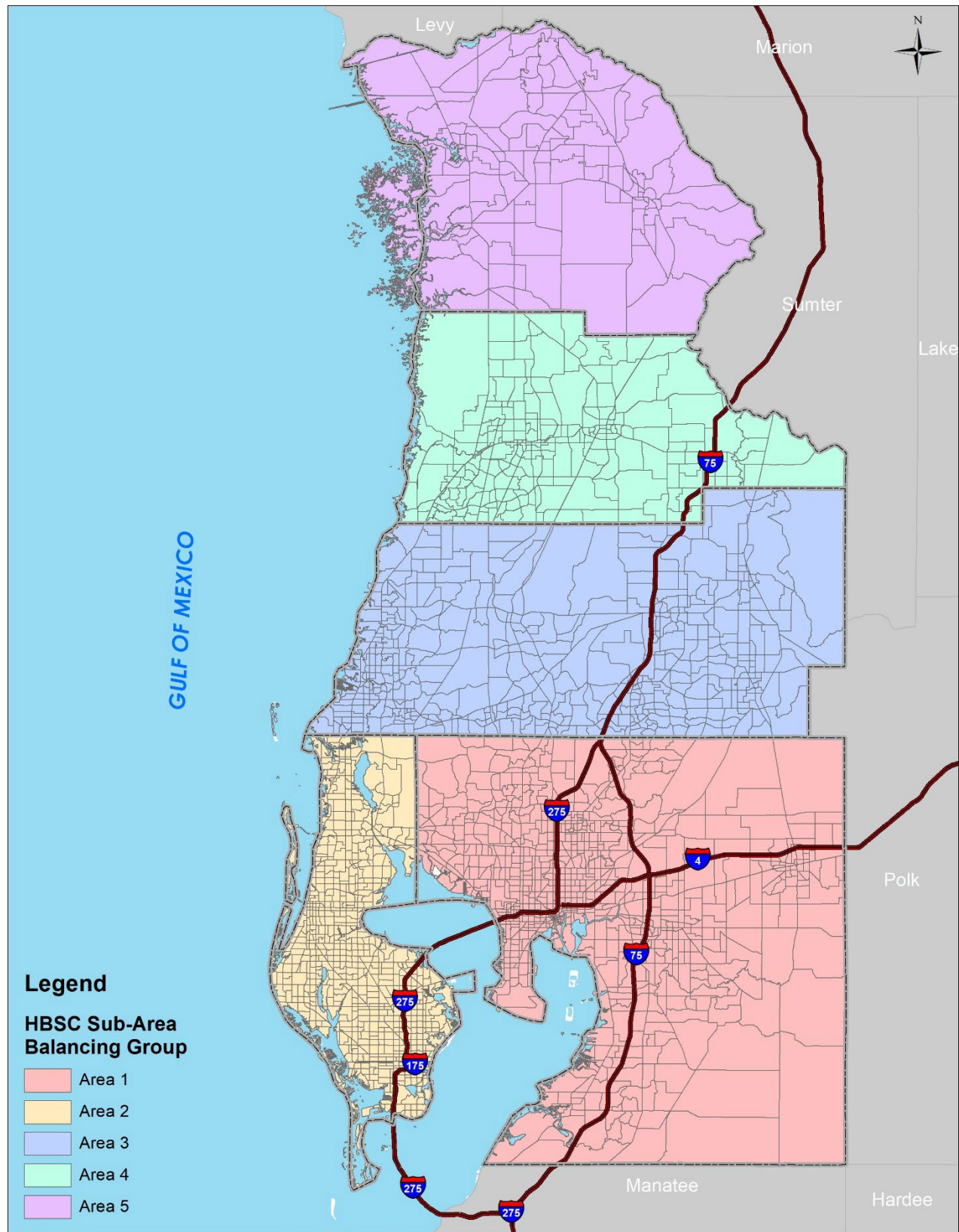


Figure 10: 2015 Base Year Home-Based School (HBSC) Trip Attraction Sub-Area Balancing Map

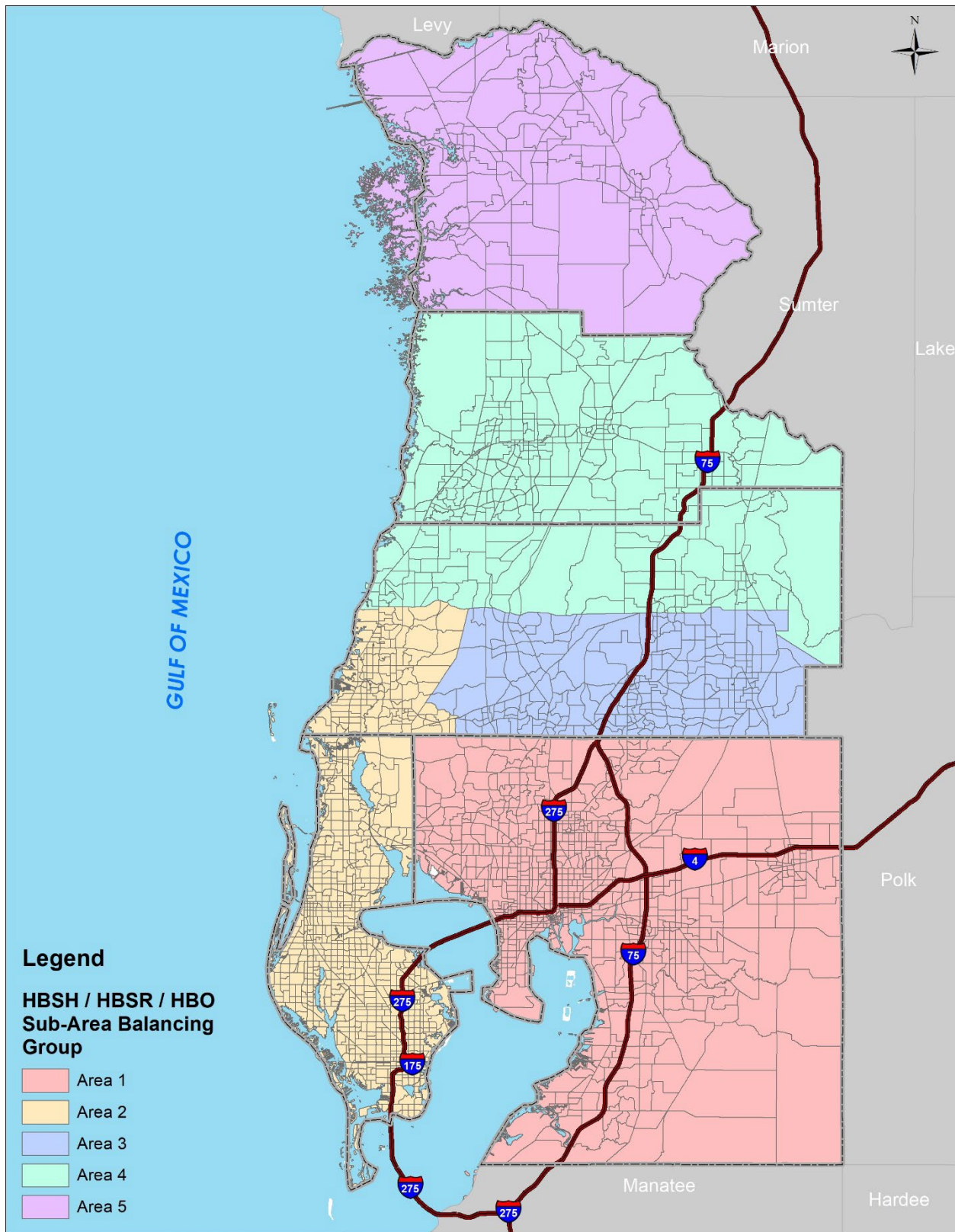


Figure 11: 2015 Base Year Home-Based Other (HBO) Trip Attraction Sub-Area Balancing Map

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Table 20 shows the Sub-Area Balancing Results for the 2015 Base Year Validation Network by purpose and balancing area with summaries for the purposes with more than one balancing area. The table reflects the adjustment factors used in balancing the Productions and Attractions for the final person and vehicle trips before use in Distribution.

Table 20: 2015 Base Year Validation Sub-Area Balancing Results

Purpose	Sub-Area Group	Productions	Attractions	Ratio of Attraction to Productions	Balance Factors
HBW	1	1,321,877	1,652,149	125%	0.796
	2	649,825	639,132	98%	1.017
	3	160,061	140,292	88%	1.153
	4	76,643	71,440	93%	1.073
HBSH	1	434,902	593,011	136%	0.731
	2	442,148	419,109	95%	1.055
	3	180,689	143,117	79%	1.271
HBSR	1	1,083,748	1,748,016	161%	0.608
	2	1,265,661	1,341,455	106%	0.943
	3	175,022	184,457	105%	0.949
	4	383,744	369,302	96%	1.039
HBSC	1	582,790	510,793	88%	1.142
	2	351,548	262,970	75%	1.337
	3	182,614	165,006	90%	1.107
	4	62,484	52,409	84%	1.193
	5	38,169	36,544	96%	1.045
HBO	1	807,236	1,012,637	125%	0.791
	2	828,453	735,149	89%	1.127
	3	125,639	74,603	59%	1.690
	4	169,760	104,497	62%	1.634
	5	94,563	60,165	64%	1.638
NHBW	1	4,858	593,412	12,215%	1.000
NHBO	1	18,184	1,800,916	9,904%	1.000
MTRK	1	10,242	185,147	1,808%	1.000
HTRK	1	22,256	82,547	371%	1.000
TAXI	1	0	54,610	N/A	1.000
EI	1	162,245	90,738	56%	1.788
AIRP	1	20,969	63,650	304%	3.035
COL/UNIV	1	279,030	266,428	95%	1.047

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4.1.7 TIME-OF-DAY SPLIT FACTORS

The Time-of-Day (TOD) factors provided in **Table 21** are used to split the number of daily trip-ends generated into Peak and Off-Peak periods by purpose before going into Trip Distribution. Also, shown in the smaller tables, are the factors used to further split the trips by period and by direction as either Production-to-Attraction or Attraction-to-Production after Mode Choice for highway assignment trip tables. Transit trip tables would remain in Production-to-Attraction format by period, Peak or Off-Peak, after Mode Choice for transit assignment.

Table 21: TBRPM v9.0 - Time of Day Splitting Factors

Purpose	TOD Factors
HBW-PK	0.5344
HBSH-PK	0.2818
HBSR-PK	0.2989
HBSC-PK	0.6061
HBO-PK	0.4314
NHBW-PK	0.3640
NHBO-PK	0.3065
LTRK-PK	0.3904
HTRK-PK	0.3154
TAXI-PK	0.4197
EI-PK	0.2840
AIRP-PK	0.3014
COL-PK	0.4875

Purpose	Factors
AMPKSF-HBW	0.4530
AMPKSF-HBNW	0.3671
AMPKSF-NHB	0.3197
AMPKSF-LTRK	0.5343
AMPKSF-HTRK	0.5667
AMPKSF-TAXI	0.4755
AMPKSF-EI	0.4100

Purpose	Factors
MDOPSF-HBW	0.6376
MDOPSF-HBNW	0.6325
MDOPSF-NHB	0.5305
MDOPSF-LTRK	0.7024
MDOPSF-HTRK	0.5906
MDOPSF-TAXI	0.4755
MDOPSF-EI	0.6200

Purpose	PK P-A Factors
AM HBW P-A	0.9890
AM HBNW P-A	0.8977
PM HBW P-A	0.0675
PM HBNW P-A	0.4564

Purpose	OP P-A Factors
MD HBW P-A	0.5165
MD HBNW P-A	0.5077
EV HBW P-A	0.5189
EV HBNW P-A	0.2838

4.1.8 TRIP GENERATION BY ZERO-CAR HOUSEHOLDS AND ONE+ CAR HOUSEHOLDS

The TOD structure of the TBRPM v9.0 has already been used in a previous version of the TBRPM. This structure was being vetted for the Federal Transit Administration (FTA) for the express nature of giving more detailed forecast ridership by market. One of these markets is known as Zero-Car households, or households that do not own or have access to an auto for daily use. Zero-Car households, typically, make up the largest percentage of transit riders and may have differences in their typical travel patterns from households that own at least one car. The TBRPM has been made to separate trips being made by Zero-Car households from trips being made by One+ Car households starting at Trip Generation module. Zero-Car household trips are now distributed, independently of One+ Car households, in the beginning stages of the Mode Choice module, whereas One+ Car household trips are distributed in a manner described in the Trip Distribution module. These trips are mixed in the Mode Choice module and are processed by auto ownership during the mode choice processing.

4.1.9 TRUCK TRIP GENERATION / ATTRACTION MODEL

The Truck Trip Attraction model developed for the TBRPM consists of two equations: one for medium trucks (less than 28,000 lb. gross weight, single unit) and one for heavy trucks (more than 28,000 lb. gross weight, combination unit). Medium trucks primarily serve local service and delivery needs, with only limited line-haul uses. While heavy trucks primarily serve longer distance line-haul trips, with only limited local service and delivery functions. However, both types of trucks may serve both purposes. The 2003 Truck Survey data, and the associated TBRPM's truck trip rates, were re-analyzed in early 2010 to assess the reasonableness of the model's inputs. The re-analysis revealed that medium truck trip lengths (in minutes) were more than 7 percent shorter than what the model was using while heavy truck trip lengths were more than 38 percent longer. The trip lengths were adjusted accordingly in the TBRPM v7.0. A Truck Rate Verification Survey was completed in 2013 for 207 businesses. As a result of these surveys, revised attraction rates were implemented into the TBRPM v8.0 for medium and heavy trucks and are now used for TBRPM v9.0.

4.1.10 TAXI TRIPS

Taxi trips were identified as a unique trip purpose for the TBRPM. While taxi trips make up a small proportion of total trip making, these trips were separated from truck trips because they serve a different set of destinations than truck trips and have different distribution patterns.

4.1.11 EXTERNAL-INTERNAL AND INTERNAL-EXTERNAL TRIPS

The **External-Internal (EI)** trip model has been completely revised through a series of updates to the TBRPM. **Figure 13** shows the external process for TBRPM v9.0. The TBRPM begins with the total volume of vehicle trips at each external station. Based on the 2008 Cordon Line Survey results, the input data for each external station in the ZDATA4 file is used to stratify the traffic volumes into several categories as described throughout the following paragraphs.

First, the volume of the **External-External (EE)** or "Through" Trips is identified and removed from the totals. These trips are treated separately in the External step of the model as discussed in *Chapter 3 – External Trips*. The percentage of EE trips at each external station is recorded in ZDATA4 but is represented as the number of trip interchanges in the EETRIPS.YYA input file. However, the percentages of EE trips are discounted from each external station volume first. All the remaining external station trips are either External-Internal (EI) or Internal-External (IE) trips.

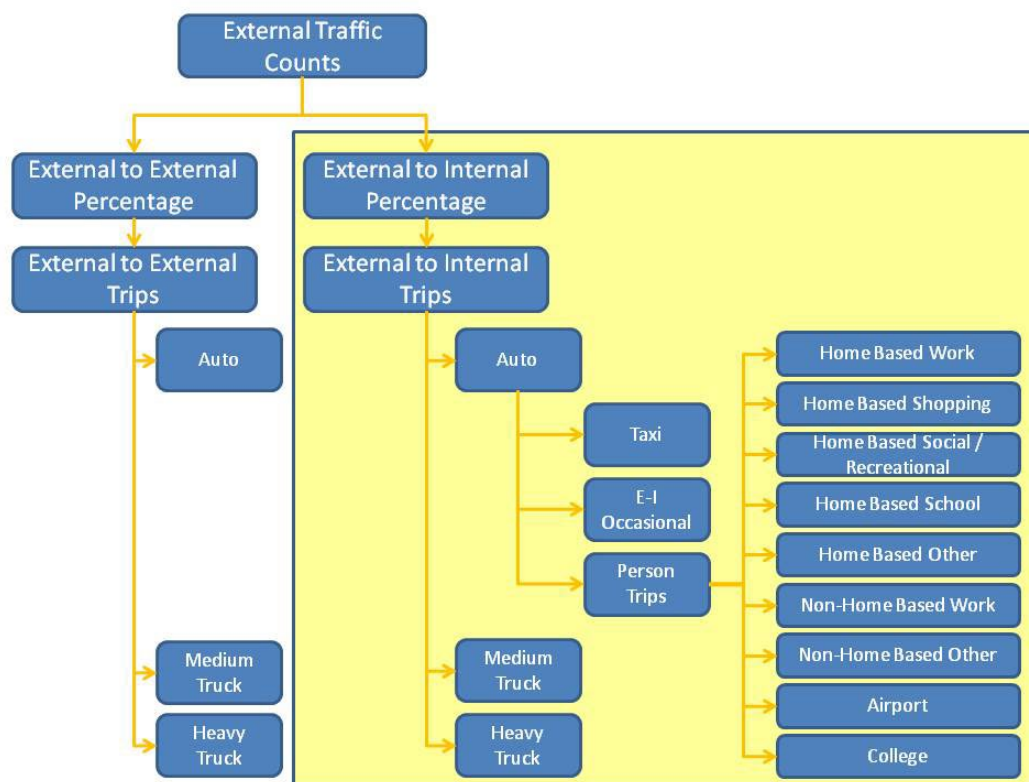


Figure 12: Model Process for External-Internal Trip Ends (in Yellow Background)

Next, the automobile trips are stratified into two basic types: **Occasional EI Trips** and **Routine EI Trips**. Most system planning models, including the traditional FSUTMS, treat all EI and IE trips as **Occasional EI Trips**. These trips are usually longer distance and infrequent, such as vacation trips, business trips or trips from surrounding small cities and rural areas for specialized services. The nature of the trips and limited knowledge of the area restrict the trip maker in responding to congestion or new opportunities by choosing alternate destinations, taking alternate routes, or taking advantage of alternative modes.

The occasional EI trip makers are not competing directly with local internal trip makers for jobs, shopping, recreation or other attractions. Instead, these trips serve as an overlay on top of the internal trips already taking place in the region. As with traditional FSUTMS, the external trip ends of all occasional EI trips are treated as productions. Attractions for these trips are distributed throughout the internal TAZs in proportion to all other person trip attractions.

While occasional EI trips still make up a significant portion of the Tampa Bay region's external trips, the results of the Cordon Line Surveys showed that a much larger portion of EI trips are made on a more frequent basis for routine day-to-day trip purposes. In the TBRPM, these trips are called the **Routine External-Internal (EI) Trips**. The routine EI trips are then further classified into the "internal" TBRPM trip purposes for productions and attractions and mixed with the internal trips.

Routine EI Trips are those trips that the trip maker makes at least once a week. They are usually shorter in distance, most often to and from any immediately adjacent urban area or other rural area. They are made for the same routine trip purposes as internal trips - work, shopping, social / recreation and other. As a result, the trip makers are directly competing with internal trip makers for jobs, services and other attractions. The high frequency of trips provides the trip maker with extensive knowledge of the area and the ability to react to congestion, changing conditions and emerging opportunities by choosing alternate destinations, taking alternate routes and taking advantage of alternate modes such as carpools, van pools, and park-n-ride (PNR) for transit. In fact, these trip makers function just like the internal trip makers; the only difference being that one trip end is outside the region.

To more accurately simulate the travel patterns of these trips, the TBRPM treats Routine EI Trips as internal trips. In order to do this, the TBRPM uses the results of the Cordon Line Surveys to modify and stratify these trips by using the following:

- After pulling out the occasional EI trips, stratify the rest of the trips into productions and attractions for the twelve (12) remaining TBRPM “internal” trip purposes
- Split out medium and heavy truck trips by percentage as vehicle trips
- Apply average automobile occupancy factors to convert auto vehicle trips to person trips by trip purpose, while dividing person trips into productions and attractions

The treatment of EI trips is a significant departure from traditional FSUTMS in several ways as described by the following:

- The External Stations serve a dual role. External stations are still treated as traditional external stations for occasional EI and EE trips. Meanwhile, throughout the remainder of the modeling process, external TAZs are treated the same as internal TAZs with a full array of both productions and attractions for all person-trip purposes and for vehicle-trip purposes such as truck and taxi trips.
- In the Distribution step, the routine external trip productions compete directly with internal TAZ productions for work, shopping and all other attractions. Similarly, the routine external trip attractions will be used to satisfy some internal productions. Having attractions as well as productions at the External Stations recognizes that travel across the study area boundary is two-way. For instance, the TBRPM recognizes that in addition to the large number of Lakeland residents who commute to Tampa each day, there are also a large number of eastern Hillsborough County residents who may work and shop in Lakeland.
- The Mode Choice process can now model the ability of these routine external (EI) trips to respond to congestion and new opportunities by carpooling or even driving to PNR lots to use transit. The Mode Choice model can also more accurately simulate ridership on rail systems which extend beyond the region’s boundaries. One caveat, since there is actually very little knowledge about the households that are producing trips from outside the study area, the default assumption for their external routine trip productions are to treat the households as One-Car households in Mode Choice.

4.2 ENHANCEMENTS

Over the RTA processes in the past years, many improvements have been made to the model. The following two sections outline other enhancements.

4.2.1 TRIP PRODUCTION ENHANCEMENTS

Since the beginning of RTA Phase I, several major trip production model enhancements have been considered, with many of them being implemented. These trip production enhancements are discussed in the following.

One of the first enhancements was the expansion of the Trip Purpose categories. In expanding the trip purpose categories, a series of local surveys along with a national literature review was conducted to develop trip generation parameters for each of the expanded trip purposes. For this purpose, Household Surveys for the RTA began in 1991, and as a result the Lifestyle Trip Generation model structure was implemented. The next major household survey was conducted in 1996 and provided the basis for updating trip generation rates in the RTA region. However, because both the 1991 and 1996 surveys were random sample surveys, traditional “low response” cells, i.e. households with low auto ownership as well as other transit trip making households along with seasonal resident households, had a large confidence interval around their mean trip rates. Further enhancements are as follows:

2000 Household Travel Survey

In an effort to ameliorate the effects of “low response” cells, a household travel survey was implemented between February and April 2000 to coincide with both the 2000 Census as well as the Tampa Bay area's peak season. The goal was to create a household survey that specifically included low auto ownership, seasonal residents, and those households that would most likely utilize transit. Prior survey efforts in the Tampa Bay Region confirmed the difficulty in reaching low auto ownership and transit dependent households. The data collected during the 2000 household survey were combined with the 1996 household survey to enrich the data set that could be used to estimate trip rates with a higher degree of confidence for each lifestyle category in the Lifestyle Trip Generation model.

2007/2008 Household & Seasonal Resident Travel Survey

A Household Travel Characteristics Survey (Household Survey) was conducted from October 2007 through early January 2008 to capture the household travel characteristics of seasonal and permanent residents. This survey provided an opportunity to review modal preferences, collect data for low auto ownership households (typical transit dependent households that have been underrepresented in previous survey efforts), and review overall driving patterns of commuters in the region. The data collected from the Household Travel Survey was used to enhance the TBRPM and these enhancements were carried through to the TBRPM v9.0 by updating:

- Trip generation rates by trip purpose for use in the Trip Generation Model;
- Trip lengths by trip purpose for use in the Trip Distribution Model; and
- Auto occupancy rates for use in the Mode Choice Model.

2013 Neighborhood Survey Counts

In 2013, a survey of commercial trucks serving 27 communities in the study area was conducted. These communities were further divided into four categories based on the dominant lifestyle characteristic (retired, working with children, working without children, and mix of all workers).

4.2.2 TRIP ATTRACTION ENHANCEMENTS

Several major trip attraction enhancements have been implemented into the previous versions of the TBRPM and have been retained through the TBRPM v9.0. One of the enhancements was a refinement of the trip attraction rates. It was expected that no single source of data would provide a complete picture of the potential trip attraction for all trip purposes. Therefore, three sets of analyses were undertaken to see how the attraction model could be improved, which included:

- Review of existing household survey data

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- Collection of local employer-based attraction data
- Research of other national trip attraction models

The 2000 West Central Florida Trip Attraction Survey was used to update the trip attraction model. The explanatory variables used in the statistical estimation of the model were:

- Employment Type based on Standard Industrial Classification (SIC) code or business type
- Area Type and other measures of land use density / intensity
- Freestanding versus non-freestanding structure type
- Available mode choices (including pedestrian and bicycle)
- Distance travelers are willing to go to satisfy different types of needs

2013 Attraction Survey

During RTA Phase XIII, an Attraction Survey was conducted to verify the existing trip attraction rates in the TBRPM. This survey focused on the number of employees by time of day, number of visitors, and number of truck trips generated by a given employer by employment type and area type. This survey indicated that the TBRPM was performing well in estimating trip attractions. The Trip Attraction model which was based on the results from the 2000 Trip Attraction Survey and is still used in the TBRPM v9.0 includes three area type categories and three employment type categories.

Area Types:

1. CBD (Central Business District)
2. Urban & Suburban
3. Suburban Fringe & Rural

Employment Types:

1. Industrial: Agriculture, Mining and Extraction, Construction, Manufacturing, Freight and Warehousing, Wholesale Trade
2. Commercial: Comparative Retail and Convenience Retail
3. Service: Air Transport, Office/Professional, Health, Government, Hotels, Others, Postal, Banking, Personal, Educational, Private Households

A comparison of the trip attraction rates found in the 2013 Attraction Survey and the rates used in the TBRPM v8.0 can be found in **Table 22** below. Any adjustments to these rates are used in the TBRPM v9.0.

Table 22: Comparison of Trip Attraction Rates with Survey

TBRPM Employment Type	Surveyed Attraction Rates				TBRPM v8.0 Attraction Rates		
	Observations	HBSH, HBSR, HBO, NHBW, NHBO	Medium Truck	Heavy Truck	HBSH, HBSR, HBO, NHBW, NHBO	Medium Truck	Heavy Truck
Industrial	63	1.192	0.047	0.011	0.735	0.110	0.061
Commercial	83	28.083	0.613	0.184	18.798	0.107	0.025
Service	64	6.582	0.140	0.002	2.339	0.046	0.003

4.3 ZONAL SOCIOECONOMIC DATA

The TBRPM v9.0 socioeconomic data was prepared by the individual Metropolitan Planning Organizations (MPOs) in the model region and reviewed by the Florida Department of Transportation (FDOT) District 7. This data was further reviewed for reasonableness and inconsistencies, converted into database files (.dbf) and subsequently entered the model as input. The following subsections discuss this review and document any changes that were made to the socioeconomic data and subsequently to the trip generation input files.

4.3.1 TRAFFIC ANALYSIS ZONE (TAZ) STRUCTURE

The TBRPM v9.0 consists of 3,000 traffic analysis zones (TAZs), including 451 dummy zones. The TAZs were obtained from the Hillsborough Metropolitan Planning Organization (MPO), Pinellas MPO, Pasco MPO, Hernando and Citrus MPO, and the FDOT, District 1, and then combined to form the TAZ structure of the TBRPM. The TAZ breakdown is shown in **Table 23**.

Table 23: TBRPM V9.0 Traffic Analysis Zones (TAZs) by County

County	TAZs	Internal TAZs	Dummy TAZs
Hillsborough	1 - 1000	1 - 884	885 - 1000
Pinellas	1001 - 2000	1001 - 1779	1780 - 2000
Pasco	2001 - 2500	2001 - 2475	2476 - 2500
Hernando	2501 - 2800	2501 - 2744	2745 - 2800
Citrus	2801 - 2950	2801 - 2922	2923 - 2950
Manatee	2951 - 3000	2951 - 2995	2996 - 3000
Total	3000	2549	451

4.3.2 HOUSEHOLD, POPULATION, AND EMPLOYMENT DATA SUMMARY

Key socioeconomic trip production variables are stored in the ZDATA1 file and consist of the following:

- Population classified by permanent and group quarters population
- Dwelling Units (DU) by lifestyle - classified by household type including retirees, workers with children and workers without children and by auto ownership
- Hotel/Motel units

Population

Population in the TBRPM region, with a total of approximately 3.05 million residents in the year 2015. Population is divided into Permanent and Group Quarters, with the former accounting for 98 percent of the total population. As shown in **Table 24**, Hillsborough County with about 1.29 million total population is the region's most populous county, accounting for nearly 42 percent of the region's population. Citrus County estimates around 141,000 total population, which accounts for only about 5 percent of the region's population.

The TBRPM regional population grew at about 1 percent per year between 2010 and 2015, the same as the State's annual growth of about 1 percent, shown in **Table 25**. Hernando County experienced the highest percent growth while Citrus County experienced the smallest percent growth. The county-developed totals were checked with US Census and the Florida BEBR population estimates. Hillsborough County remains the largest county by population followed by Pinellas, Pasco, Hernando, and Citrus. **Figure 14** shows the population density for each TAZ in the TBRPM study area.

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Table 24: Population Summary for Year 2015

	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
Permanent	1,271,613	922,187	477,662	174,380	139,141	13,366	2,998,349
Group Quarters	23,702	20,591	6,335	2,439	2,360	1,082	56,509
Total Population	1,295,315	942,778	483,997	176,819	141,501	14,448	3,054,858

Table 25: Population Change from 2010 to 2015

		Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
2010	Permanent	1,207,161	896,864	459,023	170,950	138,985	9,370	2,882,353
	Group Quarters	22,065	19,678	5,674	1,828	2,251	1,082	52,578
	Total Population	1,229,226	916,542	464,697	172,778	141,236	10,452	2,934,931
2015	Permanent	1,271,613	922,187	477,662	174,380	139,141	13,366	2,998,349
	Group Quarters	23,702	20,591	6,335	2,439	2,360	1,082	56,509
	Total Population	1,295,315	942,778	483,997	176,819	141,501	14,448	3,054,858
Percent Change	Permanent	5.3%	2.8%	4.1%	2.0%	0.1%	42.6%	4.0%
	Group Quarters	7.4%	4.6%	11.6%	33.4%	4.8%	0.0%	7.5%
	Total Population	5.4%	2.9%	4.2%	2.3%	0.2%	38.2%	4.1%
Annual Growth	Permanent	1.1%	0.6%	0.8%	0.4%	0.02%	8.5%	0.8%
	Group Quarters	1.5%	0.9%	2.3%	6.7%	1.0%	0.0%	1.5%
	Total Population	1.1%	0.6%	0.8%	0.5%	0.04%	7.6%	0.8%

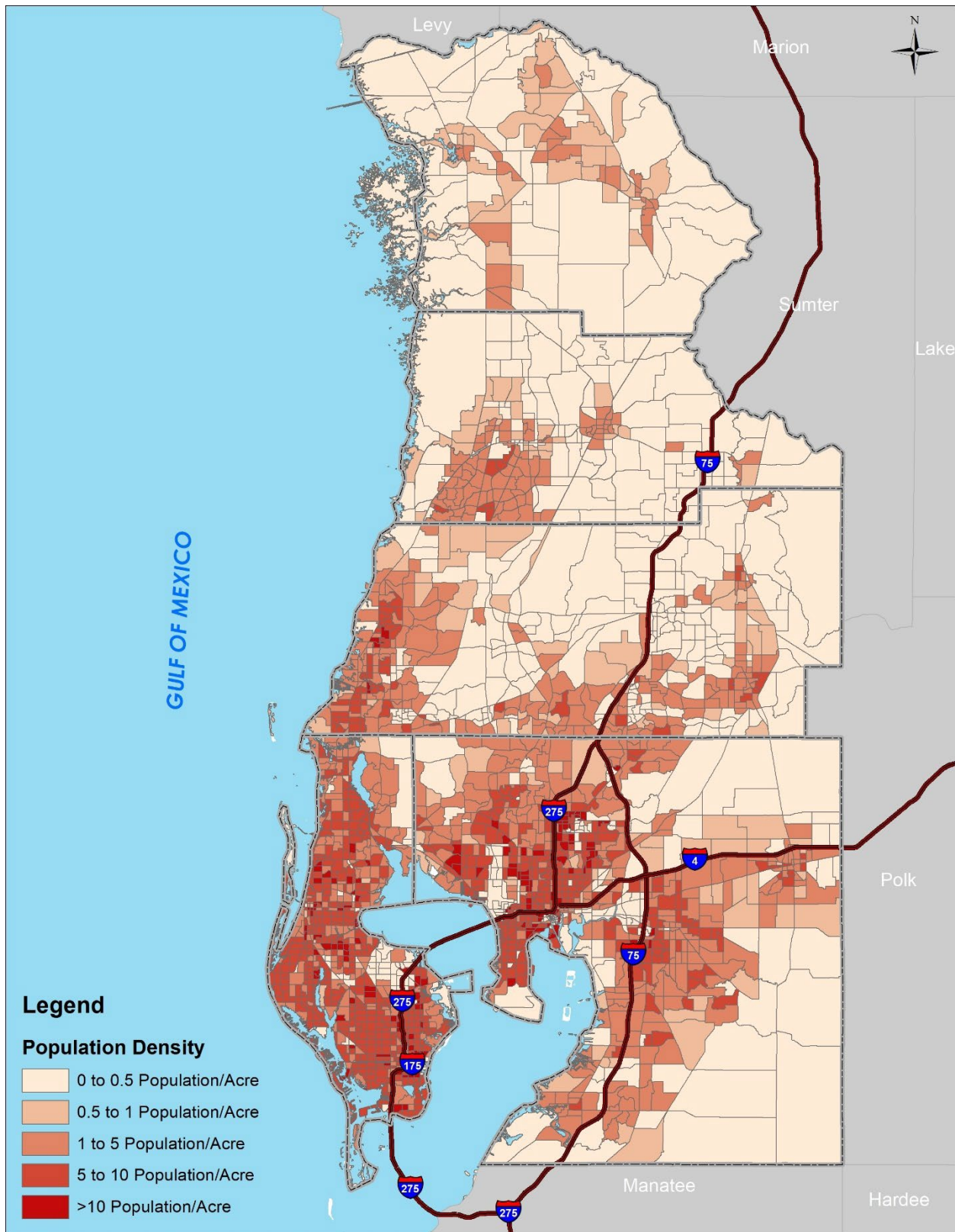


Figure 13: 2015 Base Year Population Density Map

Dwelling Units

There were approximately 1.48 million dwelling units (DUs) in the TBRPM region in the year 2015. Taking into account vacant and seasonal households, there were about 1.28 million occupied DUs, 82,000 seasonal DUs, and 119,000 vacant DUs. For the occupied DUs, there was on average 2.35 population per occupied DU. Consistent with previous versions of the TBRPM, non-vacant dwelling units have been classified into one of the following four categories based upon lifestyle characteristics of their residents:

- **Retired Households:** Include at least one retired household member and no full-time employed members
- **Working Households with No Children:** Non-retired households with no household members under the age of 16
- **Working Households with Children:** Non-retired households with at least one household member under the age of 16
- **Seasonal Households:** Households whose residents live in the region for 1 to 6 months per year

Table 26 shows the breakdown of dwelling units by lifestyle. The largest category is working households (HHs) without children, accounting for about 41 percent of all households. The remaining occupied households are divided between retired households at about 28 percent and households with children at about 25 percent. Seasonal households are located primarily in Pinellas and Pasco Counties, but the total number of seasonal households is only about 6% of the total non-vacant households. Of the nearly 1.36 million total households, more than 72 percent are in either Hillsborough or Pinellas Counties. The MPOs dwelling unit data was checked against Census data and Florida BEBR data for accuracy and reasonableness.

Table 26: 2015 Base Year Dwelling Unit Summary by Lifestyle

Lifestyle	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
Retired & 0 Auto	11,981	18,649	5,045	1,969	1,823	73	39,540
Retired & 1 Auto	41,535	67,009	33,475	14,127	13,198	1,215	170,559
Retired & 2 Auto	36,579	43,975	22,920	10,580	11,881	426	126,362
Retired & 3+ Auto	13,171	12,081	7,126	3,630	3,558	36	39,602
Total Retired	103,265	141,714	68,566	30,306	30,460	1,751	376,063
Working w/o Children & 0 Auto	17,497	17,420	4,639	1,330	1,231	36	42,153
Working w/o Children & 1 Auto	101,669	91,409	31,989	10,612	9,244	765	245,687
Working w/o Children & 2 Auto	91,332	68,489	29,350	9,678	8,418	936	208,202
Working w/o Children & 3+ Auto	31,548	18,957	10,448	3,416	2,688	182	67,239
Total Working w/o Children	242,046	196,275	76,426	25,036	21,581	1,919	563,282
Working w/ Children & 0 Auto	10,471	7,467	2,529	879	522	36	21,904
Working w/ Children & 1 Auto	60,335	38,977	20,005	7,304	4,872	129	131,624
Working w/ Children & 2 Auto	68,049	33,134	22,831	7,201	4,565	576	136,356
Working w/ Children & 3+ Auto	24,824	10,130	8,149	2,571	1,627	235	47,537
Total Working w/ Children	163,680	89,708	53,515	17,955	11,586	977	337,421
Seasonal	8,096	43,402	17,728	4,633	7,291	902	82,051
Total Non-Vacant Dwelling Units	516,754	471,069	216,303	78,058	70,945	5,549	1,358,678

Table 27 gives the change in DUs within the TBRPM area from 2010 to 2015. Overall, the growth was approximately 2.9 percent within the TBRPM area, from 2010 to 2015, with an annual growth of approximately 0.6 percent. Hillsborough County has slightly higher annual growth rate than the other four counties. The county totals were checked for reasonableness. A Dwelling Unit Density Map was generated, as shown in **Figure 15**, to ensure reasonableness of the dwelling unit data.

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Table 27: Dwelling Unit Growth 2010 to 2015

	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
2010 Total Dwelling Units	536,092	503,634	228,928	84,504	78,026	4,958	1,436,142
2015 Total Dwelling Units	562,012	509,394	236,820	85,330	78,556	5,995	1,478,107
Absolute Change	25,920	5,760	7,892	826	530	1,037	41,965
Percent Change	4.8%	1.1%	3.4%	1.0%	0.7%	20.9%	2.9%
Annual Growth	1.0%	0.2%	0.7%	0.2%	0.1%	4.2%	0.6%

Table 28 shows the population per dwelling unit information, including permanent population per permanent occupied DU and total population per total non-vacant DU. Hillsborough County has the highest number of permanent persons per permanently occupied dwelling unit, at 2.50 persons per dwelling unit, as compared to the lowest of 2.16 permanent persons per permanently occupied dwelling unit in Pinellas County. This is primarily because Hillsborough County has a higher percentage of households with children and has fewer retired households. **Figure 16** displays the Permanent Population per Permanently Occupied Dwelling Unit density.

Table 28: 2015 Base Year Persons per Dwelling Unit

	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
Permanent Population / Permanent Occupied Dwelling Unit	2.50	2.16	2.41	2.37	2.19	2.88	2.35
Total Population / Total non-Vacant Dwelling Unit	2.51	2.00	2.24	2.27	1.99	2.60	2.25

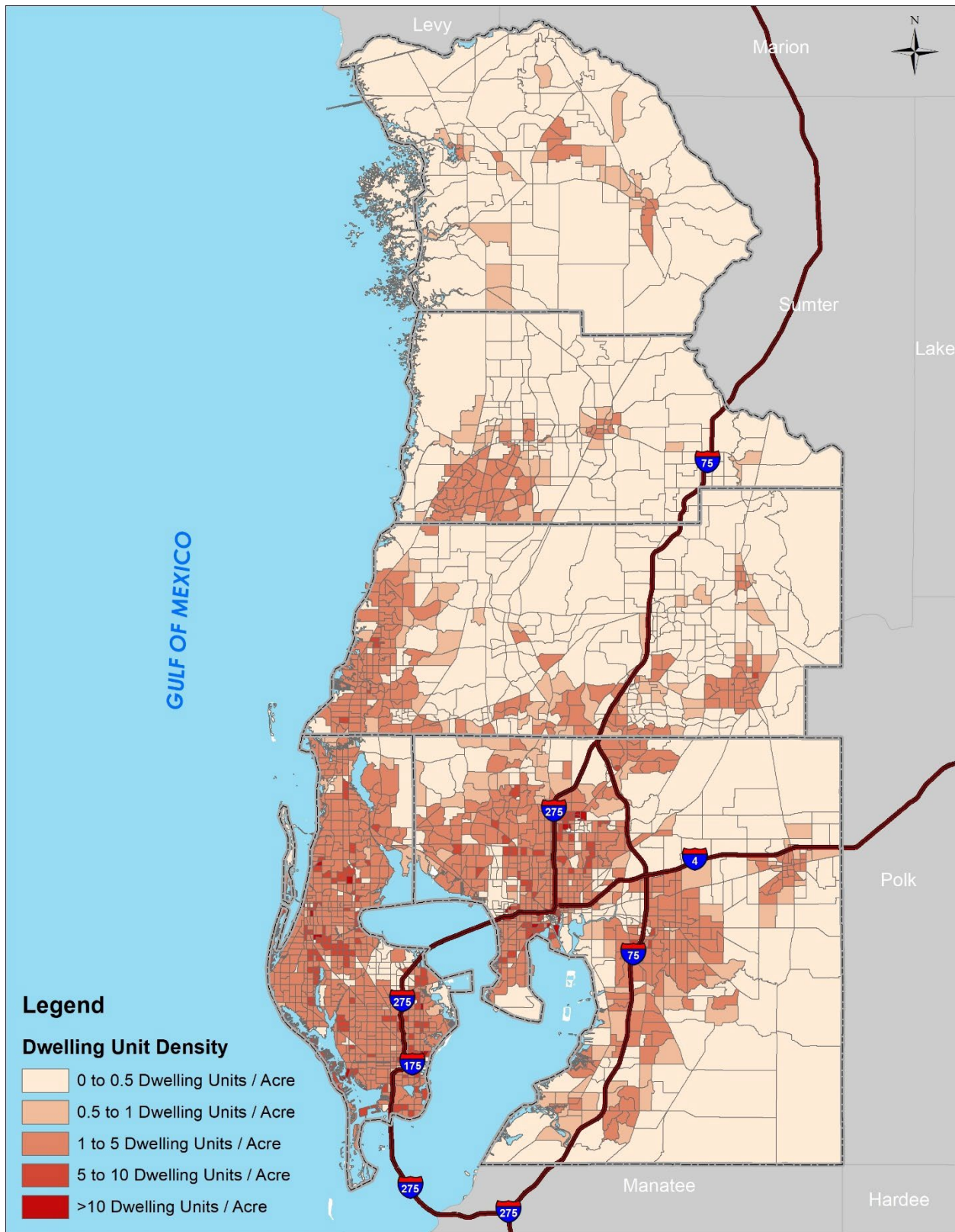


Figure 14: 2015 Base Year Dwelling Unit Density Map

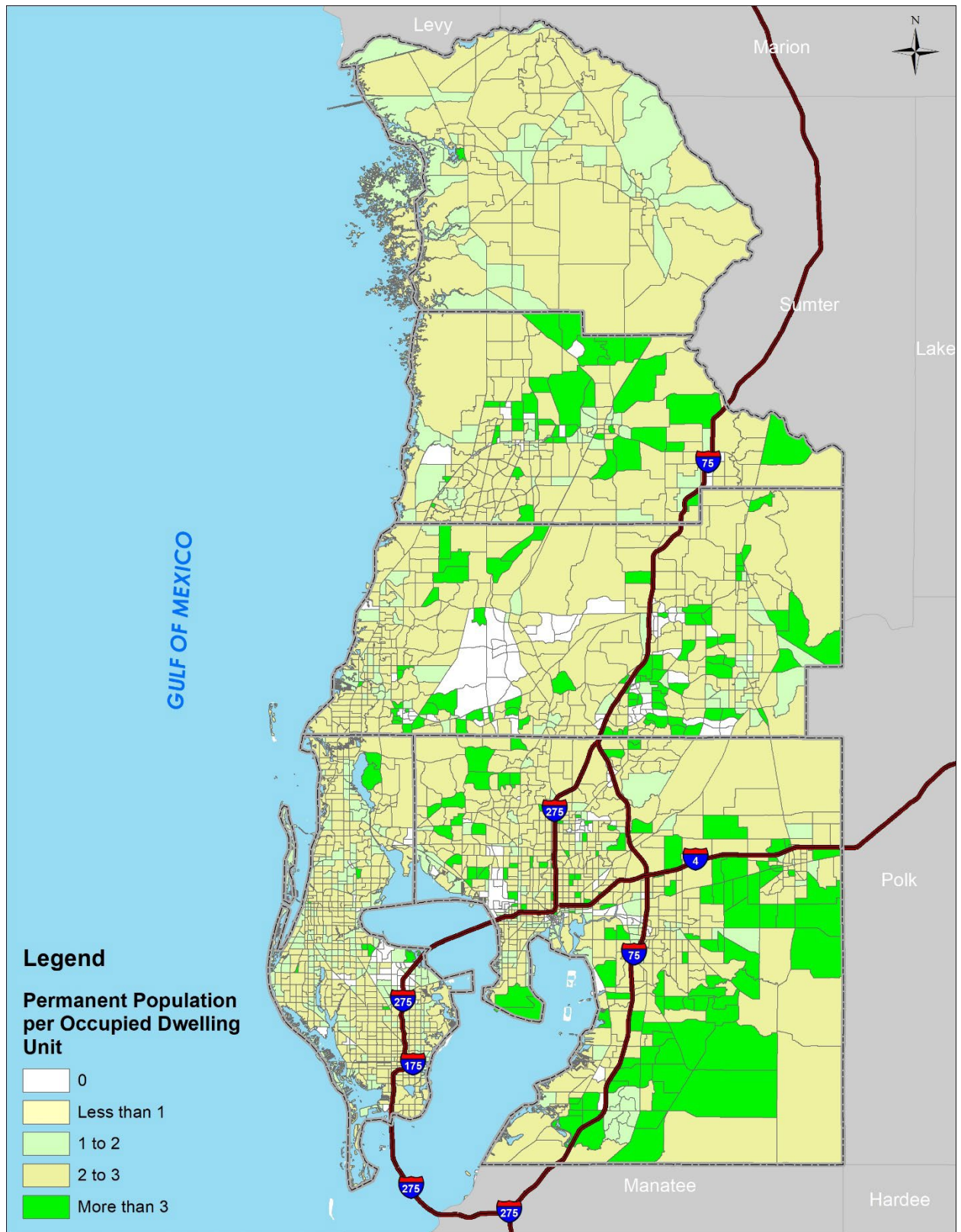


Figure 15: 2015 Base Year Permanent Population per Permanently Occupied Dwelling Unit Density Map

Hotels/Motels

The TBRPM v9.0 Lifestyle Trip Generation module carries forward refinements from the previous TBRPM versions. The original survey categorized hotels/motels as one of three types: economy, business, or resort. A re-evaluation of the survey data determined that the type of hotel/motel did not have as significant effect on the number of trips generated as the area type density did. Therefore, hotels/motels were re-classified based on TAZ activity density, defined as the ratio of population and employment activity to the area (in acres) of a TAZ. New trip rates were developed for the following three area types:

- **Central Business District (CBD) / High Density:** CBD area where Activity Density > 40.0
- **Medium/Low Density:** Activity Density between 2.5 and 40.0
- **Very Low Density:** Activity Density < 2.5

Table 29 displays the 2015 Hotels/Motels by activity density area type within the TBRPM region as calculated through the Trip Generation module. The percent breakdown shows the largest category of hotels/motels in the Medium/Low density area type at 71 percent of the total. Hillsborough and Pinellas County has the largest number of these hotels/motels with about 45 percent each.

Table 29: 2015 Base Year Hotel/Motel Summary

	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
Units in CBD / High Density	8,179	4,146	0	0	0	0	12,325
Units in Med / Low Density	13,513	17,846	2,715	449	442	0	34,965
Units in Very Low Density	468	16	76	533	841	0	1,934
Total Hotel / Motel Units	22,160	22,008	2,791	982	1,283	0	49,224

Employment

The TBRPM v9.0 has three main employment types, reduced from five categories in previous TBRPM versions due to the re-calculation of the trip attraction rates, as follows:

- Industrial Employment
- Commercial Employment (previously split between local and regional)
- Service Employment (previously split between local and regional)

Between 2010 and 2015, total employment in the TBRPM area was increased by approximately 11.4 percent. **Table 30** shows changes in employment levels that occurred throughout the Tampa Bay Area between 2010 and 2015. While employment estimates increased for Hillsborough, Pinellas, and Pasco Counties, there was no significant change for Hernando, and there was a decrease for Citrus in the SE data. Generally, there was a decline in Industrial employment and an offsetting increase in Commercial and Service employment.

For employment types, the service employment, at slightly over 1 million jobs, accounts for 64 percent of all jobs in the region. With industrial employment at about 17 percent and commercial employment at about 19 percent, they constitute the remaining employment categories for the region. Comparing between counties, Hillsborough County with more than 832,000 jobs in 2015 is still the region's largest employer, accounting for 51 percent of the region's employment. Pinellas County ranks second with about 33 percent of the region's employment. Both Hillsborough and Pinellas County represent about 84 percent of all the jobs in the TBRPM area, slightly higher than the percent of population and households in these counties. This suggests inter-county movements for the Home-Based Work (HBW) trips, especially from communities in Pasco and Hernando counties.

An employment density map, shown in **Figure 17**, was also generated to check the employment data for reasonableness. The map shows concentrated employment centers in the City of Tampa, North Tampa along the Veterans Highway, Pinellas Park, Brandon and parts of Clearwater and the City of St. Petersburg.

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Table 30: 2015 Base Year Employment Summary

		Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
2010	Industrial	155,058	102,989	21,946	10,245	9,205	1,603	301,046
	Commercial	132,006	105,621	35,203	14,403	11,806	138	299,177
	Service	424,358	308,329	68,257	31,058	28,995	560	861,557
	Total Employment	711,422	516,939	125,406	55,706	50,006	2,301	1,461,780
2015	Industrial	143,890	86,229	26,470	10,145	7,780	606	275,120
	Commercial	140,100	101,300	37,600	14,000	10,200	981	304,181
	Service	548,310	347,371	93,430	31,555	27,820	1,192	1,049,678
	Total Employment	832,300	534,900	157,500	55,700	45,800	2,779	1,628,979
Percent Change	Industrial	-7.2%	-16.3%	20.6%	-1.0%	-15.5%	-62.2%	-8.6%
	Commercial	6.1%	-4.1%	6.8%	-2.8%	-13.6%	610.9%	1.7%
	Service	29.2%	12.7%	36.9%	1.6%	-4.1%	112.9%	21.8%
	Total Employment	17.0%	3.5%	25.6%	0.0%	-8.4%	20.8%	11.4%
Annual Growth	Industrial	-1.4%	-3.3%	4.1%	-0.2%	-3.1%	-12.4%	-1.7%
	Commercial	1.2%	-0.8%	1.4%	-0.6%	-2.7%	122.2%	0.3%
	Service	5.8%	2.5%	7.4%	0.3%	-0.8%	22.6%	4.4%
	Total Employment	3.4%	0.7%	5.1%	0.0%	-1.7%	4.2%	2.3%

Reasonableness checks for employment per occupied dwelling unit and by population are shown in **Table 31**. The highest rate of 2.05 jobs per household was observed in Hillsborough County and the lowest rate of 1.21 jobs per household was found in Pasco County, among the five TBRPM counties.

Table 31: 2015 Base Year Employment Reasonableness Checks

	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
Total Employment/ Permanent Population	0.65	0.58	0.33	0.32	0.33	0.21	0.54
Total Employment/ Occupied Dwelling Units	2.05	1.87	1.21	1.30	1.38	0.96	1.81

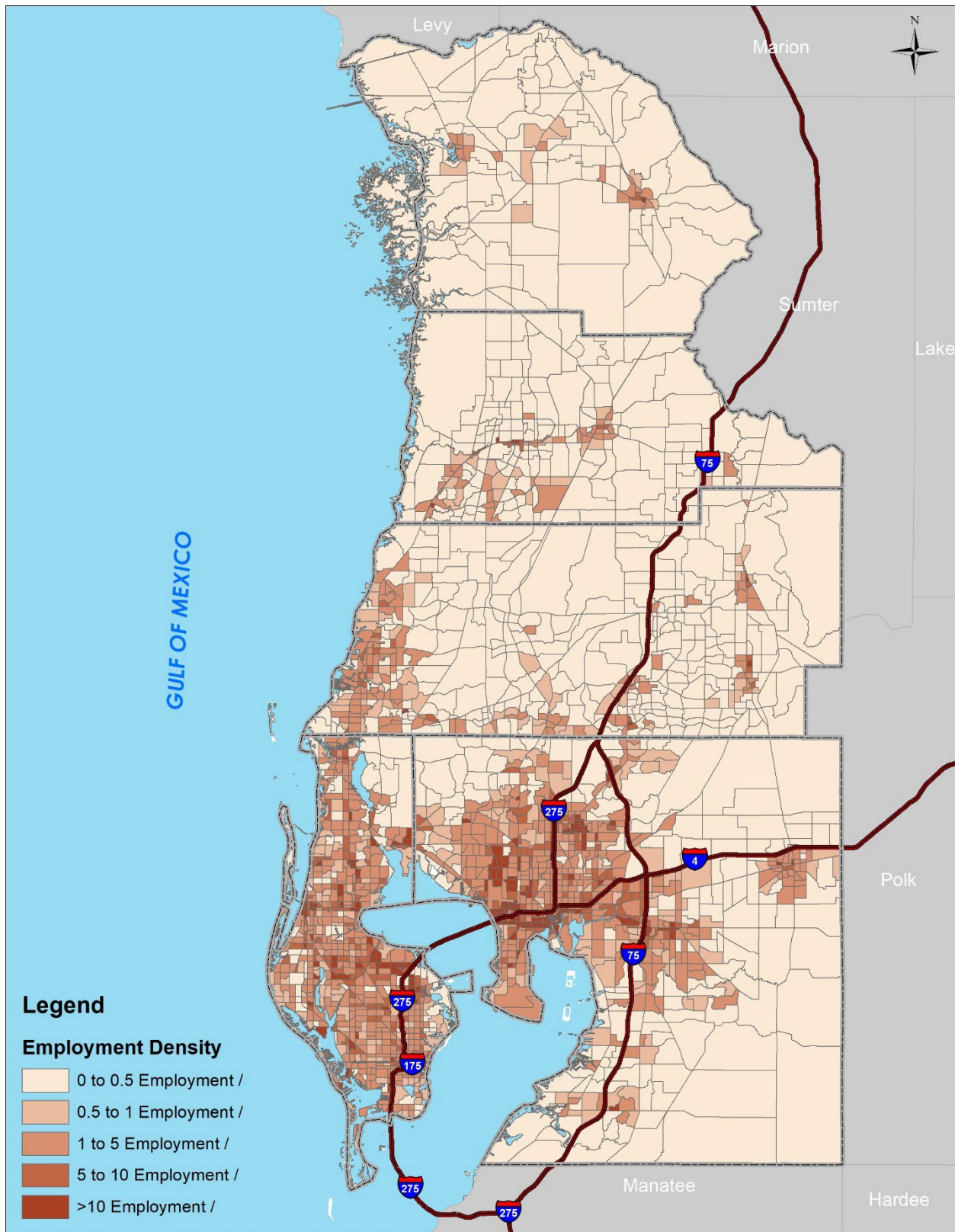


Figure 16: 2015 Base Year Employment Density Map

School Enrollment

School enrollment in the TBRPM region is categorized into K-12 and College/University. Total school enrollment in the region was estimated to be nearly 616,000 with almost 468,000 in K-12 and about 148,000 in college and university. More than 77 percent of the school enrollment is in Hillsborough (about 51 percent) and Pinellas counties (about 26 percent). **Table 32** shows school enrollment and changes by county between 2010 and 2015.

School enrollment was verified and updated using school enrollment data obtained from the MPOs. School locations were checked for accuracy and were adjusted accordingly, causing some changes in school enrollment for certain TAZs.

Table 32: 2010 vs. 2015 Base Year School Enrollment Summary

		Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
2010	K-12	218,231	119,596	69,444	23,929	16,543	2,162	449,905
	College / University	84,863	41,221	9,001	1,708	2,687	0	139,480
	Total Enrollment	303,094	160,817	78,445	25,637	19,230	2,162	589,385
2015	K-12	231,098	119,532	74,966	23,785	16,401	2,647	468,429
	College / University	85,922	38,833	17,429	3,519	2,313	0	148,016
	Total Enrollment	317,020	158,365	92,395	27,304	18,714	2,647	616,445
Percent Change	K-12	5.9%	-0.1%	8.0%	-0.6%	-0.9%	22.4%	4.1%
	College / University	1.2%	-5.8%	93.6%	106.0%	-13.9%	0.0%	6.1%
	Total Enrollment	4.6%	-1.5%	17.8%	6.5%	-2.7%	22.4%	4.6%
Annual Growth	K-12	1.2%	0.0%	1.6%	-0.1%	-0.2%	4.5%	0.8%
	College / University	0.2%	-1.2%	18.7%	21.2%	-2.8%	0.0%	1.2%
	Total Enrollment	0.9%	-0.3%	3.6%	1.3%	-0.5%	4.5%	0.9%

Reasonableness checks for school enrollment per dwelling unit in the study area are shown in **Table 33**. School enrollment in households with children ranged from 1.52 to 1.94 across the five counties with a regional average of 1.83.

Table 33: 2015 Base Year School Enrollment Reasonableness Checks

	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
Total School Enrollment / Households with Children	1.94	1.77	1.73	1.52	1.62	2.71	1.83
Total School Enrollment / Total Permanent Occupied DU	0.61	0.34	0.43	0.35	0.26	0.48	0.45

4.4 MODEL VALIDATION

The ZDATA1 input dataset provides TAZ level information describing the number of households within each cell of the cross-classification matrix. After calculating the number of households within each cell, trip productions are estimated. Besides the socio-economic data, trip generation relies upon other data as well; these include trip production and attraction rates, special generator and external station trip data. Validation efforts relative to these inputs are discussed below.

4.4.1 RESULTS AND COMPARISONS

The TBRPM v9.0 Trip Generation model for the Base Year 2015 network simulates a travel demand of approximately 12.2 million total trips. All of the Home-Based and Non-Home Based trip purposes representing daily person trips are approximately 11.3 million trips. All other truck, Taxi, EI (occasional), and EE trip purposes represent the rest of the simulated trips as vehicle trips. The distribution of trip productions among the thirteen trip purposes was assessed for accuracy by comparing TBRPM results with those from other model validation studies in Florida. **Table 34** depicts the typical range of values for percent of trip productions by trip purpose for urban study areas in Florida. It should be noted that most other urban models in Florida use a seven-purpose trip generation model which combines truck and taxi trips. The TBRPM results generally compare favorably with other modeling efforts.

Table 34: 2015 Base Year Trip Production Percentages by Purpose vs. Typical Florida Ranges

Trip Purpose	Trip Production	Percent	Typical Florida Range
Home-Based Work (HBW)	2,018,519	16.6%	13 – 19%
Home-Based Shopping (HBSH)	1,039,005	8.5%	10 – 13%
Home-Based Social / Recreation (HBSR)	2,858,324	23.5%	7 – 13%
Home-Base School (HBSC)	1,133,406	9.3%	17 – 34%
Home-Based Other (HBO)	2,025,868	16.7%	
Non-Home Based Work (NHBW)	568,896	4.7%	13 – 32%
Non-Home Based Other (NHBO)	1,644,401	13.5%	
Subtotal	11,288,419	92.9%	
Light Truck (LTRK)	176,116	1.4%	
Heavy Truck (HTRK)	80,439	0.7%	
Subtotal	256,555	2.1%	
Taxi	49,055	0.4%	
External-Internal (EI) <i>occasional</i>	175,317	1.4%	
Airport	107,894	0.9%	
College / University (COL / UNV)	275,787	2.3%	
Subtotal	608,053	5.0%	
Grand Total	12,153,027	100.0%	

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Table 35 provides the average number of trips produced per occupied dwelling unit by county and by purpose by the TBRPM for 2015. This excludes external station trips which are produced by the Externals model.

Table 35: 2015 Base Year Trip Production Rates per Occupied Dwelling Unit by County and by Purpose

Trip Purpose	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
HBW	1.82	1.51	1.39	1.32	1.07	1.43	1.58
HBSH	0.73	0.83	0.76	0.77	0.75	1.18	0.78
HBSR	2.05	2.26	2.08	2.10	1.99	2.52	2.13
HBSC	1.13	0.75	0.84	0.80	0.54	0.73	0.90
HBO	1.50	1.47	1.45	1.48	1.31	1.77	1.47
NHBW	0.58	0.39	0.29	0.30	0.27	0.23	0.43
NHBO	1.70	1.11	1.03	1.06	1.01	0.71	1.31
LTRK	0.16	0.12	0.09	0.10	0.10	0.08	0.13
HTRK	0.06	0.04	0.03	0.04	0.03	0.03	0.04
TAXI	0.05	0.04	0.03	0.03	0.03	0.03	0.04
EI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIRPORT	0.06	0.05	0.02	0.03	0.03	0.01	0.05
COL / UNIV	0.24	0.18	0.17	0.17	0.15	0.49	0.20
TOTAL	10.07	8.75	8.21	8.19	7.28	9.21	9.06

Table 36 provides the total productions by county and by purpose, excluding external station trips, which are produced by the model. The trips in the “Other” column shows the extra trip productions for the portion of Manatee County that are included in the TBRPM region.

Table 36: 2015 Base Year Productions by County (Excluding External Stations)

Trip Purpose	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
HBW	942,200	712,197	301,454	103,225	75,744	7,938	2,142,758
HBSH	377,243	391,620	164,748	60,303	53,090	6,535	1,053,539
HBSR	1,060,142	1,066,751	450,097	163,584	141,260	13,970	2,895,804
HBSC	582,467	351,548	182,537	62,401	38,169	4,065	1,221,187
HBO	775,702	693,318	313,604	115,299	93,147	9,809	2,000,879
NHBW	299,322	181,791	63,741	23,479	18,933	1,288	588,554
NHBO	876,507	523,952	223,709	82,737	71,899	3,928	1,782,732
LTRK	83,621	55,821	20,288	7,858	6,878	439	174,905
HTRK	30,264	17,461	6,803	3,266	2,338	159	60,291
TAXI	24,760	19,160	6,329	2,253	1,947	161	54,610
EI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIRPORT	28,806	25,082	5,374	2,106	2,259	68	63,695
COL / UNV	122,657	84,943	37,729	13,141	10,620	2,744	271,834
TOTAL PRODS	5,203,691	4,123,644	1,776,413	639,652	516,284	51,104	12,310,788

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Table 37 shows the number of trips produced by the external stations by purpose. These external trips are shown in the “Other” column and are mixed with the **internal-internal (II)** trips as described earlier. Productions at the external stations do not match total Attractions at the external stations due to the P’s and A’s format of trip estimation.

Table 37: 2015 Base Year External Trip Productions by Purpose

Trip Purpose	Other (EI Trips)
HBW	47,764
HBSH	10,735
HBSR	26,341
HBSC	5,176
HBO	34,581
NHBW	6,146
NHBO	22,112
LTRK	10,681
HTRK	22,415
TAXI	161
EI	162,245
AIRPORT	68
COL / UNV	9,940
TOTAL	358,365

Table 38 shows the sum of the above two tables to demonstrate all productions of the model for 2015, including external stations.

Table 38: 2015 Base Year Productions by County (Including External Stations in Other)

Trip Purpose	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
HBW	942,200	712,197	301,454	103,225	75,744	47,764	2,182,584
HBSH	377,243	391,620	164,748	60,303	53,090	10,735	1,057,739
HBSR	1,060,142	1,066,751	450,097	163,584	141,260	26,341	2,908,175
HBSC	582,467	351,548	182,537	62,401	38,169	5,176	1,222,298
HBO	775,702	693,318	313,604	115,299	93,147	34,581	2,025,651
NHBW	299,322	181,791	63,741	23,479	18,933	6,146	593,412
NHBO	876,507	523,952	223,709	82,737	71,899	22,112	1,800,916
LTRK	83,621	55,821	20,288	7,858	6,878	10,681	185,147
HTRK	30,264	17,461	6,803	3,266	2,338	22,415	82,547
TAXI	24,760	19,160	6,329	2,253	1,947	161	54,610
EI	0	0	0	0	0	162,245	162,245
AIRPORT	28,806	25,082	5,374	2,106	2,259	68	63,695
COL / UNV	122,657	84,943	37,729	13,141	10,620	9,940	279,030
TOTAL	5,203,691	4,123,644	1,776,413	639,652	516,284	358,365	12,618,049

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Table 39 provides the average number of trips attracted per employee, by county, and by purpose as calculated by the model for 2015, excluding external stations.

Table 39: 2015 Base Year Trip Attraction Rates per Employee by County and by Purpose

Trip Purpose	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
HBW	1.20	1.39	1.41	1.71	1.65	1.24	1.31
HBSH	0.47	0.74	0.89	1.15	1.05	0.88	0.64
HBSR	1.28	2.04	2.70	3.05	2.96	2.16	1.78
HBSC	0.70	0.66	1.16	1.12	0.82	1.16	0.75
HBO	0.94	1.36	1.77	2.04	1.93	1.17	1.23
NHBW	0.36	0.34	0.40	0.42	0.41	0.46	0.36
NHBO	1.05	0.98	1.42	1.49	1.57	1.41	1.09
LTRK	0.10	0.10	0.13	0.14	0.15	0.16	0.11
HTRK	0.04	0.03	0.04	0.06	0.05	0.06	0.04
TAXI	0.03	0.04	0.04	0.04	0.04	0.06	0.03
EI	0.10	0.10	0.10	0.10	0.10	0.10	0.10
AIRPORT	0.07	0.01	0	0	0	0	0.04
COL / UNIV	0.19	0.14	0.21	0.12	0.10	0	0.17
TOTAL	6.53	7.93	10.29	11.45	10.84	8.86	7.65

Table 40 provides the total attractions by county and by purpose, excluding external stations. The trips in the “Other” column shows the trip productions for portion of Manatee County that included in the TBRPM region.

Table 40: 2015 Base Year Attractions by County (Excluding External Stations)

Trip Purpose	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
HBW	994,939	742,587	222,843	95,457	75,749	3,457	2,135,032
HBSH	395,261	396,575	140,822	64,130	47,996	2,441	1,047,225
HBSR	1,066,845	1,089,259	425,655	170,058	135,534	5,994	2,893,345
HBSC	580,416	351,548	182,537	62,400	37,705	3,233	1,217,839
HBO	784,323	728,976	278,921	113,878	88,344	3,238	1,997,680
NHBW	299,322	181,791	63,741	23,479	18,933	1,288	588,554
NHBO	876,507	523,952	223,709	82,737	71,899	3,928	1,782,732
LTRK	83,621	55,821	20,288	7,858	6,878	439	174,905
HTRK	30,264	17,461	6,803	3,266	2,338	159	60,291
TAXI	24,760	19,160	6,329	2,253	1,947	161	54,610
EI	82,765	53,447	15,661	5,551	4,577	291	162,292
AIRPORT	55,850	7,800	0	0	0	0	63,650
COL / UNV	161,976	73,207	32,857	6,634	4,360	0	279,034
TOTAL	5,436,849	4,241,584	1,620,166	637,701	496,260	24,629	12,457,189

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Table 41 shows the number of trips attracted to the external stations calculated by the model for 2015. These external trip attractions are in the “Other” column.

Table 41: 2015 Base Year External Trip Attractions by Purpose

Trip Purpose	Other (EI Trips)
HBW	51,018
HBSH	12,980
HBSR	20,816
HBSC	7,684
HBO	31,242
NHBW	6,146
NHBO	22,112
LTRK	10,681
HTRK	22,415
TAXI	161
EI	291
AIRPORT	0
COL / UNV	0
TOTAL	185,546

Table 42 shows the sum of the above two tables to demonstrate all attractions generated by the model for 2015, including those from externals.

Table 42: 2015 Base Year Attractions by County (Including External Stations in Other)

Trip Purpose	Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
HBW	994,939	742,587	222,843	95,457	75,749	51,018	2,182,593
HBSH	395,261	396,575	140,822	64,130	47,996	12,980	1,057,764
HBSR	1,066,845	1,089,259	425,655	170,058	135,534	20,816	2,908,167
HBSC	580,416	351,548	182,537	62,400	37,705	7,684	1,222,290
HBO	784,323	728,976	278,921	113,878	88,344	31,242	2,025,684
NHBW	299,322	181,791	63,741	23,479	18,933	6,146	593,412
NHBO	876,507	523,952	223,709	82,737	71,899	22,112	1,800,916
LTRK	83,621	55,821	20,288	7,858	6,878	10,681	185,147
HTRK	30,264	17,461	6,803	3,266	2,338	22,415	82,547
TAXI	24,760	19,160	6,329	2,253	1,947	161	54,610
EI	82,765	53,447	15,661	5,551	4,577	291	162,292
AIRPORT	55,850	7,800	0	0	0	0	63,650
COL / UNV	161,976	73,207	32,857	6,634	4,360	0	279,034
TOTAL	5,436,849	4,241,584	1,620,166	637,701	496,260	185,546	12,618,106

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Table 43 shows the balance of productions and attractions to and from zones in each county by purpose.

Table 43: 2015 Base Year Balanced Productions and Attractions by County

Trip Purpose		Hillsborough	Pinellas	Pasco	Hernando	Citrus	Other	Total
HBW	Productions	942,200	712,197	301,454	103,225	75,744	47,764	2,182,584
	Attractions	994,939	742,587	222,843	95,457	75,749	51,018	2,182,593
	P/A	95%	96%	135%	108%	100%	94%	100%
HBSH	Productions	377,243	391,620	164,748	60,303	53,090	10,735	1,057,739
	Attractions	395,261	396,575	140,822	64,130	47,996	12,980	1,057,764
	P/A	95%	99%	117%	94%	111%	83%	100%
HBSR	Productions	1,060,142	1,066,751	450,097	163,584	141,260	26,341	2,908,175
	Attractions	1,066,845	1,089,259	425,655	170,058	135,534	20,816	2,908,167
	P/A	99%	98%	106%	96%	104%	127%	100%
HBSC	Productions	582,467	351,548	182,537	62,401	38,169	5,176	1,222,298
	Attractions	580,416	351,548	182,537	62,400	37,705	7,684	1,222,290
	P/A	100%	100%	100%	100%	101%	67%	100%
HBO	Productions	775,702	693,318	313,604	115,299	93,147	34,581	2,025,651
	Attractions	784,323	728,976	278,921	113,878	88,344	31,242	2,025,684
	P/A	99%	95%	112%	101%	105%	111%	100%
NHBW	Productions	299,322	181,791	63,741	23,479	18,933	6,146	593,412
	Attractions	299,322	181,791	63,741	23,479	18,933	6,146	593,412
	P/A	100%	100%	100%	100%	100%	100%	100%
NHBO	Productions	876,507	523,952	223,709	82,737	71,899	22,112	1,800,916
	Attractions	876,507	523,952	223,709	82,737	71,899	22,112	1,800,916
	P/A	100%	100%	100%	100%	100%	100%	100%
LTRK	Productions	83,621	55,821	20,288	7,858	6,878	10,681	185,147
	Attractions	83,621	55,821	20,288	7,858	6,878	10,681	185,147
	P/A	100%	100%	100%	100%	100%	100%	100%
HTRK	Productions	30,264	17,461	6,803	3,266	2,338	22,415	82,547
	Attractions	30,264	17,461	6,803	3,266	2,338	22,415	82,547
	P/A	100%	100%	100%	100%	100%	100%	100%
TAXI	Productions	24,760	19,160	6,329	2,253	1,947	161	54,610
	Attractions	24,760	19,160	6,329	2,253	1,947	161	54,610
	P/A	100%	100%	100%	100%	100%	100%	100%
EI	Productions	0	0	0	0	0	162,245	162,245
	Attractions	82,765	53,447	15,661	5,551	4,577	291	162,292
	P/A	0%	0%	0%	0%	0%	55754%	100%
AIRPORT	Productions	28,806	25,082	5,374	2,106	2,259	68	63,695
	Attractions	55,850	7,800	0	0	0	0	63,650
	P/A	52%	322%	0%	0%	0%	0%	100%
COL / UNV	Productions	122,657	84,943	37,729	13,141	10,620	9,940	279,030
	Attractions	161,976	73,207	32,857	6,634	4,360	0	279,034
	P/A	76%	116%	115%	198%	244%	0%	100%
TOTAL	Productions	5,203,691	4,123,644	1,776,413	639,652	516,284	358,365	12,618,049
	Attractions	5,436,849	4,241,584	1,620,166	637,701	496,260	185,546	12,618,106
	P/A	96%	97%	110%	100%	104%	193%	100%

4.5 SUMMARY

Phases XII - XIV of the RTA had several data collection efforts with the purpose of enhancing the TBRPM v8.0. Trip attraction rates were verified with the Employer Attraction Survey, a phone interview survey of employers in the FDOT, District 7 study area conducted in 2013 to validate the trips attracted to each employment type. A neighborhood verification survey was conducted to validate trip productions and attractions within neighborhoods in the FDOT, District 7 study area. This survey was a count survey for the number and type of vehicles entering and leaving a neighborhood through established cordon lines. This survey also served the purpose of validating attractions to these neighborhoods by trucks. Also, a survey of special generators was conducted and evaluated to identify the trip productions and attractions of potential special generator locations for use in the model.

In addition to these efforts, the TBRPM v9.0 is a model that is based on the most current data that reflects the characteristics of the Tampa Bay region. The results of the model indicate that it produces reasonable and useful improvements to the trip generation model that positively impact subsequent model steps.

Chapter 5 - HIGHWAY NETWORK

5.1 NETWORK CODING AND ATTRIBUTES

The highway network module for the TBRPM v9.0 uses a Cube Voyager binary network for modeling computations. Characteristics such as the number of highway links, system miles, roadway classifications, number of lanes, link speed and capacity are input into the model. It is in this module that highway system characteristics are described and summarized, and travel time skims are initially computed for free flow conditions. This module uses the roadway characteristics of area type, facility type, and number of lanes to determine the speeds and capacities of the highway system.

5.2 NETWORK ENHANCEMENTS FOR TBRPM V9.0

A few enhancements have been made to the highway network module and the use of the highway networks themselves for the TBRPM. Since before the TBRPM v7.0, the highway networks for the TBRPM have been based on GIS shapefiles which were converted from the previous stick figure style of highway networks to provide a more realistic degree of shape and distance within the highway and transit networks. These GIS shapefiles are then in turn the basis for which the Cube Voyager binary networks are built.

Using GIS source files provided by FDOT, the geometry of a previous base Cube binary network was converted to shapefile and modified to provide more efficient network shapes by combining or splitting links were necessary to accommodate new changes to the highway alignments and centroid locations. Now in its third generation, the 2015 highway network shapefile has been used as the main means for editing and representing the highway network via the ArcGIS software. This platform allows for the necessary geographic editing which allows for multiple shape points as needed for each highway link, e.g. ramps can be one (1) geographic link represented between two points instead of several links and nodes that would carry the same traffic volume in repetition. In addition, TBRPM v9.0 introduced the transit network in the shapefile format, enable geographically editing for the transit network, including micro-coded transit nodes, transit station nodes, transit only links, and transit access links connecting highway nodes and transit nodes.

The 2015 network shapefile carries all of the necessary attributes to create the Cube binary networks needed for the new modeling structure. These attributes include area type, facility type, number of lanes, anode, bnode, dircode, and a two-way flag. The “Base” binary Cube Voyager network is then updated with speed and capacity in the highway network module along with some basic traffic count information and toll link locations. A unique feature in the Tampa Bay Area highway network is the Reversible Elevated (Toll) Lanes (REL) of the Crosstown Expressway. Previously in the daily model structure, this feature of the highway network could not be fully simulated in the way it actually operates. Only one daily network was being used. So, in order to assign volumes in both directions, the REL had to be treated as a two-way facility all day and not the one-way facility by time period that it is.

With the Time-of-Day (TOD) model structure the opportunity to better model this feature was presented. The TOD model structure now uses two basic networks, Peak and Off-Peak, split from the one “Base” network to represent both directions of travel independently along the REL links of the Crosstown Expressway. After the base shapefile has been used to create the “Base” Cube Voyager network, model scripting creates two networks based on direction, using the dircode, for the facility types 96 and 97 which have been reserved for the REL links. From the two “Unloaded” networks, two different skims are produced, one for the Peak period and inbound direction of the REL links, and one for the Off-Peak period and out-bound direction of the REL links, which is to be used for the next step in the model, Distribution. All other roadways in the two “Unloaded” networks are the same for both periods.

Beside the facility types 96 and 97 being reserved for use as in the REL links, there are few other special facility types that are being used in the new TOD model structure. Facility type 49 has always been used for transit only links, or links on which autos and trucks are restricted. Trucks are also restricted on REL facility types of 96 and 97. Facility type 94 is being used for Express Lanes and is tolled based on model keys at a specified toll rate. Facility types 59 and 69 are being used for premium transit route coding which will be described later and, in the *User's Procedural Guide*. Facility type 69 is used for fixed guideway links to prescribe an independent transit speed for routes that are using these links, and facility type 59 is used for special walk links between micro-coded transit nodes, station nodes, or highway nodes that might not be generated by the transit access module.

CHAPTER 5 – HIGHWAY NETWORK

5.3 DESCRIPTION OF 2015 HIGHWAY NETWORK

Table 44 reports the number of system links (i.e. directional centerlines) by facility type and by area type for the Base Year 2015 network validation. While writing this report, there are 34,197 links in this regional model, including 21,467 non-centroid links and 12,730 centroid links. **Figure 17** below depicts the 2015 Highway Network by Directional Number of Lanes.

Table 44: 2015 Base Year Directional Links by Area Type and Facility Type

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	15	7	449	187	41	699
Divided Arterial	135	103	3,268	3,095	75	6,676
Undivided Arterial	40	74	2,043	440	256	2,853
Collector	350	227	7,448	820	494	9,339
Centroids	482	298	7,638	2,824	1,488	12,730
One-way Facilities	258	151	196	188	0	793
Ramps	20	42	436	199	20	717
HOV Facilities	0	0	0	0	0	0
Toll Facilities	10	27	319	22	12	390
Total	1,310	929	21,797	7,775	2,386	34,197

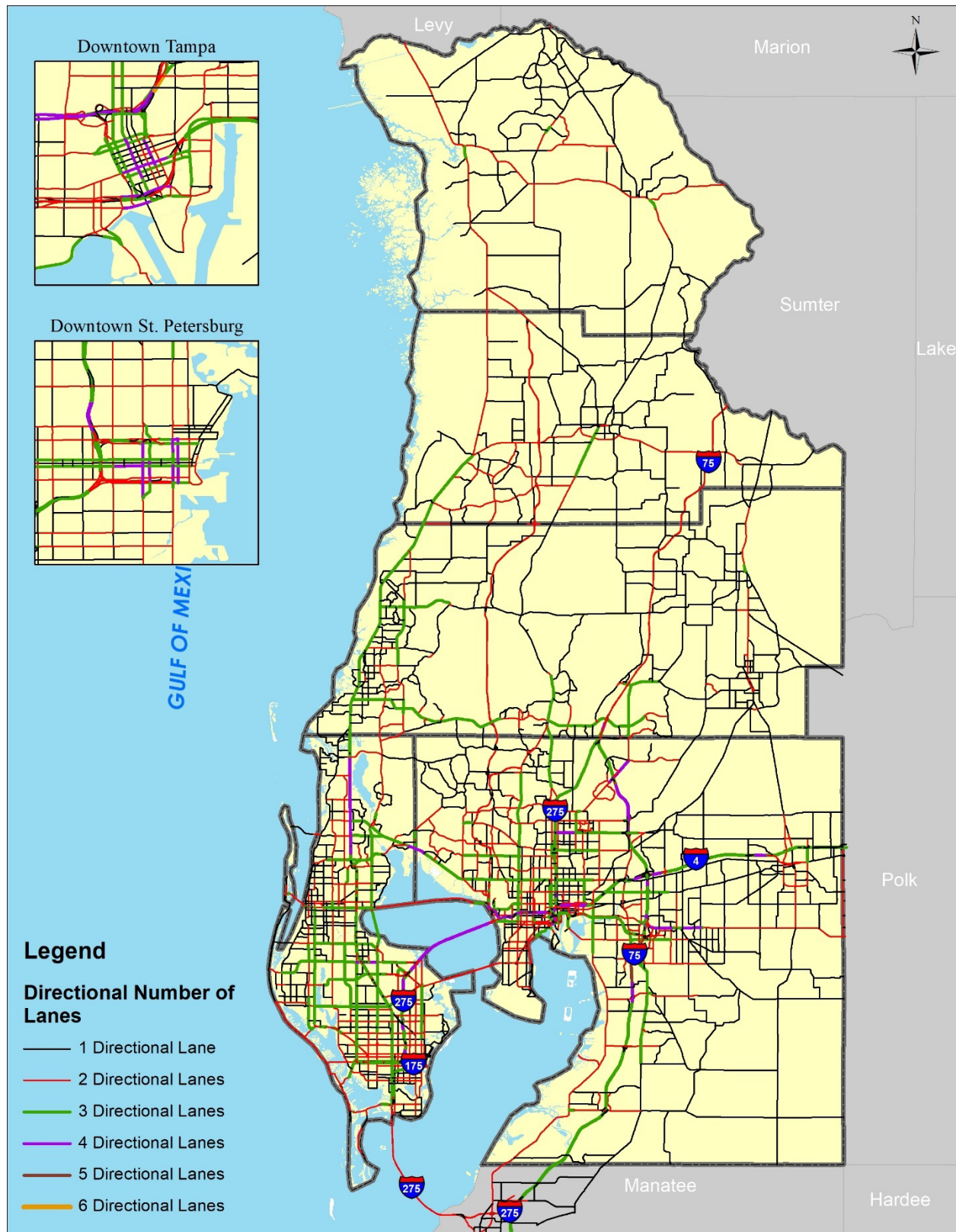


Figure 17: 2015 Base Year Directional Number of Lanes Map

5.3.1 AREA TYPE DEFINITIONS

A set of standard area type and facility type definitions are used to describe key roadway characteristics in the TBRPM v9.0. Area types are used to define land uses adjacent to each roadway link. Area type is also an attribute of traffic analysis zones (TAZ) and affects trip rates in Trip Generation, terminal times in Trip Distribution and link capacities in Highway Assignment.

The two-digit area types stem from the single-digit area types in early versions of the TBRPM. The five major categories consist of Central Business District (CBD), CBD Fringe Areas, Other Urbanized Areas, Outlying Business Districts (OBD) and Rural Areas. **Table 45** and **Figure 18** illustrate the two-digit area type codes.

Table 45: TBRPM v9.0 – Area Type Definitions

Area Type	Description
1X – Central Business Districts	
11	Urbanized Area (over 500,000) Primary City Central Business District
12	Urbanized Area (under 500,000) Central Business District
13	Other Urbanized Area Central Business District and Small City Downtown
14	Non-Urbanized Area Small City Downtown
2X – Central Business District Fringe Areas	
21	All CBD Fringe Areas
3X – Other Urbanized Areas	
31	Developed Portions of Urbanized Areas
32	Undeveloped Portions of Urbanized Areas
33	Transitioning Areas/Urban Areas over 5,000 Population
34	Residential Beach Area
4X – Outlying Business Districts	
41	Major Outlying Business Districts
42	Other Outlying Business Districts
43	Beach OBD
5X – Rural Areas	
51	Developed Rural Areas/Small Cities under 5,000 Population
52	Undeveloped Rural Areas

The area type codes are described in more detail as follows:

- 11: Urbanized Area (over 500,000) Primary City Central Business District (CBD)

The central core of the principal city or cities in the FHWA urbanized area with a population of at least 500,000 people. These areas generally are concentrations of service employment, predominantly government and business office activity, as well as some retail and high-density residential uses. These areas usually have very high land values, mid- and high-rise buildings, and intense pedestrian activity with sidewalks linking most areas.

Examples in the Tampa Bay Region include: Downtown core areas of Tampa and St. Petersburg.

Examples elsewhere in Florida include: Downtown core areas of Ft. Lauderdale, Orlando, Jacksonville and Miami.

- 12: Urbanized Area (under 500,000) Central Business District (CBD)

Same as Area Type 11 except that the urbanized area population is 500,000 or less. Usually these CBDs will be smaller, with fewer high-rise buildings and possibly less retail.

Examples in the Tampa Bay Region include: Downtown core area of Clearwater.

Examples elsewhere in Florida include: Downtown core areas of Pensacola, Tallahassee, Naples and Ft. Myers.

- 13: Other Urbanized Area Central Business District and Small City Downtown

This is the Central business core of smaller cities in the urbanized area. These areas, though much smaller than the Primary City CBDs, are still intensely developed with low- and mid-rise commercial buildings, and with noticeable pedestrian activity. In addition, the Primary CBD of very small urban areas may appear the same.

Examples in the Tampa Bay Region include: Downtown core area of Tarpon Springs, Port Richey and New Port Richey.

Examples elsewhere in Florida include: Downtown areas of Hollywood, Milton, Vero Beach, Stuart, and Baldwin.

- 14: Non-Urbanized Area Small City Downtown

This is the central business / retail core of small urban towns with over 5,000 in population outside the urbanized area boundary within the MPO coverage area.

Examples in the Tampa Bay Region include: Downtown areas of Brooksville, Plant City, Zephyrhills and Dade City.

Examples elsewhere in Florida include: Downtown areas of Lake Wales, Immokalee and Crestview.

- 21: All Central Business District (CBD) Fringe Areas

This is the area immediately adjacent to the CBDs of primary cities. These areas often include small businesses, warehousing and light industrial activity, and extensive parking serving the CBD. The areas often form a buffer between the highly developed CBD and the less dense development of the surrounding area. Most of the traffic in these areas is either passing through or accessing parking areas that serve the CBD.

Examples in the Tampa Bay Region include: Fringe areas of the Tampa and St. Petersburg CBDs.

Examples elsewhere in Florida include: Fringe areas of the Ft. Lauderdale, Hollywood, Miami, Orlando and Jacksonville CBDs.

- 31: Developed Portions of Urbanized Areas

All developed areas within the FHWA urbanized area which are not included in the CBD areas, CBD Fringe areas, OBD areas, or beach areas. The predominant land use is residential.

Examples in the Tampa Bay Region include: Carrollwood, Brandon, Land O' Lakes and Spring Hill.

Examples elsewhere in Florida include: Avondale (Jacksonville), Coral Springs, Hollywood, Dania Beach, Kendall (Miami) and Killeam (Tallahassee).

- 32: Undeveloped Portions of Urbanized Areas

Large areas within the FHWA urbanized area which are relatively undeveloped. These areas, which may include some agricultural lands, forests, large vacant / undeveloped parcels, wetlands, state and regional parks, and other open recreational spaces, are not likely to be developed in the future. It may also include areas bordering large developments with few access points such as airports and military bases, as well as bridges over major water bodies.

Examples in the Tampa Bay Region include: Howard Frankland Bridge; Gandy Causeway; Courtney Campbell Causeway; Ulmerton Road between I-275 and Feather Sound; the U.S. 41 corridor between Gibsonton and Apollo Beach; Northwest Pasco County between Hudson and Springhill; and, major portions of Northeast Pinellas County between East Lake Road and the Hillsborough County Line.

Examples elsewhere in Florida include: Sawgrass Expressway between Coral Ridge Drive and Sunrise Boulevard; all bridges to S.R. A1A in Broward County; the Pensacola Bay Bridge; Key Biscayne (Miami); the I-295 / Buckman Bridge (Jacksonville); Pineda Causeway (Melbourne and the area of Broward County bounded by U.S. 27, SW 127th Street); Griffin Road and Pines Boulevard.

- 33: Transitioning Areas / Urban Areas over 5,000 Population

Transitioning Areas are all areas outside the FHWA Urbanized Area that are expected to meet the criteria for becoming part of the Urbanized Area within the next twenty years. These criteria are 1) the U.S. Bureau of the Census urbanized standard of a population density of at least 1,000 persons per square mile, or 2) the development of intense commercial, retail, or industrial activity.

Examples in the Tampa Bay Region include: Areas outside the downtown areas of Plant City, Dade City, Zephyrhills and Brooksville, and the I-4 corridor between Tampa and Plant City.

Examples elsewhere in Florida include: Areas outside the downtown areas of Lake Wales, Immokalee and Crestview, US 27 north of Griffin Road (Broward), US 27 south of Miramar Parkway (Broward).

- 34: Residential Beach Areas

Residential areas within the FHWA urbanized area located on or adjacent to the beach. These areas typically have higher densities than other residential areas, and may include mid- and high-rise buildings.

Examples in the Tampa Bay Region include: St. Petersburg Beach, Bellaire Shores, Bellaire Beach, and Indian Rocks Beach.

Examples elsewhere in Florida include: Riverside Drive, SR A1A south of Oakland Park Boulevard, SR A1A north of the Dade County Line, Santa Rosa Island (Fort Walton Beach) and Miami Beach.

- 41: Major Outlying Business District (OBD)

These areas are major nodes of business and commercial activity that are outside of the CBD areas. These are highly developed concentrations of retail and service employment typified by higher land values and a range of building heights. In many aspects, these areas are similar to CBDs and may include some high density residential and hotel development and pedestrian activity. Trip generation in these areas may be very similar to those of CBD areas. These areas have been categorized as “suburban downtowns” or “edge cities” and are usually found in large cities and urbanized areas.

Examples in the Tampa Bay Region include: Westshore and the Gateway Centre Area.

Examples elsewhere in Florida include: the Baymeadows area (Jacksonville), Maitland Center (Orlando), Cypress Creek (Broward) and the Miami International Airport area.

- 42: Other Outlying Business District (OBD)

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These areas are noticeable concentrations of business and / or retail activity outside the CBD areas not classified as Major OBDs. These include commercial strips, clusters of retail activity such as malls and super centers, medical centers, and office / industrial parks. Major educational institutions such as universities and community colleges would also be considered as Other OBDs. These areas have significantly higher trip generation than the surrounding area.

Examples in the Tampa Bay Region include: U.S. 19 corridor in Pinellas and Pasco Counties, Countryside Mall area, University Mall / University of South Florida area.

Examples elsewhere in Florida include: Apalachee Parkway (Tallahassee), Florida Turnpike (Broward), I-95 (Broward), I-595 (Broward), H.E.F.T. (Broward), University Drive (Broward), Perimeter Road (Broward), Orange Blossom Trail (Orlando), Okeechobee Road (West Palm Beach) and Phillips Highway (Jacksonville).

- 43: Beach Outlying Business District

Concentrations of commercial strips, shopping centers, and other commercial activity located on or near the beach. These areas typically have higher densities than other OBDs, include moderate to heavy pedestrian activity, and may function in a similar manner to major OBDs.

Examples in the Tampa Bay Region include: Clearwater Beach, John's Pass, and the downtown area and motel strip of St. Petersburg Beach.

Examples elsewhere in Florida include: Destin Harbor, Jacksonville Beach, and the Art Deco area of Miami Beach.

- 51: Developed Rural Areas / Small Cities under 5,000 Population

Developed Rural Areas are clusters of residential development and / or industrial or commercial activity outside the FHWA urbanized area and transitioning area boundaries. These areas may have slightly lower traffic speeds than other rural areas. Small Cities with under 5,000 in population are small incorporated towns or specific communities outside the FHWA urbanized area and transitioning area boundaries with fewer than 5,000 persons.

Examples in the Tampa Bay Region include: Ridge Manor, Lacoochee, Ruskin, and Sun City.

Examples elsewhere in Florida include: Frostproof (Polk County) and Green Cove Springs (Jacksonville).

- 52: Undeveloped Rural Areas

All areas not included in the FHWA urbanized area that are not Small City Downtowns, Urban Areas (over 5,000 population), or Developed Rural Areas. These areas are likely to still be largely rural in twenty years and consist primarily of agricultural and / or forest lands.

Examples in the Tampa Bay Region include: Central Pasco County, Southeast Hillsborough County, and Central Citrus County.

Examples elsewhere in Florida include: US 27 north of I-595 (Broward), I-575 west of US 27 (Broward), the area north of the Jacksonville International Airport, and southern Osceola County.

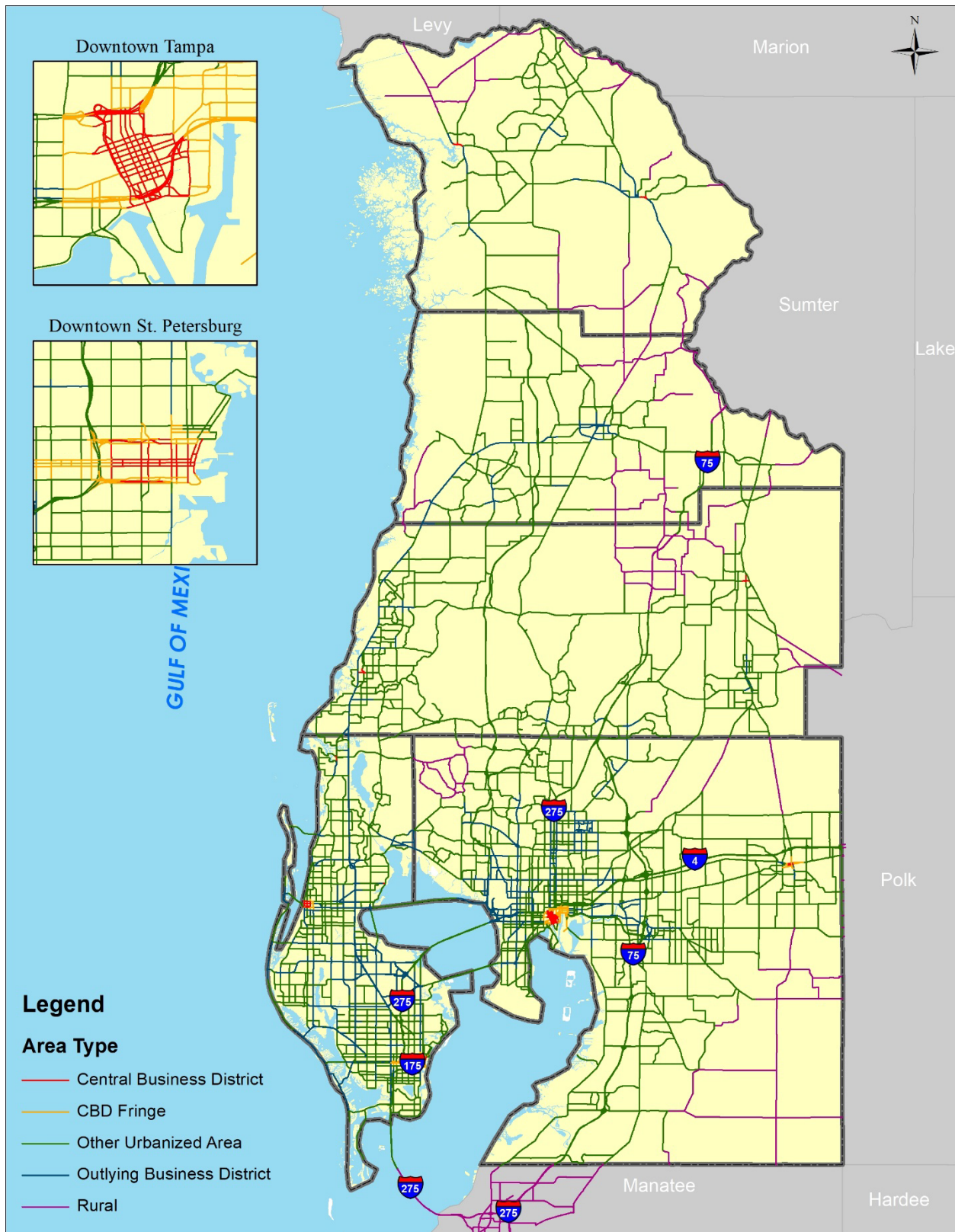


Figure 18: 2015 Base Year Area Type Map

5.3.2 FACILITY TYPE DEFINITIONS

Facility types are used to classify each roadway link according to its function and (or) design characteristics. Historically, FSUTMS used single-digit codes for area types and facility types. In order to provide for a greater variation in link speeds and to better reflect capacity values recommended in the FDOT Level of Service (LOS) Manual, previous versions of the TBRPM were modified to accept two-digit codes for area types and facility types. These two-digit area types and facility types were retained for TBRPM v9.0. **Table 46** shows the two-digit facility type codes; while **Figure 19** visually depicts the TBRPM v9.0 coded Facility Types, collapsed to the one digit level. Facility types 96 and 97 were added to the Toll Facilities category, while facility type 49 was added to the Collectors category as a transit only facility type, auto and truck restricted facility.

Table 46: TBRPM v9.0 – Facility Type Definitions

Facility Type	Description
1X – Freeways and Expressways	
11	Urban Freeway Group 1 (cities of 500,000 or more)
12	Other Freeway (not in Group 1)
15	Collector / Distributor Freeway Lanes / Facilities
16	Controlled Access Expressways
17	Controlled Access Parkways
2X – Divided Arterials	
21	Divided Arterial Unsignalized (55 mph)
22	Divided Arterial Unsignalized (45 mph)
23	Divided Arterial Class I
24	Divided Arterial Class II
25	Divided Arterial Class III / IV
3X – Undivided Arterials	
31	Undivided Arterial Unsignalized with Turn Bays
32	Undivided Arterial Class I with Turn Bays
33	Undivided Arterial Class II with Turn Bays
34	Undivided Arterial Class III / IV with Turn Bays
35	Undivided Arterial Unsignalized without Turn Bays
36	Undivided Arterial Class I without Turn Bays
37	Undivided Arterial Class II without Turn Bays
38	Undivided Arterial Class III / IV without Turn Bays
4X – Collectors	
41	Major Local Divided Roadway
42	Major Local Undivided Roadway with Turn Bays
43	Major Local Undivided Roadway without Turn Bays
44	Other Local Divided Roadway
45	Other Local Undivided Roadway with Turn Bays
46	Other Local Divided Roadway without Turn Bays
47	Low Speed Local Collector
48	Very Low Speed Local Collector

CHAPTER 5 – HIGHWAY NETWORK

Facility Type	Description
49	Transit Only Facilities
5X – Centroid Connectors	
51	Basic Centroid Connector
52	External Station Centroid Connector
53	Dummy Zone Centroid Connectors
6X – One-Way Facilities	
61	One-Way Facilities Unsignalized
62	One-Way Facilities Class I
63	One-Way Facilities Class II
64	One-Way Facilities Class III / IV
65	Frontage Road Unsignalized
66	Frontage Road Class I
67	Frontage Road Class II
68	Frontage Road Class III / IV
7X – Ramps	
71	Freeway On / Off Ramp
72	Freeway On / Off Loop Ramp
73	Other On / Off Ramp
74	Other On / Off Loop Ramp
75	Freeway-Freeway Ramp
76	Truck-Only Ramp
8X – HOV Facilities	
81	Freeway Group 1 HOV Lane (Barrier Separated)
82	Other Freeway HOV Lane (Barrier Separated)
83	Freeway Group 1 HOV Lane (Non-Barrier Separated)
84	Other Freeway HOV Lane (Non-Barrier Separated)
85	Non Freeway HOV Lane
86	AM&PM Peak HOV Ramp
87	AM Peak Only HOV Ramp
88	PM Peak Only HOV Ramp
89	All Day HOV Ramp
9X – Toll Facilities	
91	Freeway Group 1 Toll Facility
92	Other Freeway Toll Facility
93	Expressway / Parkway Toll Facility
94	Divided Arterial Toll Facility
95	Undivided Arterial Toll Facility
96	Freeway Group 1 REL Toll Facility

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Facility Type	Description
97	Other Freeway REL Toll Facility
98	Acceleration / Deceleration Lanes – Toll Facility
99	Toll Plaza – Toll Facility

Detailed definitions of each code are provided below. Facility Type 1x (Freeways / Expressways) facilities are as follows:

- 11: Freeway Group 1

Freeways which are within an urbanized area over 500,000 in population and either leading to or within 5 miles of the primary city CBD.

- 12: Other Freeway

All other freeways not classified in Group 1.

- 15: Collector / Distributor Lanes

Auxiliary lane(s) parallel to, but physically separated from, a freeway, usually between close interchanges. All access to the C/D lanes is provided via ramps.

- 16: Controlled-Access Expressway

These are high capacity, high speed facilities with controlled access primarily through grade-separated interchanges. Expressways may also include a few at-grade intersections as well as slip ramps for access to and from frontage roads and side streets. Frontage road systems are often included within the corridor. Posted speed is generally lower, and access more frequent, than on a typical freeway.

- 17: Controlled-Access Parkway

These facilities are similar to Controlled-Access Expressways, but typically designed for more moderate speeds. Design may include more landscaping, more curving alignment, tighter access controls, and other features to make the facility more visually pleasing. Parkways generally are more compatible with residential, rural, or park type land uses and / or less attractive for commercial development.

Facility Type 2x (Divided Arterials), 3x (Undivided Arterials), and 6x (One-Way Streets) facility types are stratified by LOS groups, as follows:

- 21, 31, & 61: Unsignalized (55 mph); 22: Unsignalized (45 mph)

No signalized intersections.

- 23, 32, & 62: Class I

Up to 2.49 signalized intersections per mile in urban areas or up to 1.50 signalized intersections per mile in rural areas.

- 24, 33, & 63: Class II

2.50 to 4.50 signalized intersections per mile in urban areas or more than 1.50 signalized intersections per mile in rural areas.

- 25, 34, & 64: Class III / IV

More than 4.50 signalized intersections per mile. Class III applies to those facilities within the primary city CBD of an urbanized area with over 500,000 population.

- 35-38: Undivided Arterials without Turn Bays

31-34 are Undivided Arterials with Turn Bays. 35-38 use the same four classes as above, but without turn bays or turn lanes.

Facility Type 4x (Collectors) are local road facilities and are classified as follows:

- 41: Major Local Divided Roadway

Streets that are divided local collector facilities which primarily provide access between arterials and major activity centers.

- 42: Major Local Undivided Roadway with Turn Bays

Streets that are undivided local collector facilities with turn bays which primarily provide access between arterials and major activity centers.

- 43: Major Local Undivided Roadway without Turn Bays

Streets that are undivided local collector facilities without turn bays which primarily provide access between arterials and major activity centers.

- 44: Other Local Divided Roadways

Streets that are divided local collector facilities that primarily provide access to major residential areas.

- 45: Other Local Undivided Roadways with Turn Bays

Streets that are undivided local collector facilities with turn bays that primarily provide access to major residential areas.

- 46: Other Local Undivided Roadways without Turn Bays

Streets that are undivided local collector facilities without turn bays that primarily provide access to major residential areas.

- 47: Low Speed Local Collectors

Streets that are sub-collector facilities for internal circulation within residential and commercial developments.

- 48: Very Low Speed Local Collectors / Truck Restricted Facilities

Streets that are sub-collector facilities for internal circulation that exhibit traffic calming design characteristics such as speed bumps.

- 49: Transit-Only links

Connectors used for routing transit buses without adding local highway network links.

Facility Type 5x (Centroid Connectors) representing neighborhood streets and other connectors are classified as follows:

- 51: Basic Centroid

Centroid connectors providing access to TAZs with socio-economic data except those connecting external zones to the model network.

- 52: External Centroid

Those centroid connectors that provide access between external zones and the model network.

- 53: Dummy Centroid

Centroid connectors used as placeholders for TAZs not being used in the current validation of future year networks. (These can be used for other traffic studies as needed).

- 59: Walk Connector

Walk connectors used as pedestrian connections between transit modes and highway nodes.

- 65-68: Frontage Roads

One-Way streets providing access to parallel freeways and expressways via slip ramps. Frontage Roads generally include driveway access and at grade intersections with crossroads. Use the same four classes as above for the other 2's, 3's, and 6's.

- 69: Fixed Guideway Transit Links

Transit-Only links for coding fixed guideway transit modes.

Facility Type 7x (Ramps) are classified as follows:

- 71: Ramps

Generally, diamond and slip ramps for freeways on and off (speeds generally greater than 30 mph).

- 72: Loop Ramps

Generally, loop / cloverleaf ramps for freeways on and off (speeds generally less than 30 mph).

- 73: Other Ramps

Generally, diamond and slip ramps for facilities other than freeways (speeds generally greater than 30 mph).

- 74: Other Loop Ramps

Generally, loop / cloverleaf ramps for facilities other than freeways (speeds generally less than 30 mph).

- 75: Freeway-Freeway Ramps

High capacity, high speed ramps providing connection between two freeways (generally fly-over ramps).

- 76: Truck Only Ramp

High capacity, high speed ramps for trucks. Added for the new I-4 Crosstown Express Connector for trucks entering and leaving the Port area.

Facility Type 8x (HOV Facilities) are High Occupancy Vehicle facilities and are classified as follows:

- **Barrier Separated:** Physically separated from general use lanes with some form of raised median.
- **Non-Separated:** HOV lane "painted" to distinguish from general use lanes.
- **Group 1:** HOV lanes which are within an urbanized area over 500,000 population and either leading to or within 5 miles of the primary city CBD.

- **Other:** All other HOV lanes not classified in Group 1.
- **Non-Freeway:** HOV lanes along expressways or divided arterials.
- **HOV Ramps:** Categorized by time-of-day restrictions (e.g., FT 86 would be restricted to HOVs during both AM and PM peak periods while FT 87 and FT 88 are restricted to HOVs during only AM and PM peak periods respectively).

Facility Type 9x (Toll Facilities) are Toll facilities and are classified as follows:

- 91: Freeway Group 1 Toll Facility

Assumed to be equivalent to FT 11.

- 92: Other Freeway Toll Facility

Assumed to be equivalent to FT 12.

- 93: Expressway / Parkway Toll Facility

Assumed to be equivalent to FT 16 or 17.

- 94: Express Lane Toll Facility

New facility type used for Express Lane testing along with General Purpose Lanes (GPL) that are tolled using a specified number of cents per mile.

- 95: Undivided Arterial Toll Facility

Not used at this time.

- 96: Freeway Group 1 Reversible Elevated Lane Toll Facility

Crosstown Expressway reversible elevated roadway which are within an urbanized area over 500,000 in population and either leading to or within 5 miles of the primary city CBD.

- 97: Other Freeway Reversible Elevated Lane Toll Facility

Crosstown Expressway reversible elevated roadway not classified in Group 1.

- 98: Toll Ramps

These are assumed to be equivalent to FT 71 (Freeway On / Off-Ramps) but for toll facilities. FT 98 should be used only for ramps with toll plazas on the ramp itself (if not use FT 7x series). The toll plaza itself should be coded as FT 99.

- 99: Toll Plazas

All physical toll plazas need to be coded with three links per direction – a deceleration link, the toll plaza itself, and an acceleration link. The distances should be 0.2, 0.01, and 0.2 miles respectively. FT 91 or 92 should be used for acceleration and deceleration links. Electronic tolling gantries do not need separate acceleration and deceleration links coded, only the FT 99 link for the gantry structure location. All links coded as FT 99 will automatically bypass the SPDCAP file and receive all necessary information from the TOLLINK file. All toll links should store its information properly in the tolllink_YYA.dbf. These gantry type toll links would not need svcminutes or svcseconds coded since there should be no service delays at these locations.

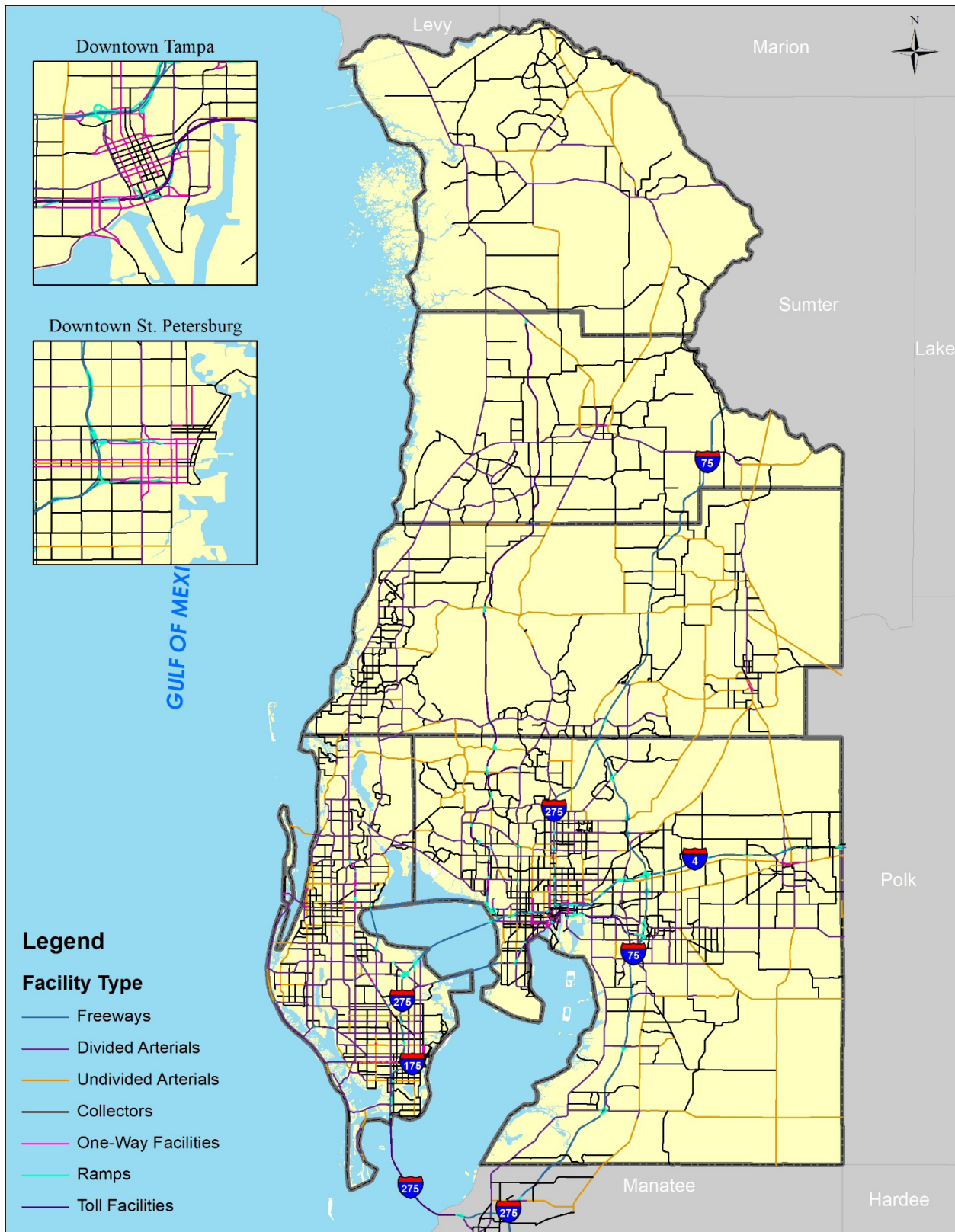


Figure 19: 2015 Base Year Facility Type Map

5.3.3 SPEED-CAPACITY TABLE

After all highway link characteristics have been input, the HIGHWAY NETWORK module internally computes and adds network attributes of speed, capacity, free-flow travel time, capacity factors such as UROAD (LOS C) factors and CONFAC factor, BPR coefficients and exponents, toll data such as toll type, cost, acceleration and deceleration and finally link costs.

Speed and capacity values are a function of the facility type, area type, and number of lanes on each link. The highway link uncongested travel speeds in miles per hour (mph) and capacity are input into the HIGHWAY NETWORK module through a Speed / Capacity Table (SPDCAP) lookup. These speeds are used in the determination of inter-zonal travel times and represent the uncongested conditions for highway links under each combination of facility type, area type, and number of lanes. The SPDCAP table is one of the key model parameters that may be adjusted during the validation process. Speeds are based upon the uncongested average travel speeds. During the assignment process speeds are adjusted to better replicate observed travel patterns based on assignment volumes and roadway capacities. Capacities used in the model represent hourly capacities of various facility types at approximately Level of Service (LOS) “E.” The adjustment of speeds and capacities is an iterative process designed to yield estimates of traffic volumes that reflect observed traffic flows. During model validation, capacities are adjusted to better represent observed capacities in the region. The validated speed and capacity tables by Facility Type and Area Type can be found in **Table 85** and **Table 86** respectively, found in *Appendix C-Highway Network*.

5.3.4 TOLL LINKS

In the TBRPM region, there are two major toll roads and several tolled bridges. The Suncoast/Veteran’s Expressway operated by the Florida’s Turnpike Enterprise aligns between the Westshore area in Hillsborough County and Northern Hernando County. The Lee Roy Selmon Crosstown Expressway operated by the Tampa Hillsborough Expressway Authority (THEA) aligns between Brandon, Downtown Tampa, and South Tampa. Tolled bridges include the I-275 Sunshine Skyway connecting south Pinellas County to Manatee County and the Pinellas Bayway bridges. **Figure 20** depicts the locations of all toll plazas in the region for 2015.

5.4 SUMMARY

In the TBRPM v9.0, the 2015 Base Year highway network accurately describes the characteristics of the transportation system elements that affect travel demand in the region. The topography of the simulated network, in concert with the input highway speeds and capacities, provides an accurate simulation of the highway traffic volumes estimated by later modeling steps.

There are more than 12,000 links in the model and approximately 10,980 lane miles of simulated highway travel lanes. These links are described by area type, facility type and number of lanes, and are assigned to various counties in a manner that is reflective of actual, observed 2015 conditions.

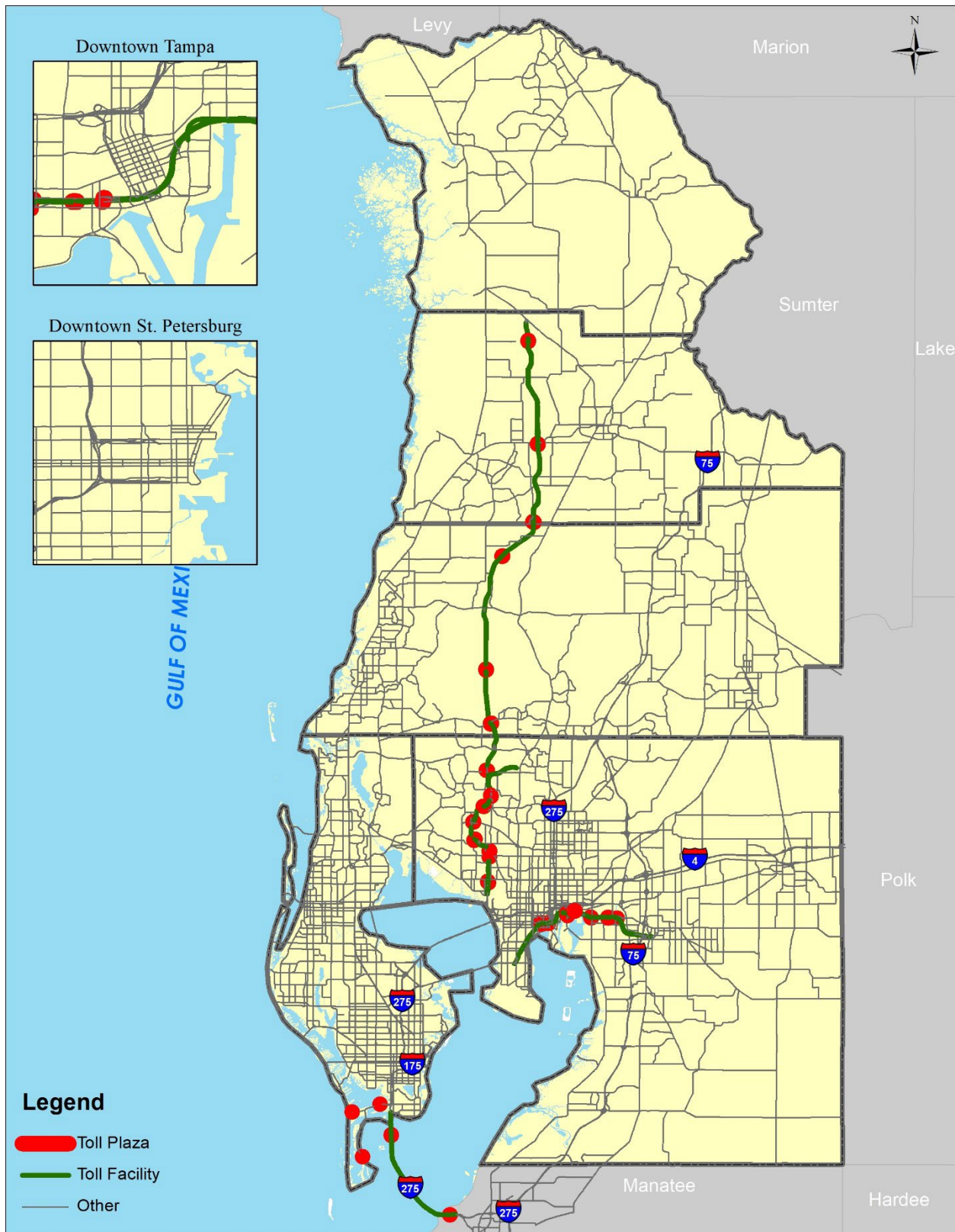


Figure 20: 2015 Base Year Toll Plaza Locations Map

Chapter 6 - HIGHWAY PATHS

The highway path building (HPATH) process identifies the minimum uncongested travel time path between each pair of zones for use later in the model chain. Path selection is important to the modeling process, as it has a significant impact on the final distribution of trips generated during the trip generation module of the model.

6.1 MODEL VALIDATION

In the TBRPM, there are several variables considered significant in determining the minimum path between any given pair of zones. These variables include:

- In-vehicle travel time,
- Terminal time,
- Prohibited and penalized movements, and
- Toll cost and service time.

Using these variables, a single composite measure of impedance is used in determining the minimum path between all pairs of zones.

6.1.1 IN-VEHICLE TRAVEL TIME

During the creation of the highway network, all highway links are assigned travel times as a function of distance and input speed from the SPDCAP file. In-Vehicle Travel Time is the primary variable being represented by these highway link travel times. If no other variables are introduced, the minimum path is determined based strictly upon this criterion.

6.1.2 TERMINAL TIME

Terminal time is the average time required at the origin (production) end of a trip to get in a vehicle and get it from a driveway to the street or it can also be the average time required to park a vehicle plus the time to reach the final destination (attraction) end of a trip. Terminal times vary according to the area type of which a zone is classified. The values applied for terminal times in the TBRPM v9.0 are presented in **Table 47**.

Terminal times are added to the in-vehicle travel time for both ends of a trip, resulting in the total travel time between a pair of zones. After these times have been calculated, they are added to the travel times calculated by the Highway Network module. The resulting travel times are then used as inputs to the gravity model.

Table 47: TBRPM v9.0 - Terminal Times by Area Type

Area Type		Terminal Time (minutes)
Central Business Districts (CBD)	11 -- Urbanized Area Primary City Central Business Districts	5
	12 -- Urbanized Area Central Business Districts and Small City Downtown areas	5
	13 -- Other Urbanized Area Central Business District and Small City Downtown	3
	14 -- Non-Urbanized Area Small City Downtown Areas	5
Central Business District Fringe	21 -- All CBD Fringe Areas	4
Residential Areas	31 -- Developed Portions of Urbanized Areas	2
	32 -- Undeveloped Portions of Urbanized Areas	2
	33 -- Transitioning Areas/Urban Areas over 5000 Population	2
	34 -- Beach Residential	2
Outlying Business Districts (OBD)	41 -- High Density Outlying Business Nodes	2
	42 -- Other Outlying Business Districts	2
	43 -- Beach OBD	2
Rural Areas	51 -- Developed Rural Areas/Small Cities under 5000 Population	1
	52 -- Undeveloped Rural Areas	1

6.1.3 PROHIBITED AND PENALIZED MOVEMENTS

In TBRPM v9.0, turn prohibitors and penalties are contained in the TURN_OP_YYA.PEN and TURN_PK_YYA.PEN, where YY is the scenario year and A is its alternative letter, for the Off-Peak and Peak turn prohibitors and penalties, respectively. Turn prohibitors and penalties are generally coded to identify turn movements in the highway network that are not permitted. The two files allow for flexibility in using different turn penalties by period if needed; otherwise most all prohibitors should be present in both periods unless there are special restrictions to be tested, such as a policy of no left turns in the Peak period for a given intersection. Another use for prohibitors and penalties is in "double-line coding" of freeway facilities, toll plazas, and interchanges where they are used to route vehicles to the proper entrance and exit ramps, as well as to prevent "U-turns" or illogical movements from occurring.

The turn prohibitors and penalties files were generated in relation to the double-line coding of all freeways and their interchanges. All interchanges were viewed on-screen and compared with detailed street maps to identify vehicle turning movements that would be prohibited due to ramp configurations. These locations were then marked on a TBRPM network plot and later entered into the turn prohibitors and penalties files.

The turn prohibitors and penalties files include time penalties, which are typically used for two purposes. First, they can represent movements that are unusually difficult, such as left turns where no signal exists. These types of time penalties are minimized during model validation, as they are difficult to assign when developing future year highway network scenarios. Second, time penalties are also used to reflect psychological impediments to travel. These are coded when the standard computations of impedance do not adequately account for perceived barriers to traveling on a specific link in the network. Common uses for these penalties include large bodies of water or large stretches of undeveloped rural areas where there is a perceived barrier to travel not accounted for purely in terms of travel time, cost, and distance. For example, a resident of a barrier island may intentionally limit the number of trips made to the mainland, and even travel a longer distance on the island to shop rather than cross a long bridge to serve the same travel need. All time penalties currently used for the model validation are between 1 and 5 minutes.

Table 48 provides a sample of the turn prohibitors and penalties file. Each row represents a turning movement, requiring three points given by the three nodes. The “Type” flags the movement as either prohibited (1) or penalized (2). The “Penalty” indicates the time penalty in minutes, with -1 representing a prohibited movement.

Table 48: 2015 Base Year Turn Prohibitors and Penalties File (Sample)

From Node	Turn Node	To Node	Type	Penalty
5050	5048	5047	1	-1
5271	5302	5309	1	-1
13693	5151	5202	2	4
12291	5263	5331	2	2

6.1.4 TOLL COST AND SERVICE TIME

The TOLLINK file is required in areas where toll facilities exist or are planned to be included in a future year model. The purpose of the TOLLINK file is to identify and account for the costs and delays associated with using toll facilities (i.e., stopping at a toll plaza to pay a toll) in the computation of travel impedance. These costs and delays impact a user's potential decision of whether or not to travel on the toll facility. The TOLLINK file contains the following data for each toll plaza link in the highway network:

- Toll class
- Toll type
- Node numbers at both ends of the toll links
- Identification of Toll Plaza locations (text)
- Number of lanes
- Number of Toll Plaza lanes
- Toll value / cost
- Average service time
- Deceleration and acceleration codes
- Number of exact change and AVI lanes
- Percent of heavy trucks (for reporting only)

The toll facilities model converts dollars, or units of toll, to equivalent units of time. In the Base Year 2015 network, there are 58 toll collection facilities. Most of these are located on facilities operated by the Florida Turnpike or the Hillsborough County Expressway Authority. Toll costs are converted to travel time through a parameter called CTOLL. In the Year 2015 network validation, a range of values from 0.052 to 0.152 was used for the CTOLL parameter to better validate across the region to varying values of time by county, with the default being 0.06. It is assumed that the value of time for a typical user of a toll facility during the peak hour is equivalent with their average wage rate since the value of time during this period would be higher. The typical formulation of CTOLL is as follows:

$$CTOLL = 1 / (\text{Wage Rate} * A)$$

where A, derived from other mode choice studies, is the approximate value of time which is 30 to 40 percent of the average wage rate for the study area. Therefore, the amount of time added to a highway link for travel time (T) that represents the imposition of a toll is as follows:

$$T = CTOLL * TOLL$$

where TOLL is defined as the link toll cost.

Service times and other monetary costs for the toll facility are also converted to travel time, and these values are added to the regular travel time for toll links, based upon link speeds. At this point in the process, a single composite measure of impedance, represented by adjusted travel time, can be used to determine the minimum path between all pairs of zones. The calculations of impedance based on the combination of time and distance (on non-toll links) or time and toll (on toll links) are as follows:

For non-toll links,

$$IMPED = CTIME * TIME$$

For toll links,

$$\text{IMPED} = \text{CTIME} * (\text{SERVT} + \text{TIME}) + \text{CTOLL} * \text{TOLL}$$

Where,

CTIME = a time coefficient,

TIME = travel time on the link, and

SERVT = service time at toll booths.

6.1.5 VOLUME-DELAY CURVES BY TIME-OF-DAY

Volume Delay Curves, or functions, are used during the highway assignment process to adjust the free-flow speed of a link to a more realistic travel speed which is caused by congestion (volume) on the link. The TBRPM uses several functions to account for various aspects of the calculation of congested travel time within each highway link group. The largest highway link group is the non-toll links. Non-toll links use a function which increases the travel time, in addition to the free-flow time, for a link by using the volume to capacity ratio of the link. Since the TBRPM is now a Time-of-Day model, the calculation of capacity has been adjusted to accommodate four (4) separate time periods; AM – 6:30AM to 9:00AM (2.5 hours), MD – 9:00AM to 3:30PM (6.5 hours), PM – 3:30PM – 6:30PM (3 hours), and EV – 6:30PM to 6:30AM (12 hours). None of these time periods are the same size. So, four distinct capacity/congestion factors (CONFACs) have been developed to be applied in calculating a links capacity by time period. The factors themselves represent the percent of traffic in the worst congested hour of each time period. In contrast to the daily model, only one factor was generally used which was 0.09, the default for FDOT. This default factor basically represents that 9% of the daily traffic flowed through the worst peak hour of the day. So, the daily model assigned traffic was assigned using the worst peak hour congested speeds and equivalent capacity for daily traffic. Because there are now four (4) time periods and CONFACs, the model capacities summed for the four time periods don't equal the capacity as expressed in the daily model using the default CONFAC. These capacities should not be confused as to represent the total capacity of the network, but they are the equivalent capacity needed to represent the worst peak hour speeds and capacity for each time period.

To calculate the congested travel time for a non-toll link, the volume of a link is divided by the link's time period capacity to produce the link's V/C ratio. Applying other factors to the V/C ratio, a time of delay is calculated and added to the link's free-flow time for the next iteration in the assignment process. Other highway link groups include the toll links, with associated acceleration and deceleration links near the major toll facilities, a class of links which are truck only ramps, and lastly express lane links which are toll links but are treated with tolls being calculated in cents per mile and not a fixed toll value. Toll links are different when it comes to the Volume Delay functions. Their travel time reflects toll dollars and service time spent at the toll booth converted to travel time. Although, most tolls in the area are now being converted to electronic tolling so the service time is not as necessary as before. The toll acceleration and deceleration links have the same volume delay function as the non-toll links, so their travel time goes up as the volume increases, but their free-flow travel time is first adjusted by either an acceleration or deceleration rate factor. Truck only links are treated as the other non-tolled links but had to be separated as a group for proper assignment. Lastly, the express lanes have a combination volume delay function which uses the travel time of the link plus a converted toll equivalent time and then has to apply the V/C ratio time of delay for the final congested time. The following list of functions represents the implementation of the Volume Delay function in the Cube script environment:

- $\text{TC}[1] = \text{T0} * (1 + (\text{LI.BPRCOEFFICIENT} * (\text{V/C}) ^ \text{LI.BPREXPONENT}))$;congested time (min) for non-toll links
- $\text{TC}[2] = (\text{LW.CTOLL} * \text{LI.CARTOLL} * 60) + \text{LI.SVCMINUTES} + (\text{LI.SVCSECONDS} / 60)$;congested time (min) for toll links
- $\text{TC}[3] = \text{T0} * (1 + (\text{LI.BPRCOEFFICIENT} * (\text{V/C}) ^ \text{LI.BPREXPONENT}))$;congested time (min) for toll acceleration links
- $\text{TC}[4] = \text{T0} * (1 + (\text{LI.BPRCOEFFICIENT} * (\text{V/C}) ^ \text{LI.BPREXPONENT}))$;congested time (min) for toll deceleration links
- $\text{TC}[5] = \text{T0} * (1 + (\text{LI.BPRCOEFFICIENT} * (\text{V/C}) ^ \text{LI.BPREXPONENT}))$;congested time (min) for non-toll TRUCK ONLY links
- $\text{TC}[6] = \text{T0} * (1 + (\text{LI.BPRCOEFFICIENT} * (\text{V/C}) ^ \text{LI.BPREXPONENT}))$;congested time (min) for express links

- $\text{COST}[1] = \text{TIME}$;congested COST (min) for non-toll links
- $\text{COST}[2] = \text{TIME} + \text{ROUND}((1 / (\text{LW.SERVR} - \text{LW.ARRIVR})) * 60 * 1000) / 1000$;congested COST (min) for toll links
- $\text{COST}[3] = \text{TIME} + \text{ROUND}(((\text{LW.CGSTSPED} / \{\text{ACCELRATE}\}) / 60) / 2 * 1000) / 1000$;congested COST (min) for toll acceleration links

- $COST[4] = TIME + ROUND(((LW.CGSTSPEED / DECEL(1, LW.CGSTSPEED)) / 60) / 2 * 1000) / 1000$; congested COST (min) for toll deceleration links
- $COST[5] = TIME$;congested COST (min) for non-toll TRUCK ONLY links
- $COST[6] = TIME + (LW.CTOLL * LW.ELTOLL * 60)$;congested COST (min) for express lanes

6.1.6 ISOCHRON MAPS FOR CONNECTIVITY

Figure 51, Figure 52, Figure 53, Figure 54, Figure 55, Figure 56, and Figure 57 in *Appendix D- Highway Network* are Isochrone maps which provide travel times in minutes to and from selected zones from all other zones in the model using the highway network.

The gray zones highlight the selected zones or adjacent zones. Travel time ranges from dark blue (shortest travel time) to red (longest travel time). These zones were selected to highlight major activity areas in each county.

6.2 SUMMARY

Highway path development is a critical component of the FSUTMS model stream. Paths not only prescribe the roadways and modes to which trips are to be assigned, but they also provide input into mode choice and transit speed calculations. For all zonal pairs, minimum paths are determined based upon the least impedance criteria. The Highway Path calculation includes In-Vehicle Travel Time (IVTT), prohibited and penalized movements, and toll costs with service time. As such, care was used in developing parameters, such as turn penalties and turn prohibitors that act to modify the paths selected within the TBRPM. Similarly, a thorough understanding of the dynamics of a particular facility, or type of facility (such as a future HOV), has allowed for modification of the path building process to yield paths which closely reflect what drivers perceive as the minimum path between zonal pairs.

Chapter 7 - TRIP DISTRIBUTION

7.1 MODELING PROCESS

The Trip Distribution model matches trip productions to trip attractions using the gravity model. It also computes the intrazonal and terminal times and adds them to the free skim time for the gravity model. Preliminary highway assignment and development of congested travel time skims are also conducted in this module.

The Trip Distribution validation procedure is an iterative process, where a set of travel time factors is developed for each trip purpose. Calibration of the gravity model centers on the adjustment of the friction factor component of the equation. The FSUTMS gravity model is an adaptation of the classic Newtonian model and is mathematically expressed as:

$$T_{ij} = P_i \frac{A_j F_{ij} K_{ij}}{\sum_{j=1}^n A_j F_{ij} K_{ij}}$$

where:

T_{ij} = trip produced in zone i and attracted to zone j ;

P_i = total trip production at i ;

A_j = total trip attraction at j ;

F_{ij} = friction factor representing impedance for interchange between zones i and j ;

K_{ij} = socioeconomic adjustment factor for interchange between zones i and j ;

i = origin zone number, $i = 1, 2, 3 \dots n$;

j = destination zone number $j = 1, 2, 3 \dots n$;

n = number of zones.

7.1.1 TRAVEL TIME SKIM DETERMINATION

Based on the inter-zonal highway path calculations outlined in *Chapter 5 - Highway Network*, the shortest possible In-Vehicle Travel Time (IVTT) can be determined for trips between any pair of zones. This serves as the primary measure of impedance for all vehicular trip purposes and as the initial measure of time used to develop the distribution of person trips. A similar process is followed to determine congested travel time skims.

Before uncongested travel time skims are used in the gravity model, two additional measures of time must be estimated, intrazonal travel time and out-of-vehicle travel time (Terminal Time). These added measures of highway travel time are the basis for distribution of all vehicle trip purposes and are the basis for the pre-distribution of person trip purposes.

7.1.2 INTRA-ZONAL TRAVEL TIMES

Intrazonal travel time is the time needed for a trip between two sites within the same zone. Little information is generally available concerning intrazonal travel times, but it is reasonable to assume that they are lower than times computed for traveling to another zone.

FSUTMS estimates intrazonal travel time based upon the nearest neighbor theory. This theory postulates that intrazonal travel time is proportional to the amount of time it takes to get to the nearest adjacent zone or zones. The TBRPM follows standard practice that intrazonal travel time is equal to the following:

$$IZ_i = \frac{IVTT_a}{2}$$

where:

IZ_i = intrazonal travel time for zone i , and

$IVTT_a$ = in-vehicle travel time to nearest adjacent zone.

7.1.3 TERMINAL TIMES

Terminal times are the average time required at the origin (production) end of a trip to get in a vehicle and get it from a driveway to the street or it can also be the average time required to park a vehicle plus the time to reach the final destination (attraction) end of a trip. Terminal times vary according to the area type of which a zone is classified. The values applied for terminal times in the TBRPM v9.0 are presented in **Table 47** and discussed in *Chapter 6 - Highway Paths*.

Terminal times are added to the in-vehicle travel time for both ends of a trip, resulting in the total travel time between a pair of zones. After these times have been calculated, they are added to the travel times calculated by the Highway Network module. The resulting travel times are then used as inputs to the gravity model.

7.1.4 FRICTION FACTORS

Different friction factors are used for peak period distribution versus off-peak period distribution for home based shopping, home based social/recreational, home based school, and home based other trip purposes.

7.1.5 SEPARATE DISTRIBUTION FOR ZERO-CAR AND ONE-PLUS CAR HOUSEHOLDS

Zero-car household distribution is handled in the Mode Choice module separately from the 1+ Car HH trip distribution. Federal Transit Administration (FTA) wants the model to consider zero-car household distribution using transit skims because when all households are combined for distribution, zero-car HH trips may not be distributed fairly with respect to their trip making characteristics. This may cause more non-transit trips than transit trips for zero-car HHs which are normally the largest market for transit use. The best solution may require a mix between auto and transit skims. Currently, only auto skims are used, but zero-car household trips are treated separately from 1+ car household trips.

7.1.6 PERIOD DISTRIBUTION

For Distribution there are only two periods considered: Peak and Off-Peak. Off-peak trip distribution uses free-flow conditions and peak period trips are distributed through a congested skim feedback process. For this feedback process, six (6) iterations of trip distribution and preliminary assignment of AM peak period trips are used to converge to the best average congested AM peak period auto skims which are used in a final distribution of peak period person trips. The final distribution of Peak and Off-Peak, Zero-car and 1+ car household person trips are combined before being processed in the Mode Choice module.

7.2 MODEL VALIDATION

Table 49 shows the trip length frequency distributions for all purposes from the Off-Peak period trips using Free-Flow skims. The validation trip length summary statistics for Peak period trips using the final congested highway skim is found in **Table 50**.

Figure 21 and **Figure 22** present the trip length frequency distributions for Home-Based Work (HBW) trips. The distribution of HBW trips is extremely important in the transportation modeling process. It is this trip purpose that usually determines peak-hour usage, and is often the trip purpose for which facilities are designed. The daily mean congested travel time for HBW trips is approximately 26.6 minutes. This compares favorably with reported average trip lengths from the 2000 Census, which range from 20 to 24 minutes

CHAPTER 7 – TRIP DISTRIBUTION

for counties in the study area. The model trip length is a bit shorter than the reported trip lengths from the 1993, 1996, and 2007 household surveys. This is reasonable given how travelers perceive and report time (usually rounded up to the nearest 5-minute increment). Based on a comparison of Census information, other studies conducted around Florida and other urban models, it appears that the reported trip length on the household surveys indicates perceived trip duration and is typically overstated for all trip purposes.

Table 49: 2015 Base Year Off-Peak Average Trip Length Summaries

Trip Purpose	Trip-Minutes	Trip-Miles	Total Trips	Average Trip Length (Min)	Average Trip Length (Miles)
HBW	20,771,455	10,039,894	918,745	22.61	10.93
HBSH	10,836,516	4,287,190	720,673	15.04	5.95
HBSR	33,433,317	14,669,701	1,902,595	17.57	7.71
HBSC	5,709,147	1,956,012	429,730	13.29	4.55
HBO	17,529,185	7,329,355	1,057,796	16.57	6.93
NHBW	5,816,314	2,317,625	360,189	16.15	6.43
NHBO	19,146,350	7,622,203	1,200,625	15.95	6.35
LTRK	1,917,608	823,737	112,904	16.98	7.30
HTRK	2,448,197	1,636,340	56,506	43.33	28.96
TAXI	492,284	195,051	30,119	16.34	6.48
EI	6,150,531	4,449,880	116,168	52.95	38.31
AIRP	1,508,179	879,415	42,729	35.30	20.58
COL/UNIV	2,987,604	1,417,039	134,353	22.24	10.55
Total	128,746,688	57,623,441	7,083,132	18.18	8.14

Table 50: 2015 Base Year Peak Average Trip Length Summaries

Trip Purpose	Trip-Minutes	Trip-Miles	Total Trips	Average Trip Length (Min)	Average Trip Length (Miles)
HBW	31,714,114	11,590,526	1,192,826	26.59	9.72
HBSH	5,278,293	1,682,166	319,868	16.50	5.26
HBSR	16,757,581	5,655,465	917,342	18.27	6.17
HBSC	10,880,525	3,375,009	747,941	14.55	4.51
HBO	19,177,248	6,624,509	907,978	21.12	7.30
NHBW	3,665,876	1,181,016	233,217	15.72	5.06
NHBO	9,301,464	2,995,886	600,287	15.50	4.99
LTRK	1,200,085	432,133	72,230	16.61	5.98
HTRK	1,261,266	702,660	26,045	48.43	26.98
TAXI	416,107	139,623	24,566	16.94	5.68
EI	3,469,363	1,952,041	46,077	75.29	42.36
AIRP	984,821	436,027	20,966	46.97	20.80
COL/UNIV	3,949,355	1,452,038	144,677	27.30	10.04
Total	108,056,096	38,219,099	5,254,021	20.57	7.27

HBW (Off-Peak) Trip Length Frequency

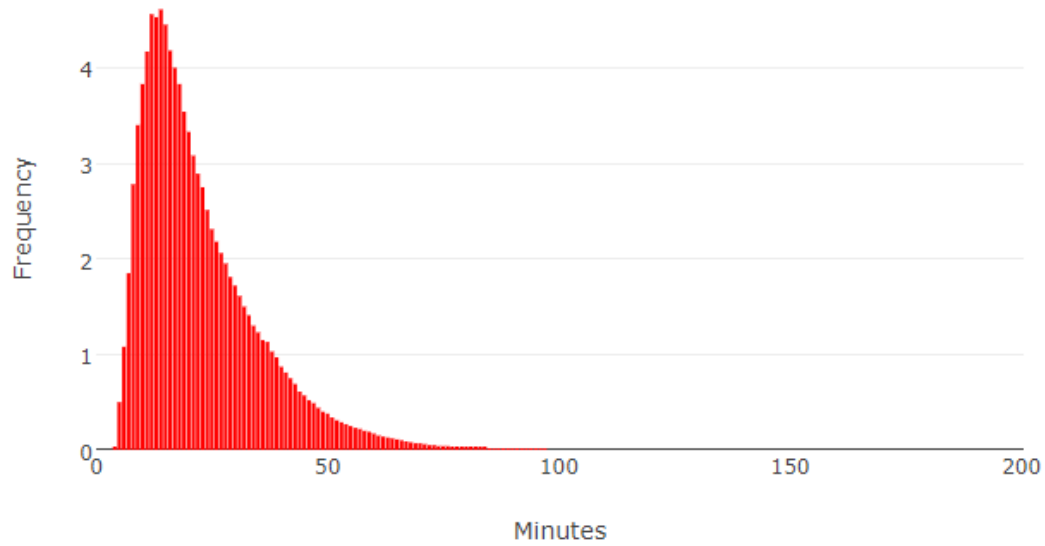


Figure 21: 2015 Home-Based Work (HBW) Off-Peak Period Trip Length Frequency

HBW (Peak) Trip Length Frequency

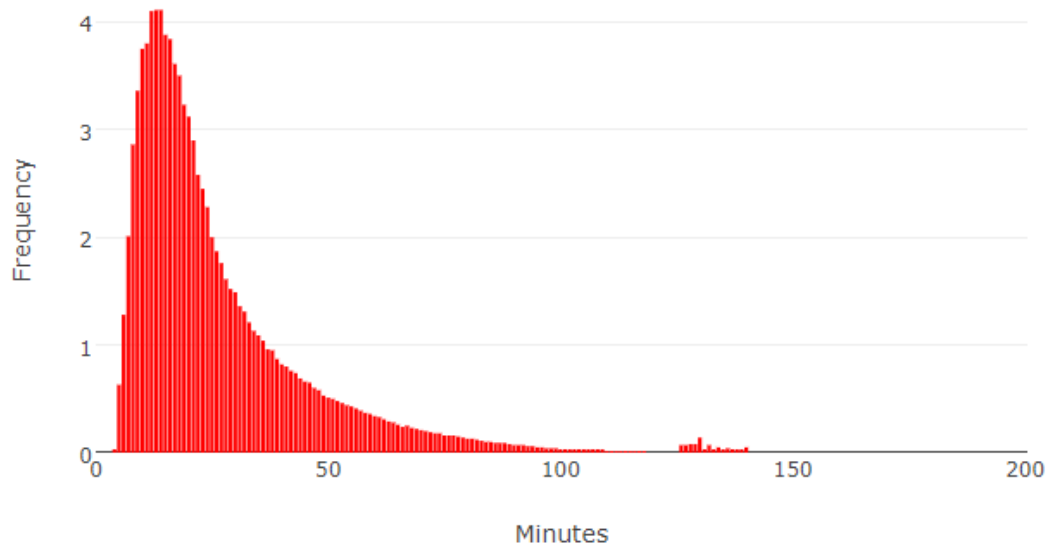


Figure 22: 2015 Home-Based Work (HBW) Peak Period Trip Length Frequency

Figure 26 and **Figure 27** present the trip length frequency distributions for Home-Based Shopping (HBSH) trips. Usually, it is expected that home-based shopping trips are shorter in duration than home-based work trips. The 2015 scenario of the TBRPM v9.0 has a mean peak period travel time for home-based shopping trips of 16.5 minutes, an average much shorter than for work trips.

HBSH (Off-Peak) Trip Length Frequency

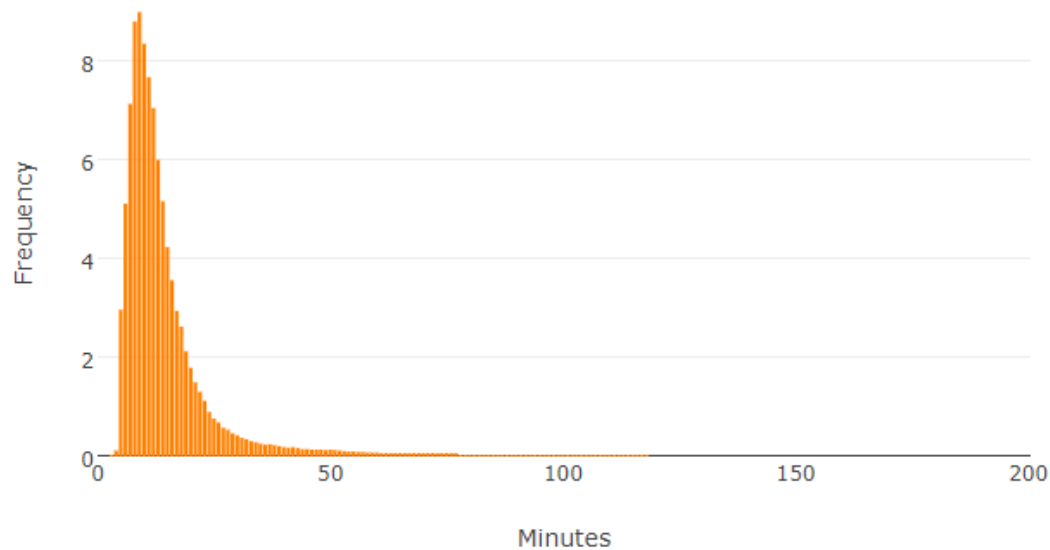


Figure 23: 2015 Home-Based Shopping (HBSH) Off-Peak Period Trip Length Frequency

HBSH (Peak) Trip Length Frequency

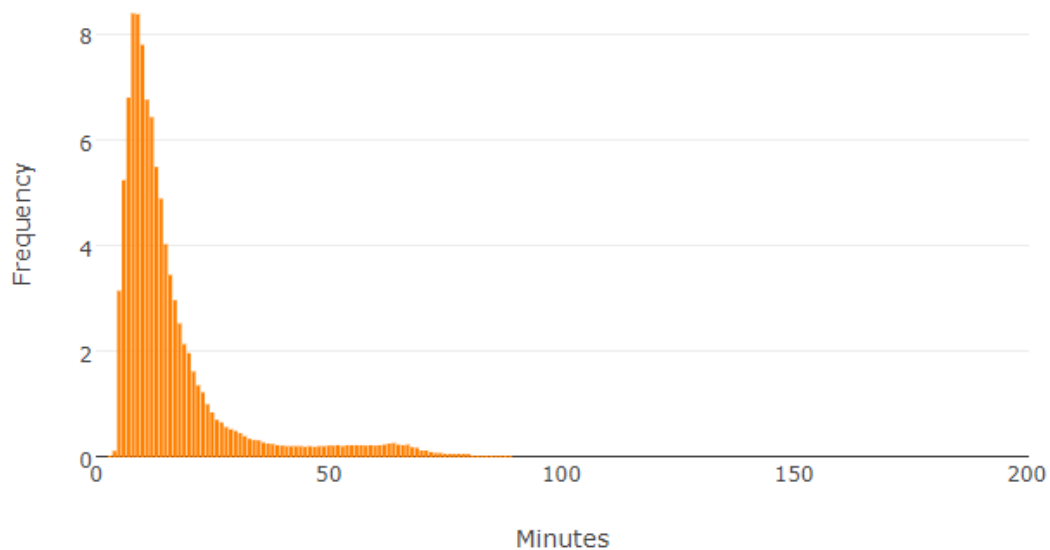


Figure 24: 2015 Home-Based Shopping (HBSH) Peak Period Trip Length Frequency

On the following pages there are several representations of the trip length frequency curves as generated by the model. **Figure 25** and **Figure 26** present the trip length frequency distributions for Home-Based Social / Recreation (HBSR) trips. As urban development patterns and transportation infrastructure are unique to each urban area, trip length frequency distributions are unique to each urbanized area, as well. Usually, it is expected that, like home-based shopping trips, home-based social / recreation trips are shorter in duration than home-based work trips. However, they should be longer than general shopping trips. The 2015 scenario of the TBRPM v9.0 has a mean peak period travel time for home-based social / recreation trips of 18.3 minutes. As expected, the mean trip length for these trips is shorter than that for work trips but longer than shopping trips.

Figure 27 and **Figure 28** presents the trip length frequency distributions for Home-Based School (HBSC) trips. The average peak period trip length for home-based school trips is 14.6 minutes.

Figure 29 and **Figure 30** presents the trip length frequency distributions for Home-Based Other (HBO) trips. The HBO trip purpose represents a significant number of trips in the model. The 2015 scenario of the TBRPM has a mean peak period travel time for HBO trips of 21.1 minutes.

Figure 31 and **Figure 32** show that the 2015 scenario of the TBRPM has an average peak period travel time for Non-Home-Based Work (NHBW) trips of 15.7 minutes. As expected, these travel times are shorter than that for work trips.

Figure 33 and **Figure 34** shows that the 2015 scenario of the TBRPM has an average peak period travel time for Non-Home Based Other (NHBO) trips of 15.5 minutes.

Truck trips are estimated to account for over 267,000 daily trips. The mean peak period travel times for these trips range from 16.6 minutes for light truck trips to 48.4 minutes for heavy truck trips. **Figure 35**, **Figure 36**, **Figure 37**, and **Figure 38** show the travel time distributions for these truck purposes, respectively.

Taxi trips are estimated at almost 54,000 daily trips in the Tampa Bay region. The mean peak period travel time for these trips is 16.9 minutes. **Figure 39** and **Figure 40** show the travel time distributions for taxi trips.

As explained in *Chapter 4 - Trip Generation* of this report, External-to-Internal (EI) occasional trips are long distance trips that do not have the same characteristics as routine External-to-Internal travel. Occasional EI trips for the 2015 scenario of the TBRPM have an average trip length of 75.3 minutes in the peak period. **Figure 41** and **Figure 42** show the travel time distributions for EI *occasional* trips. Routine EI trips, by contrast, have trip distribution characteristics similar to Internal-to-Internal (II) travelers. They compete with internal travelers for trip attractions. Therefore, they are distributed with internal trips by trip purposes and are accounted for in those statistics.

Airport trips are estimated to account for approximately 63,700 daily trips. The mean peak period travel time for these trips is 47.0 minutes. **Figure 43** and **Figure 44** show the travel time distributions for this purpose.

College / University trips account for approximately 279,000 daily trips in the Tampa Bay region. The mean peak period travel time for these trips is 27.3 minutes. The average travel time for College / University trips is slightly less than that of Home-Based Work (HBW) trips. **Figure 45** and **Figure 46** show the travel time distributions for this purpose.

Figure 47 and **Figure 48** Shows the travel time distribution for all trip purposes. On average, the mean peak period travel time for all trip purposes is 20.6 minutes.

HBSR (Off-Peak) Trip Length Frequency

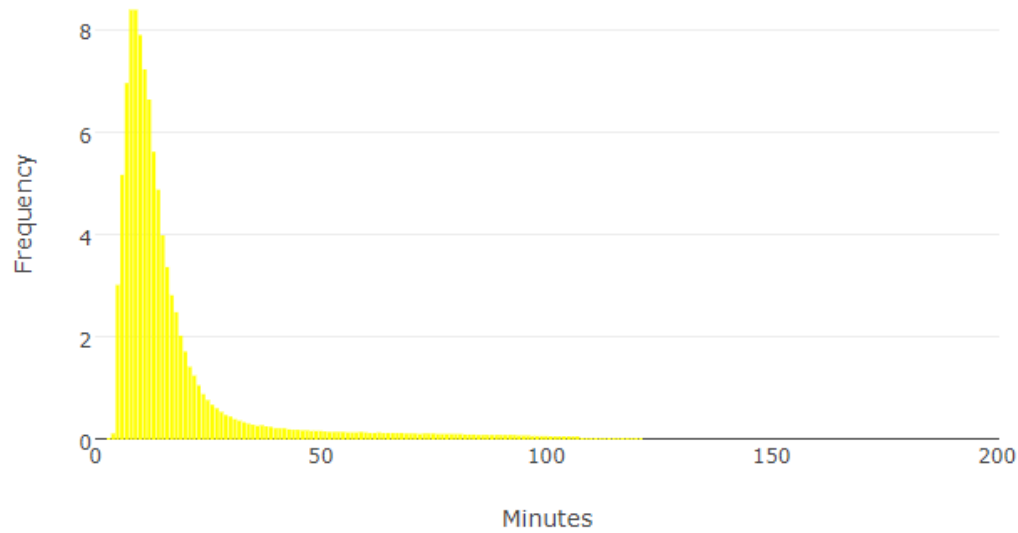


Figure 25: 2015 Home-Based Social Recreation (HBSR) Off-Peak Period Trip Length Frequency

HBSR (Peak) Trip Length Frequency

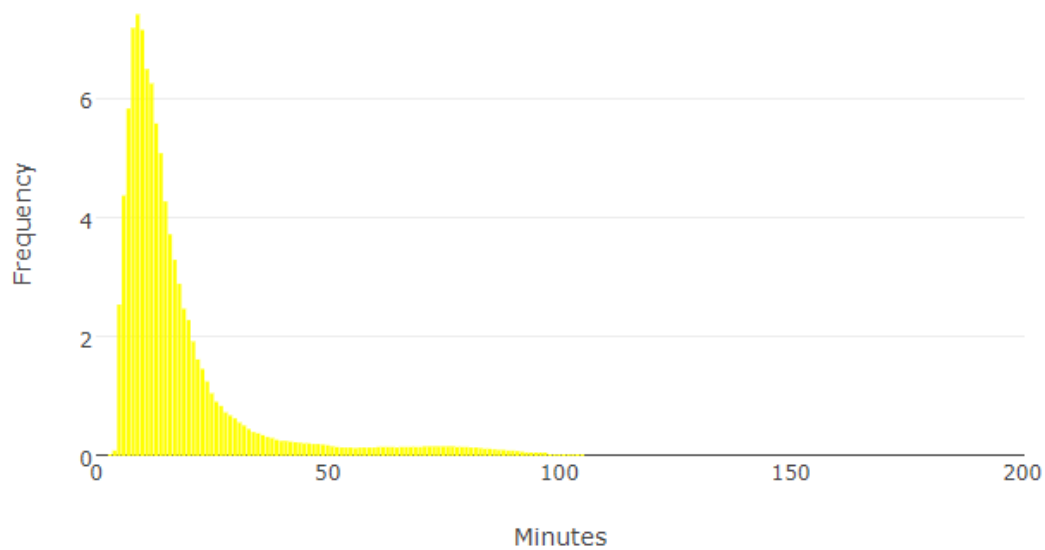


Figure 26: 2015 Home-Based Social Recreation (HBSR) Peak Period Trip Length Frequency

HBSC (Off-Peak) Trip Length Frequency

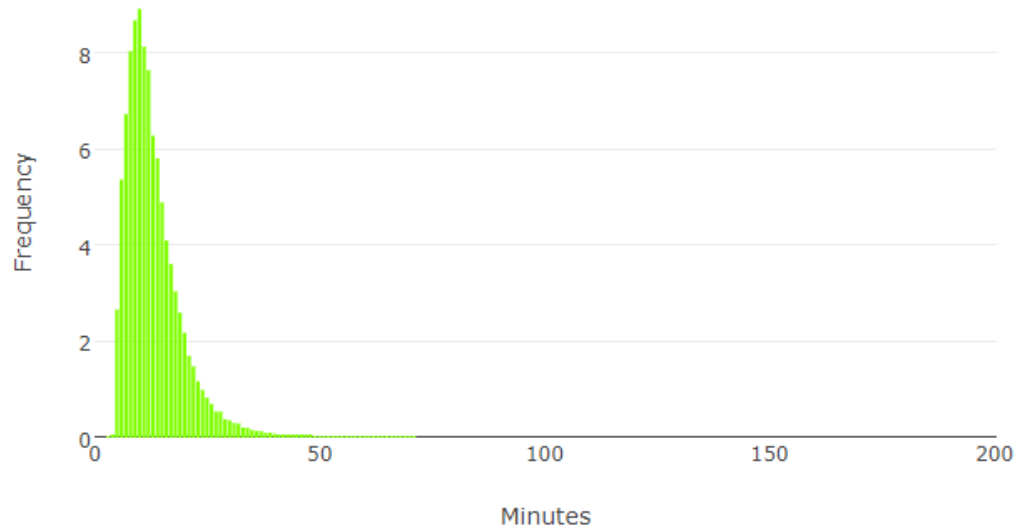


Figure 27: 2015 Home-Based School (HBSC) Off-Peak Period Trip Length Frequency

HBSC (Peak) Trip Length Frequency

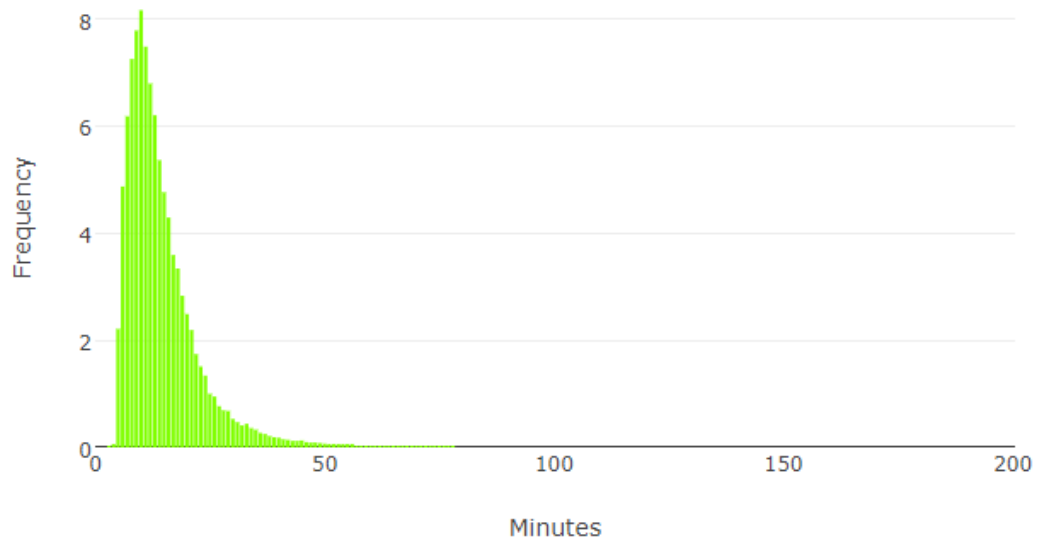


Figure 28: 2015 Home-Based School (HBSC) Peak Period Trip Length Frequency

HBO (Off-Peak) Trip Length Frequency

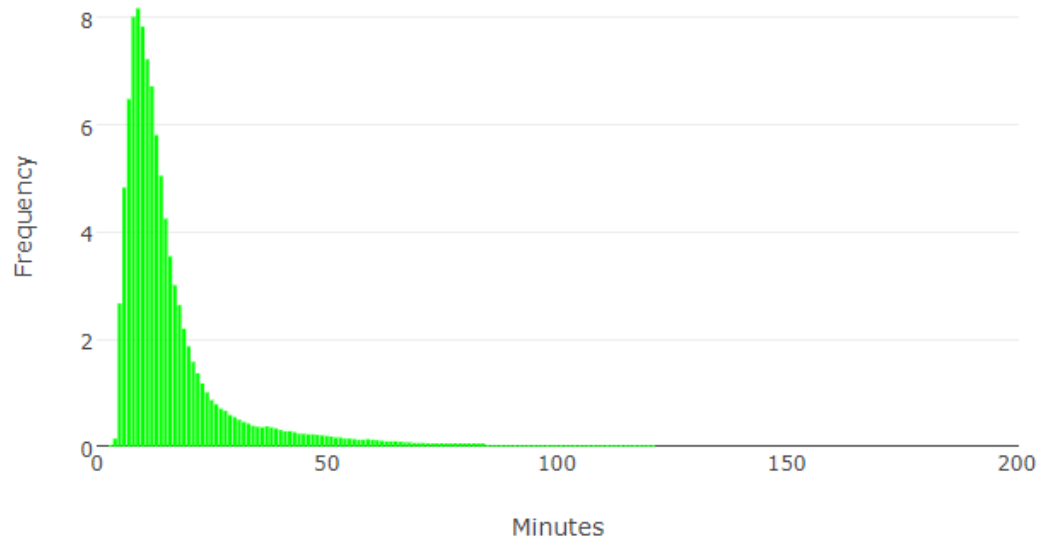


Figure 29: 2015 Home-Based Other (HBO) Off-Peak Period Trip Length Frequency

HBO (Peak) Trip Length Frequency

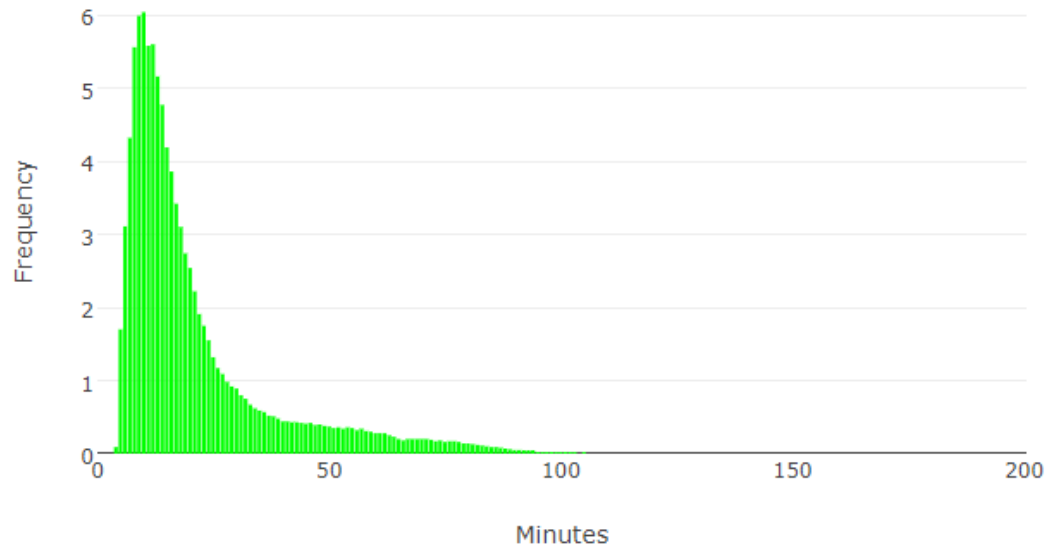


Figure 30: 2015 Home-Based Other (HBO) Peak Trip Length Frequency

NHBW (Off-Peak) Trip Length Frequency

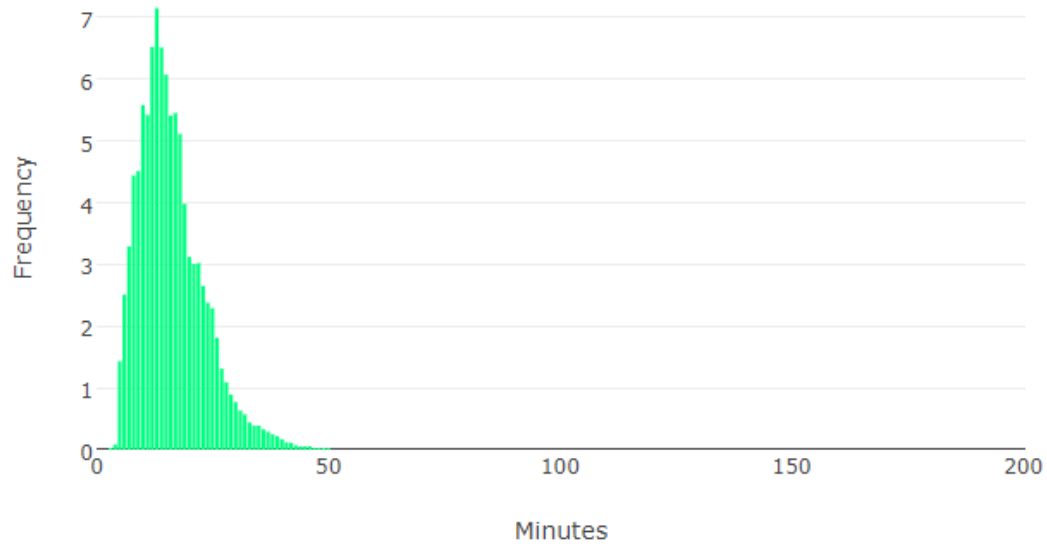


Figure 31: 2015 Non-Home-Based Work (NHBW) Off-Peak Period Trip Length Frequency

NHBW (Peak) Trip Length Frequency

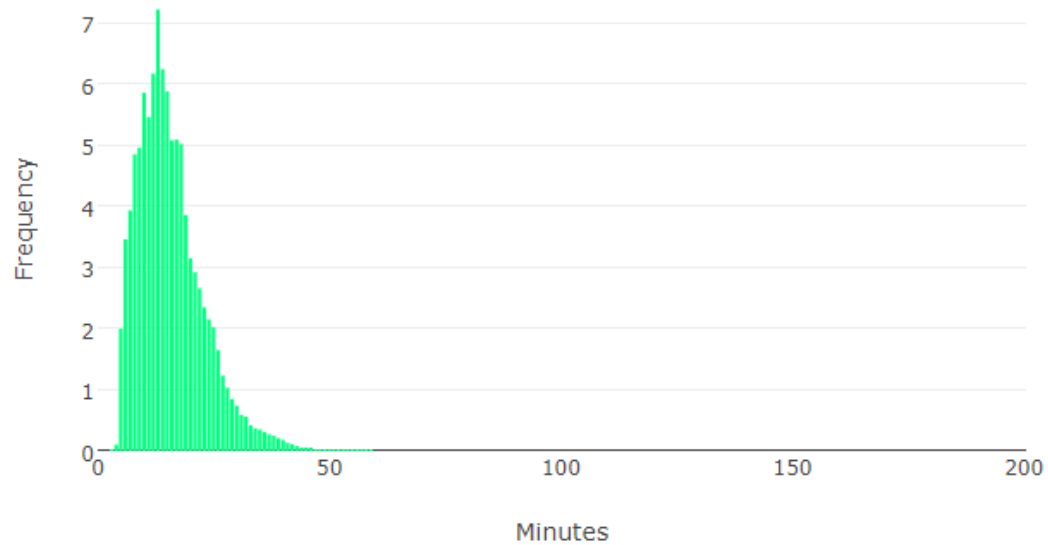


Figure 32: 2015 Non-Home-Based Work (NHBW) Peak Period Trip Length Frequency

NHBO (Off-Peak) Trip Length Frequency

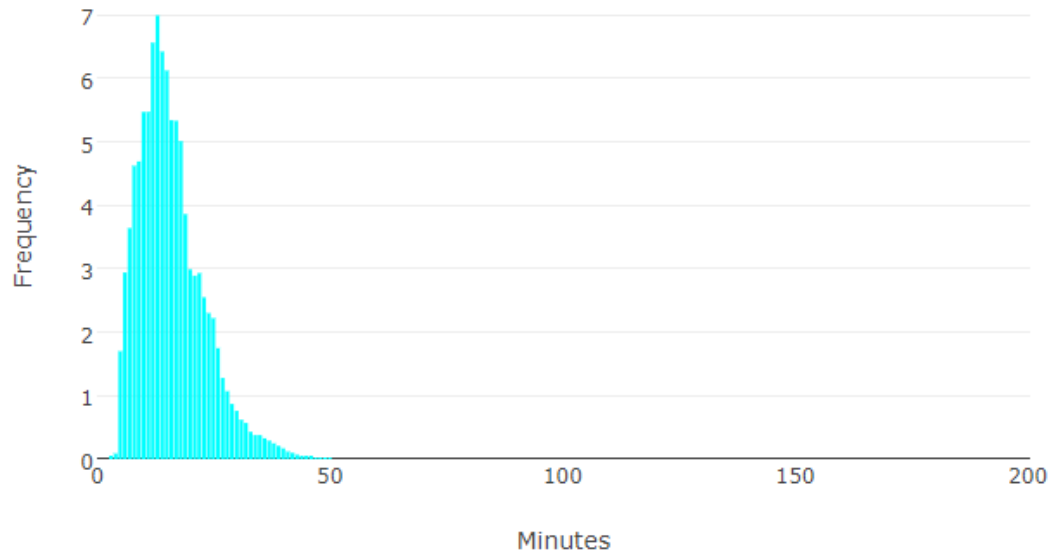


Figure 33: 2015 Non-Home-Based Other (NHBO) Off-Peak Period Trip Length Frequency

NHBO (Peak) Trip Length Frequency

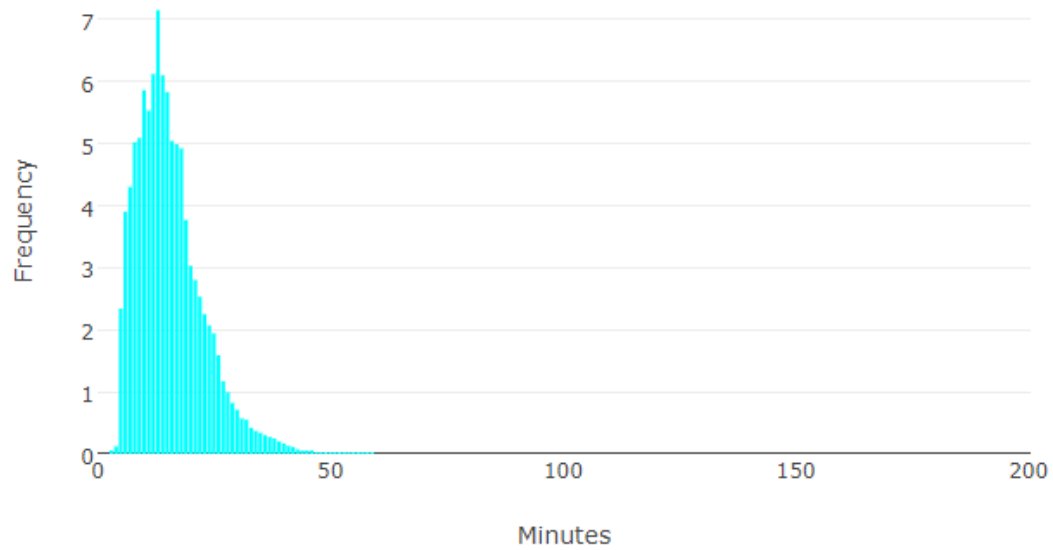


Figure 34: 2015 Non-Home-Based Other (NHBO) Peak Period Trip Length Frequency

LTRK (Off-Peak) Trip Length Frequency

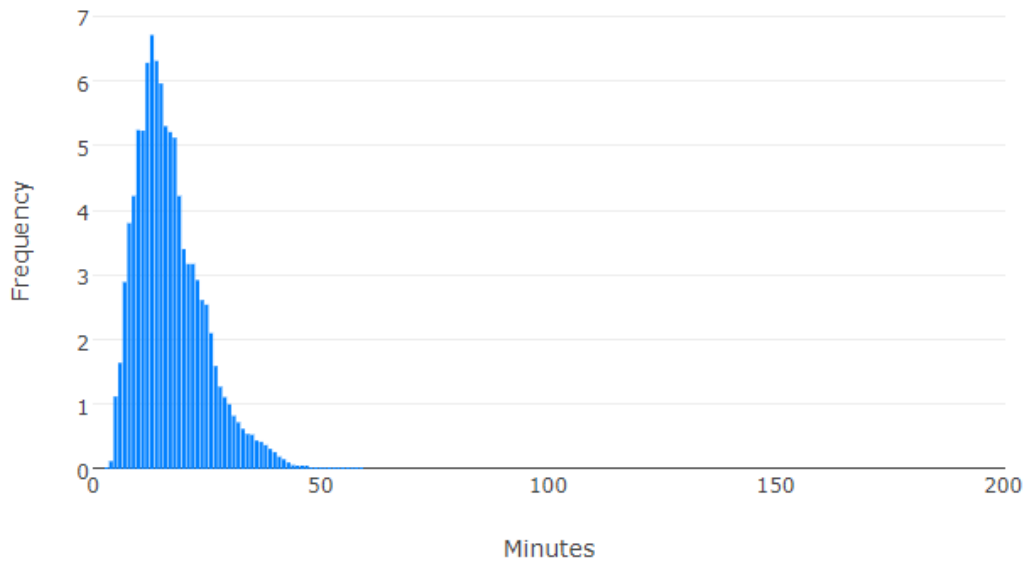


Figure 35: 2015 Light Truck (LTRK) Off-Peak Period Trip Length Frequency

LTRK (Peak) Trip Length Frequency

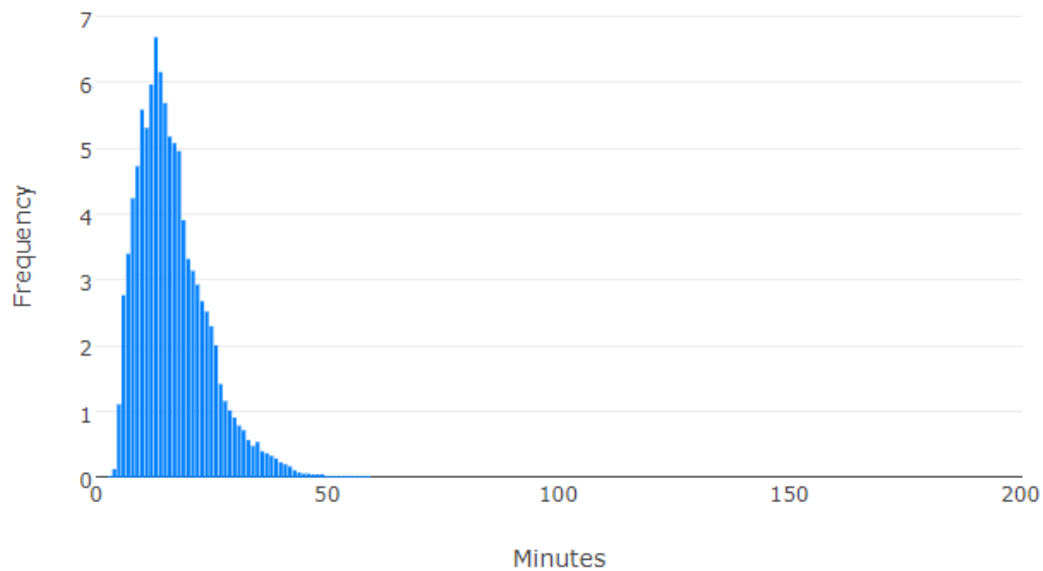


Figure 36: 2015 Light Truck (LTRK) Peak Period Trip Length Frequency

HTRK (Off-Peak) Trip Length Frequency

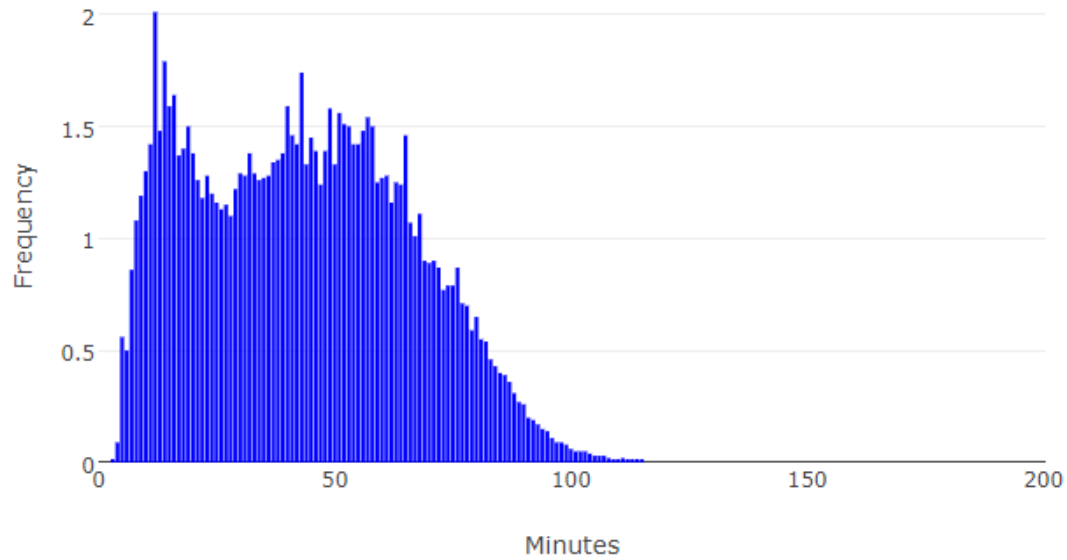


Figure 37: 2015 Heavy Truck (HTRK) Off-Peak Period Trip Length Frequency

HTRK (Peak) Trip Length Frequency

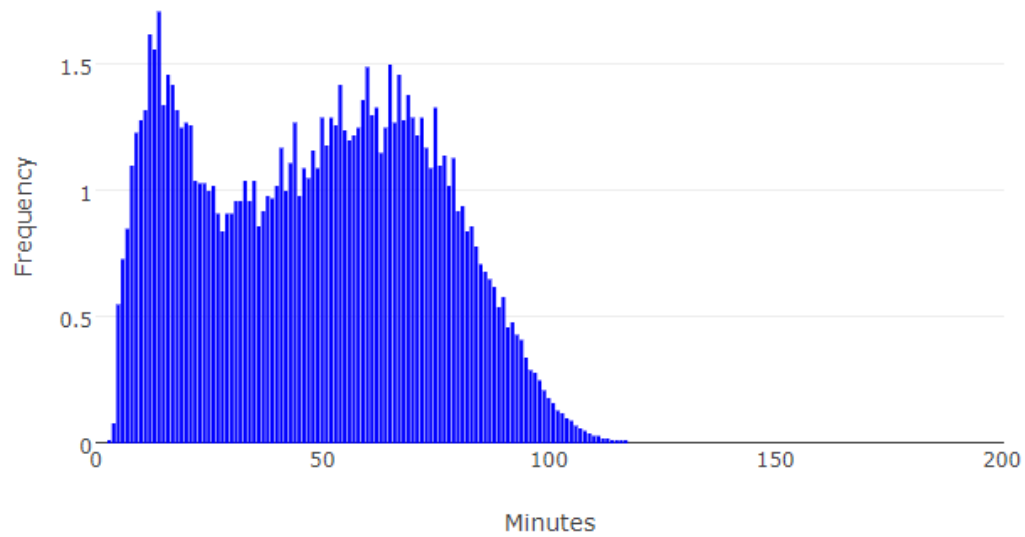


Figure 38: 2015 Heavy Truck (HTRK) Peak Period Trip Length Frequency

TAXI (Off-Peak) Trip Length Frequency

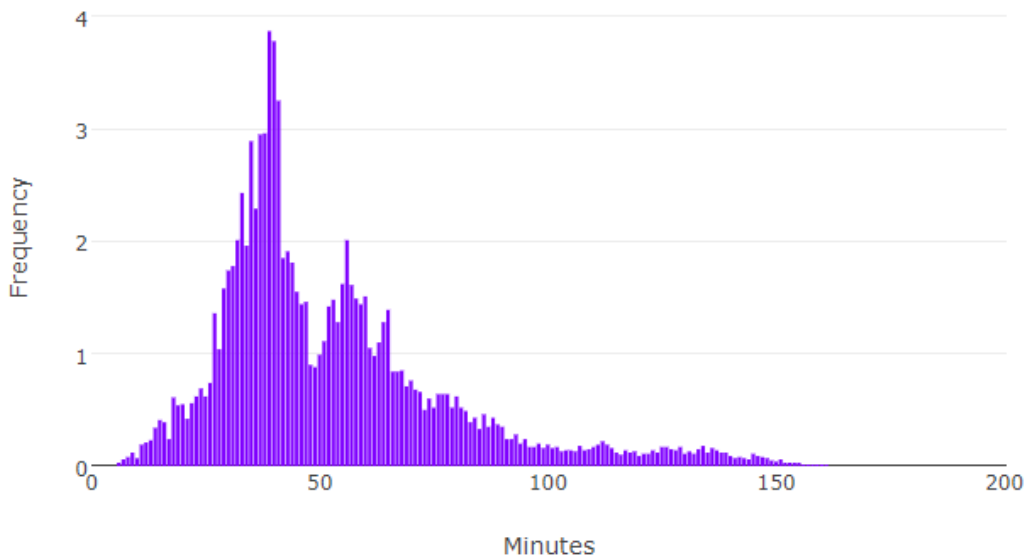


Figure 39: 2015 Taxi Off-Peak Period Trip Length Frequency

TAXI (Peak) Trip Length Frequency

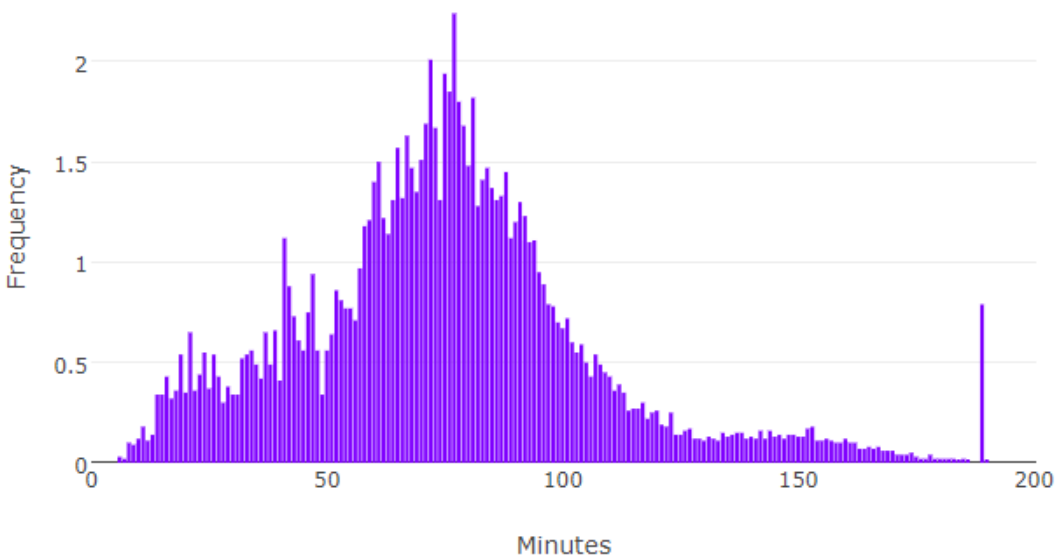


Figure 40: 2015 Taxi Peak Period Trip Length Frequency

EI (Off-Peak) Trip Length Frequency

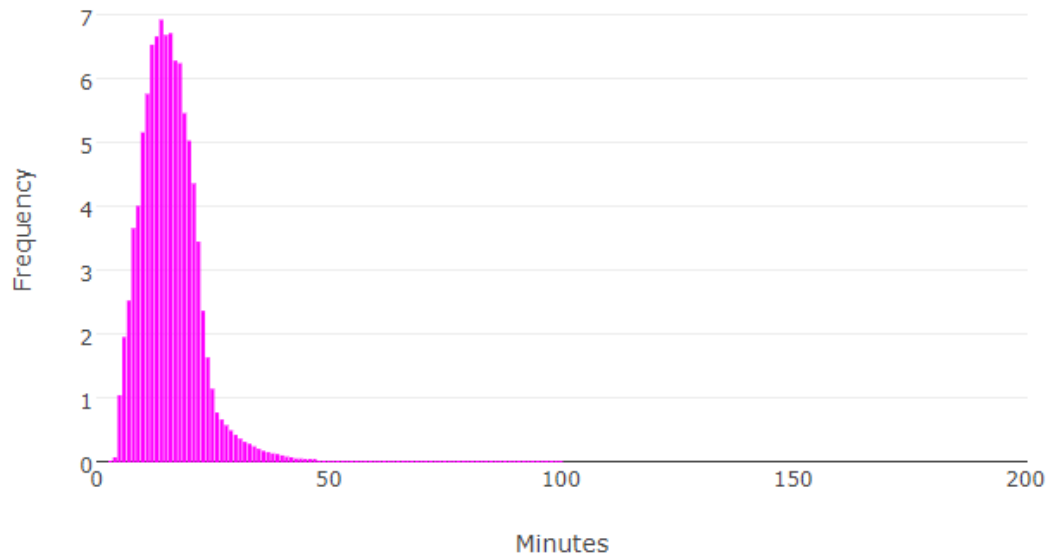


Figure 41: 2015 Occasional External to Internal (EI) Off-Peak Period Trip Length Frequency

EI (Peak) Trip Length Frequency

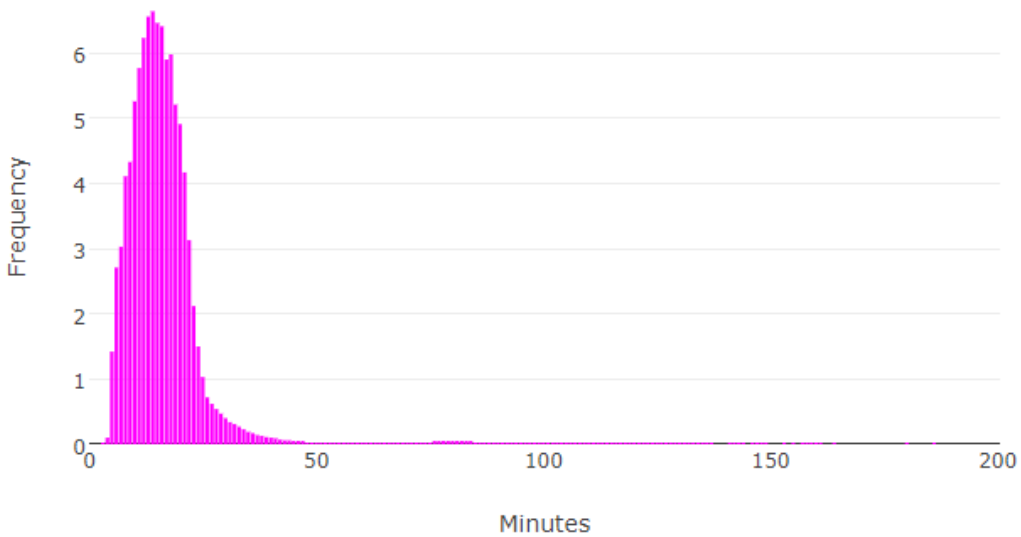


Figure 42: 2015 Occasional External to Internal (EI) Peak Period Trip Length Frequency

AIRPORT (Off-Peak) Trip Length Frequency

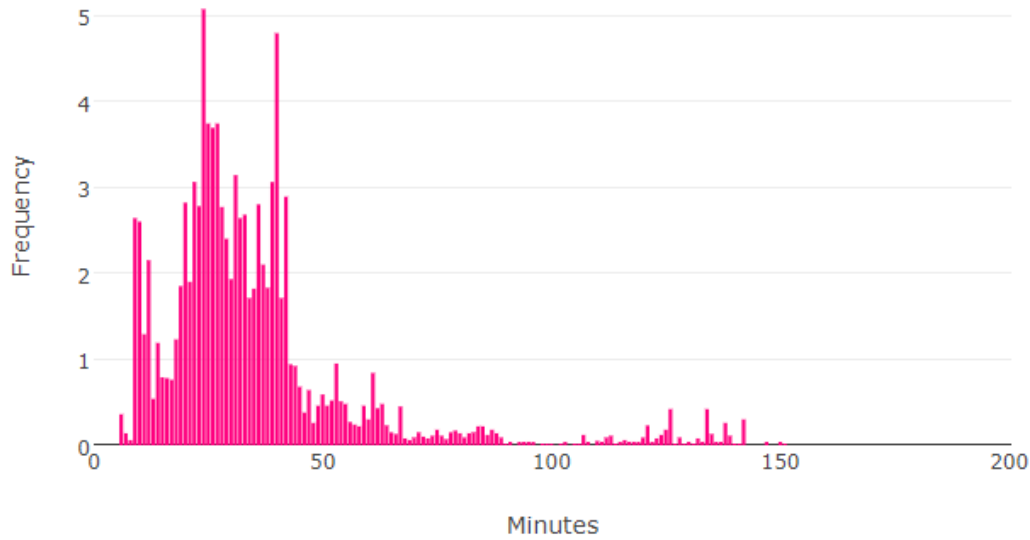


Figure 43: 2015 Airport (AIRP) Off-Peak Period Trip Length Frequency

AIRPORT (Peak) Trip Length Frequency

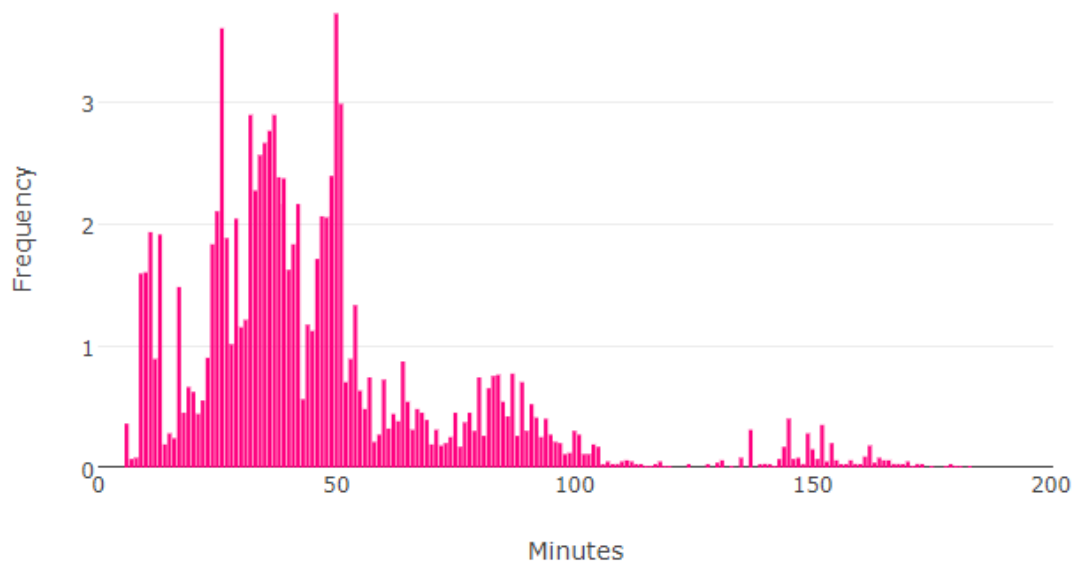


Figure 44: 2015 Airport (AIRP) Peak Period Trip Length Frequency

COL/UNV (Off-Peak) Trip Length Frequency

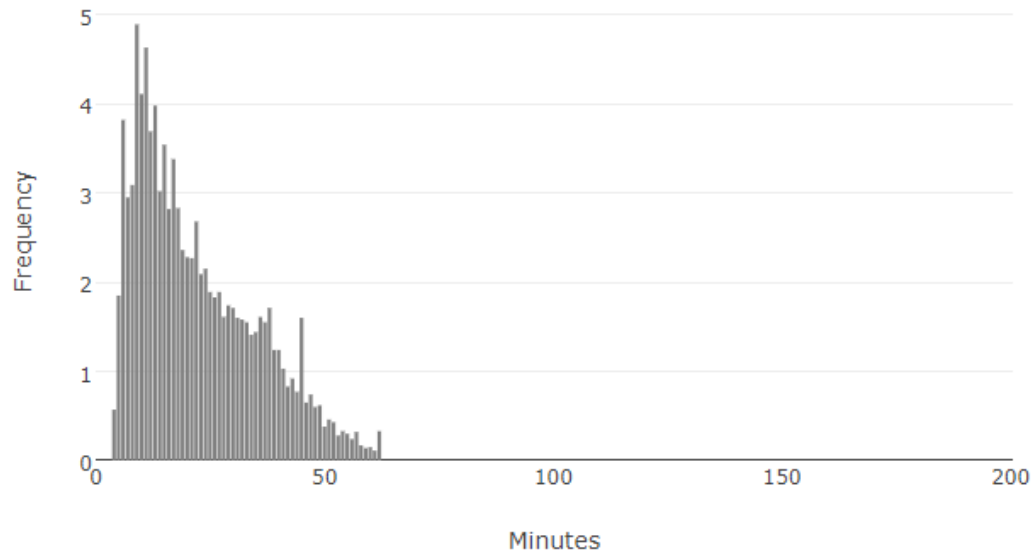


Figure 45: 2015 College / University (COLUNV) Off-Peak Period Trip Length Frequency

COL/UNV (Peak) Trip Length Frequency

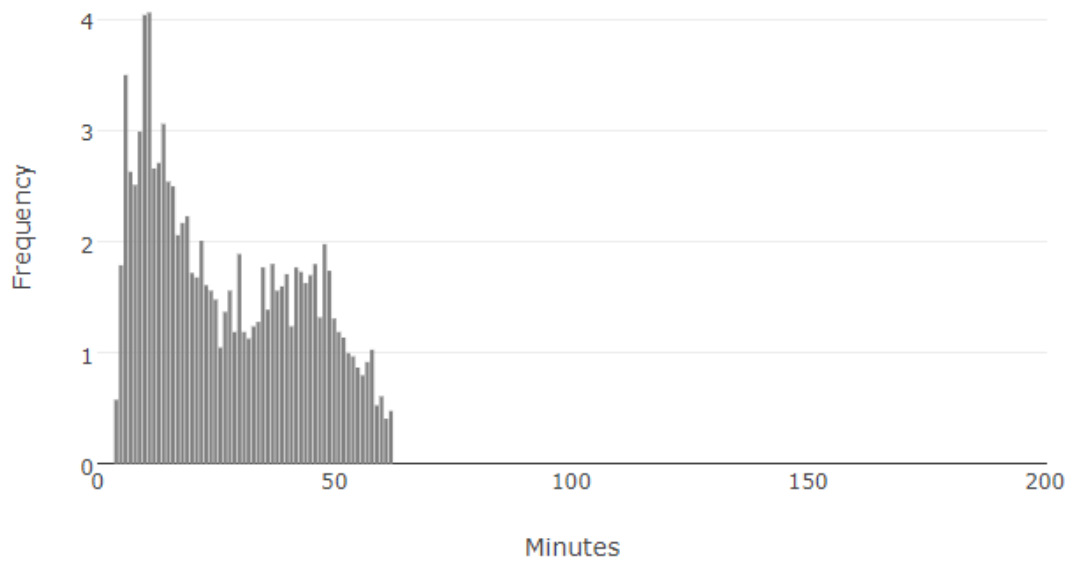


Figure 46: 2015 College / University (COLUNV) Peak Period Trip Length Frequency

TOTAL (Off-Peak) Trip Length Frequency

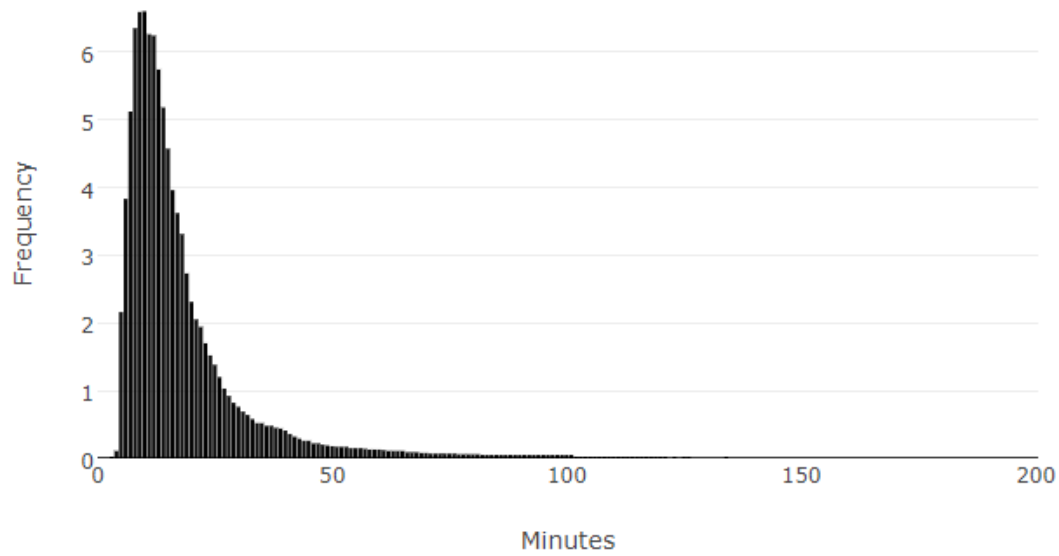


Figure 47: 2015 Total Off-Peak Trip Length Frequency

TOTAL (Peak) Trip Length Frequency

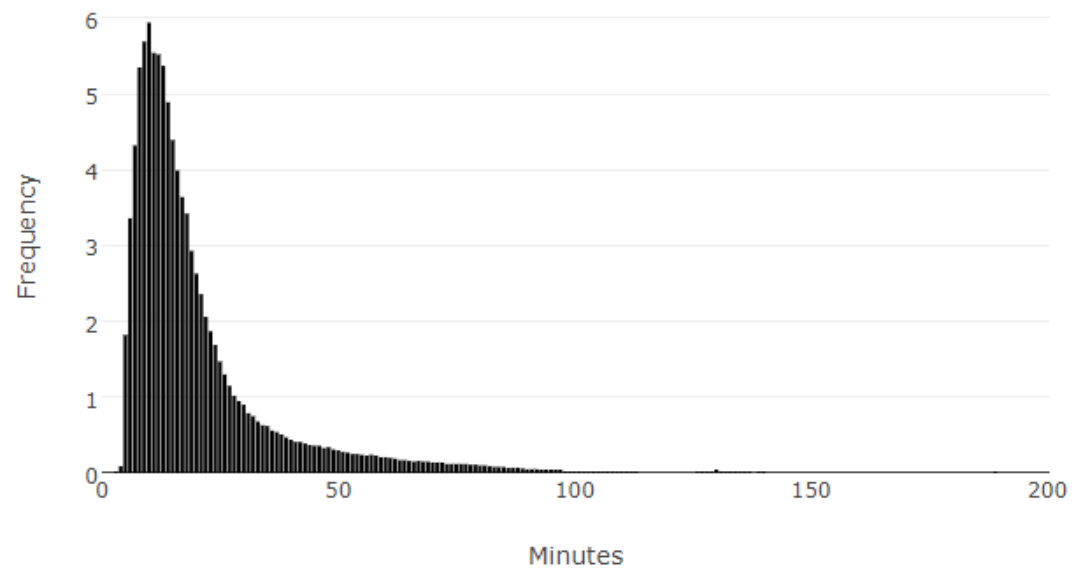


Figure 48: 2015 Total Peak Trip Length Frequency

7.3 SUMMARY

The TBRPM v9.0 Trip Distribution module performs several important tasks. First, it finalizes estimates of travel time initiated in the HPATH module. It then matches trip attractions to productions based on impedances of travel time, turn penalties/ prohibitors and tolls. These impedance calculations are then used as input for transit network building and skimming and then the mode choice calculations.

Chapter 8- TRANSIT NETWORK

The transit network is built from highway link and transit line data and is usually referred to as TNET. The Base Year 2015 network validation for the TBRPM v9.0 transit network consists of the region's five existing transit agencies: the Hillsborough Area Regional Transit (HART) Authority in Hillsborough County; the Pinellas Suncoast Transit Authority (PSTA) in Pinellas County; Pasco County Public Transit (PCPT) in Pasco County; TheBus in Hernando County; and Citrus County Transit. This chapter documents the development of the Base Year 2015 regional transit network for validation for the TBRPM v9.0.

The Transit Network module (TNET) builds the transit networks for transit path finding and skimming to be used in mode choice for the TBRPM. The TNET module uses two transit line files, a non-premium transit file (TROUTE_15A_NonPrem.lin) and a premium transit file (TROUTE_15A_Prem.lin), and two percent walk files (pcwalk and pcwalk_prem) for non-premium and premium transit service, respectively. A transit stations file (STATDATA), optional links file (TransitLink_15A), and micro-coded stops (MicroCodedStops_15A) files are also needed. In addition, TNET uses just one (1) user defined programs (AUTOCON) to automatically generate auto access connectors. Walk and side-walk connectors are generated as part of the Cube scripting within the TNET module.

The capability for modeling premium transit routes and modes separately from other transit modes is a function within the TBRPM. This capability allows for the model to calculate two levels of ridership demand within the Mode Choice module: the “traditional”, and the “choice set”. These will be described in more detail later in *Chapter 10 - Mode Choice*.

8.1 TRANSIT NETWORK CODING AND ATTRIBUTES

Coding the transit route (TROUTE) file involves listing the highway network node numbers from the beginning of each route to its end, designating stops at various nodes along the way, usually at street intersections or centroid connectors, zonal loading points, park-n-ride (PNR) locations/stations or node points where transfers to other transit routes are available. Each bus route is identified by a single line identifier or name. Each route is coded as a two-way route if the bus route follows exactly the same route in the inbound and outbound directions. The bus routes are coded as a pair of one-way routes if there are differences between the streets traveled on the inbound and outbound directions, usually along divided roadways like the interstates or US 19. The coded routes are stored in two files, TROUTE_15A_NonPrem.lin and TROUTE_15A_Prem.LIN, for non-premium and premium routes respectively.

All bus routes were coded to accurately reflect actual street routes followed by buses to the extent possible for the Base Year conditions using available highway network links. Since the model network does not consist of every single local road and neighborhood street, it is not always possible to completely code a route in the model network exactly the way it operates. For certain situations optional links are used as substitutes for these missing network details. Optional links were used sparingly, and only for those roadways that were required for maintaining the continuity of transit routes. Other places where optional links could be used are for fixed guideway or special transit lines that don't necessarily use normal highway network links.

Table 51 provides the mode numbers used in the 2015 Base Year transit network of the TBRPM v9.0. The first digit corresponds to the operator (Citrus and Hernando are combined) while the second digit corresponds to the mode.

Table 52 provides the operator number for each transit agency being used in the model for 2015. The operator numbers generally correspond to the first digit in the mode numbers except that Citrus has its own operator number for reporting purposes even though it shares mode numbers with Hernando.

Table 51: TBRPM v9.0 – 2015 Base Year Transit Modes and Descriptions

Mode	Description
10	HART Local Bus
11	HART Express Bus
12	HART Premium In-Street BRT
14	HART Streetcar
17	HART Project Circulator Bus
20	PSTA Local Bus
21	PSTA Express Bus
27	PSTA Project Circulator Bus
30	PCPT Local Bus
40	TheBus/Citrus County Local Bus

Table 52: TBRPM v9.0 – Transit Operators and Descriptions

Operator	Description
10	HART (Hillsborough Area Regional Transit)
20	PSTA (Pinellas Suncoast Transit Authority)
30	PCPT (Pasco County Public Transportation)
40	TheBus (Hernando County Public Transportation)
50	Citrus County Public Transportation

TBRPM v9.0 uses optional links when a transit route of any mode must use a road or guideway that is not in the highway network. These are primarily used for either slip ramps to transit terminals from the highway network or fixed guideway such as rail which is not coded on the highway network. Occasionally these optional links are used for local buses where the local bus use a small local road not on the highway network and re-routing the bus does not make sense. For premium transit or fixed guideway transit, this will also give the modeler the option to test other transit scenarios or alternatives without having to re-run the entire model from scratch by keeping the highway network coding separate from the premium transit network. A description of attributes used in this TransitLink_15A.dbf file can be found in **Table 53** below.

Table 53: TBRPM v9.0 - Option Link Attributes (TransitLink_15A.dbf)

Attribute	Description
A	A node of the link
B	B node of the link
FACL_TYPE	Facility type of the link
AREA_TYPE	Area type of the link
TMODE1	List of transit modes coded on the link
TMODE2	
TMODE3	
TMODE4	
TMODE5	
TDIST	Distance in miles
TSPEEDAM	AM peak period speed (mph)
TSPEEDMD	MD period speed (mph)
TWOWAY	2 if two-way link, 1 if one-way link, 0 if not in alternative
ROUTES	Routes traversing link

Table 54 provides a description of the variables stored in the micro-coded stations / nodes file (MicroCodedStops_15A.dbf). The station nodes coded in this file are those that are not / cannot be coded directly on the highway network and are only used by transit lines or walk links, such stations would usually be areas like transit terminals. **Table 55** provides the list of micro-coded stations / nodes used in the 2015 base year.

Table 54: TBRPM v9.0 - Description of Micro-coded Stations File

Attribute	Description
N	Highway network node number
X	X coordinate
Y	Y coordinate
TSNAME	Name of the station

Table 55: 2015 Base Year List of Micro-coded Stations

N	TSNAME
20001	MARION TRANSIT CENTER
20002	UATC
20003	NETPARK
20005	MTC - Morgan St
20006	Orange Groove P&R
20007	Williams Park PSTA
20008	Park Street Terminal PSTA
20009 – 20040	MetroRapid N-S
20041	Huey Ave
20042 – 20062	MetroRapid E-W
20501 – 20520	Teco Streetcar E-W

The micro-coded stations / nodes are then an extension of the highway network coding for the purpose of transit. To tell the model how to use these stations / nodes, the STATDATA file which contains the characteristics of transit stations for the fixed guide way systems, park-and-ride (PNR) and kiss-and-ride (KNR) lots, and major transit centers needs to be maintained. The description of this file is shown in **Table 56**. If the micro-coded station / node is a simple transit stop it does not need to be entered into the STATDATA file, but it should be at least connected by one or more optional transit links in the TransitLink_15A.dbf described above.

Table 56: TBRPM v9.0 - Description of StatData File

Attribute	Description
STATNO	Transit Station Number
N	Highway network node number
TSZONE	Nearest zone number
TSRANGE	Parking range in miles
TSPARK	Number of parking spaces
TSCOSTAM	Peak period parking fee
TSCOSTMD	Off-peak period parking fee
TSTYPE	0 if not in use, 1 if both park and ride and drop-off, 4 if drop-off/transfer only
TSPNRTERM	Park and ride terminal time (default 2 min)
TSKNRTERM	Kiss and ride terminal time (default 1 min)
PREM_STAT	Whether this station is served by a premium service
TSNAME	Name of station

8.2 ACCESS TO TRANSIT

8.2.1 PERCENT WALKS

The percent walk file (PCWALK and PCWALK_prem) for the TBRPM is an input file that designates the availability of walk access to the transit network. It identifies, on a percentage basis, the short- and long-walk access available to the transit system for each traffic analysis zone (TAZ).

The PCWALK file must be updated whenever the transit network is altered due to a change in the walk access as transit routes are revised or new transit corridors are created. Therefore, it is important that the methodology for the development of the PCWALK file be applied consistently for all current and future applications. For TBRPM v9.0, updates to the PCWALK files are handled within the model flow using a combination of Python and Cube scripts in the Transit Network application.

The walk access distances for short- and long-walk access are one-third of a mile and one mile, respectively. These distances represent the maximum walk distance allowed for the short- and long-walk. The short-walk distance represents the maximum distance most people would be willing to walk to a transit stop if they have other modes readily available to them, such as an automobile. The long-walk distance represents the maximum distance anyone, even someone that was transportation disadvantaged, would be willing to walk to a transit stop.

The TBRPM uses the standard assumption that the walk attractors will be located near the roadways. Walk attractors include areas, such as retail districts and office complexes. These types of land uses are usually located along arterials or major roadways and generally include a shorter walking distance to transit than do trip producers like residential areas which tend to be located off the major arterials. Therefore, the attraction percentage is enhanced by a factor of 2, to 100 percent, for both short- and long-walk access. **Table 57** below depicts the file format needed for the Percent Walk (PCWALK) file. The model actually uses two files; one for local transit, and one for premium transit which usually represents access only near the premium stations.

The “percent of area covered methodology” which is used to calculate the PCWALK percentages assumes that the population within each TAZ is distributed evenly. **Figure 49** shows the transit walk access coverage for short- and long-walk access for Hillsborough Area Regional Transit (HART), Pinellas Suncoast Transit Authority (PSTA), Pasco County Public Transit (PCPT), Hernando County (TheBus), and Citrus County Transit.

Table 57: TBRPM v9.0 - Percent Walk (PCWALK) File Format

Column	Description
1 - 5	Zone Number
6 - 11	Short production walk percentage - peak period
12 - 17	Short attraction walk percentage - peak period
18 - 23	Long production walk percentage - peak period
24 - 29	Long attraction walk percentage - peak period
30 - 35	Short production walk percentage - off-peak period
36 - 41	Short attraction walk percentage - off-peak period
42 - 47	Long production walk percentage - off-peak period
48 - 53	Long attraction walk percentage - off-peak period

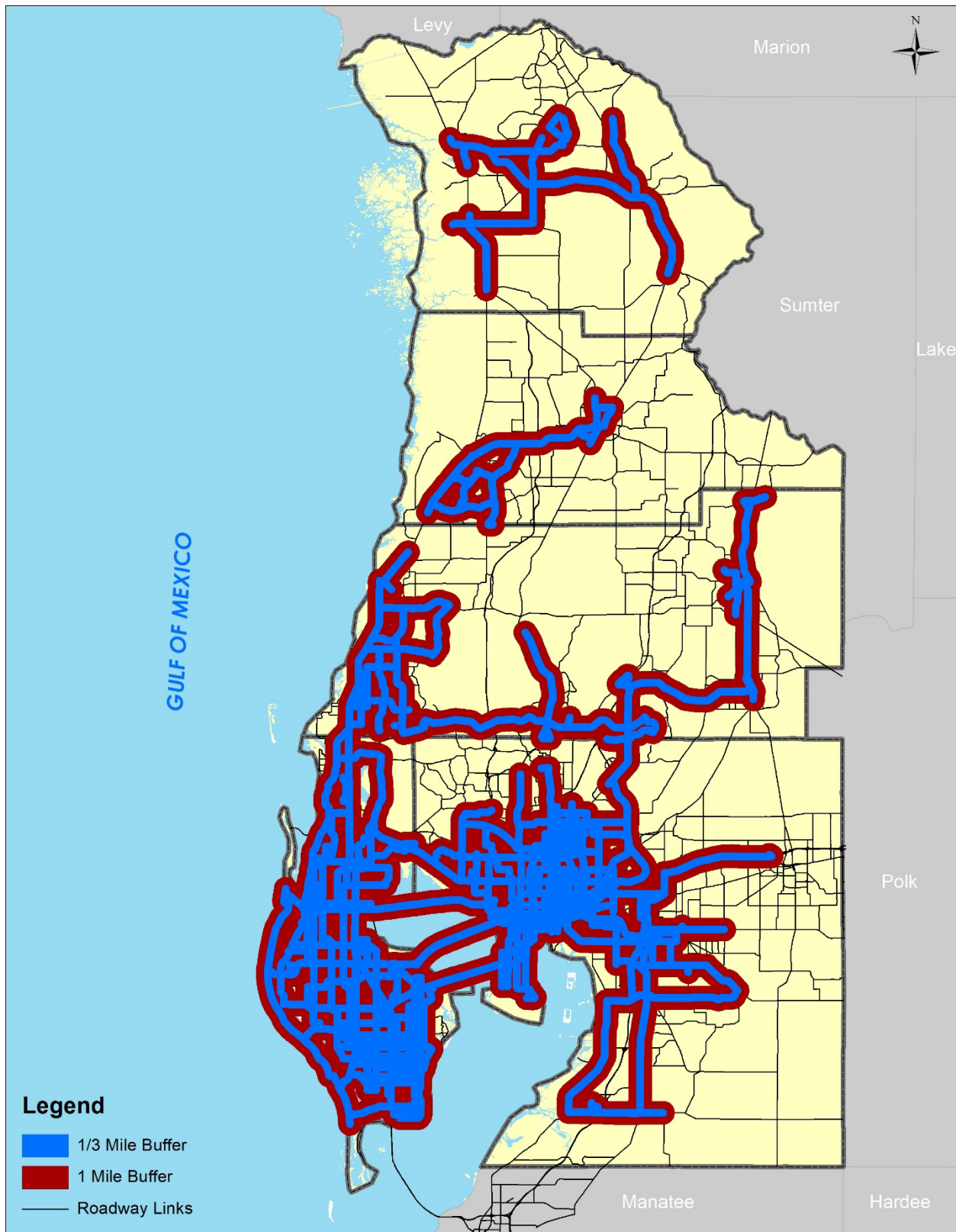


Figure 49: 2015 Base Year Transit Network Coverage Map

8.3 TRANSIT SPEED

While speeds for modes that have exclusive right-of-way (optional links) are "hard-coded" into the transit links as attributes, speeds for modes that share the right-of-way with vehicular traffic are estimated based on the highway link speeds and the number of stops coded. Bus transit speeds are based on highway network travel times plus the dwell time for each stop based on the type of bus mode. Peak period transit speeds are taken from the congested Peak highway network. Off-peak transit speeds are based on free-flow conditions from the Off-Peak highway network.

HART, PSTA, PCPT, TheBus, and Citrus County Transit provide approximately 2,740 route miles of service for Peak period and 2,380 route miles of service for Off-Peak period. **Table 58** and **Table 59** summarize the 2010 transit network attributes for the available transit services for the Peak and Off-Peak periods respectively.

Table 58: 2015 Base Year Peak Transit Operating Characteristics Summary

Transit Agency	Route			Vehicle		
	Miles	Minutes	Speed	Number	Miles	Hours
Hillsborough Local Bus	856.2	3,584	14	163	8,763	897
Hillsborough Express Bus	296.8	876	20	29	2,227	160
Hillsborough Premium In-Street BRT	54.7	214	15	10	602	55
Hillsborough Circulator Bus	4.2	22	12	2	93	11
Hillsborough Total	1,211.9	4,696	15	204	11,685	1,122
Pinellas Local Bus	1,238.2	4,529	16	182	11,713	1,001
Pinellas Express Bus	80.2	218	22	11	882	61
Pinellas Circulator Bus	22.4	70	19	2	70	11
Pinellas Total	1,340.8	4,817	17	195	12,665	1,073
Pasco Local Bus	382.6	1,069	21	28	2,255	154
Pasco Total	382.6	1,069	21	28	2,255	154
Hernando Local Bus	95.8	302	19	7	421	39
Hernando Total	95.8	302	19	7	421	39
Citrus Local Bus	132.7	302	26	4	365	22
Citrus Total	132.7	302	26	4	365	22
Local Bus Total	2,705.5	9,786	17	384	23,517	2,112
Express Bus Total	376.9	1,094	21	40	3,109	220
Premium In-Street BRT Total	54.7	214	15	10	602	55
Circulator Bus Total	26.6	92	17	4	163	22
PEAK Total	3,163.7	11,186	17	438	27,391	2,409

CHAPTER 8 – TRANSIT PATHS

Table 59: 2015 Base Year Off-Peak Transit Operating Characteristics Summary

Transit Agency	Route			Vehicle		
	Miles	Minutes	Speed	Number	Miles	Hours
Hillsborough Local Bus	856.2	3,289	16	136	12,802	1,292
Hillsborough Express Bus	17.4	31	33	1	198	10
Hillsborough Premium In-Street BRT	54.7	206	16	10	1,039	95
Hillsborough Streetcar	5.3	36	9	6	300	57
Hillsborough Total	933.5	3,564	16	153	14,339	1,454
Pinellas Local Bus	1,202.3	4,216	17	154	17,376	1,463
Pinellas Express Bus	80.2	190	25	4	381	38
Pinellas Circulator Bus	22.4	62	22	2	122	19
Pinellas Total	1,304.8	4,469	18	160	17,878	1,520
Pasco Local Bus	382.6	1,019	23	28	3,894	266
Pasco Total	382.6	1,019	23	28	3,894	266
Hernando Local Bus	95.8	307	19	8	728	76
Hernando Total	95.8	307	19	8	728	76
Citrus Local Bus	132.7	285	28	4	630	38
Citrus Total	132.7	285	28	4	630	38
Local Bus Total	2,669.6	9,117	18	330	35,430	3,135
Express Bus Total	97.5	221	26	5	579	48
Premium In-Street BRT Total	54.7	206	16	10	1,039	95
Streetcar Total	5.3	36	9	6	300	57
Circulator Bus Total	22.4	62	22	2	122	19
OFF-PEAK Total	2,849.5	9,644	18	353	37,470	3,354

8.4 TRANSIT NETWORK SUMMARY

The Base Year 2015 network validation of the TBRPM v9.0 transit network represents a complex multimodal system. Transit model development requires the identification of separate transit networks, representing Peak period transit, and Off-Peak period transit systems by agency. Together with the highway network, these transit networks represent part of the mode choice set available for local travelers in the Tampa Bay area.

Chapter 9 - TRANSIT PATHS

The transit path (TPATH) process calculates how a passenger gets from the zone of origin to the destination zone using a particular mode(s) of transit. The following sections describe how the transit paths module was developed to replicate the 2015 Base Year conditions for the TBRPM v9.0.

TBRPM v9.0 utilizes a Mode Choice model structure that was developed for Federal Transit Administration (FTA) New Starts Alternatives Analysis (AA) studies in Pinellas and Hillsborough counties since the last LRTP model was adopted. Success of New Starts applications for the Tampa Bay Region depends on a Mode Choice model that has a favorable structure for supporting multiple transit modes for testing higher premium transit modes. The following sections describes the validation efforts needed for this structure.

9.1 PATH BUILDING PARAMETERS

Twenty-four sets of paths are developed using the TRNBUILD transit pathing module, twelve for Peak period and twelve for Off-Peak period service. These paths, which support the Mode Choice model, require the following information:

For Peak Period service -

- TPATHAM1: Walk Access, Peak Period, Bus Service
- TPATHAM2: Walk Access, Peak Period, New Mode
- TPATHAM3: Walk Access, Peak Period, In-street BRT
- TPATHAM4: Walk Access, Peak Period, Fixed Guideway
- TPATHAM5: Park-and-Ride Access, Peak Period, Bus Service
- TPATHAM6: Park-and-Ride Access, Peak Period, New Mode
- TPATHAM7: Park-and-Ride Access, Peak Period, In-street BRT
- TPATHAM8: Park-and-Ride Access, Peak Period, Fixed Guideway
- TPATHAM9: Kiss-and-Ride Access, Peak Period, Bus Service
- TPATHAM10: Kiss-and-Ride Access, Peak Period, New Mode
- TPATHAM11: Kiss-and-Ride Access, Peak Period, In-street BRT
- TPATHAM12: Kiss-and-Ride Access, Peak Period, Fixed Guideway

For Off-Peak Period service -

- TPATHMD1: Walk Access, Peak Period, Bus Service
- TPATHMD2: Walk Access, Peak Period, New Mode
- TPATHMD3: Walk Access, Peak Period, In-street BRT
- TPATHMD4: Walk Access, Peak Period, Fixed Guideway
- TPATHMD5: Park-and-Ride Access, Peak Period, Bus Service
- TPATHMD6: Park-and-Ride Access, Peak Period, New Mode
- TPATHMD7: Park-and-Ride Access, Peak Period, In-street BRT
- TPATHMD8: Park-and-Ride Access, Peak Period, Fixed Guideway
- TPATHMD9: Kiss-and-Ride Access, Peak Period, Bus Service
- TPATHMD10: Kiss-and-Ride Access, Peak Period, New Mode
- TPATHMD11: Kiss-and-Ride Access, Peak Period, In-street BRT
- TPATHMD12: Kiss-and-Ride Access, Peak Period, Fixed Guideway

Paths are developed by parameters intended to isolate a mode, or a sub-mode, such as walk or auto access. Several factors must be considered in developing these paths. People usually tend to perceive the time they spend walking to transit, waiting to board, and waiting for transfers, as greater than it actually is. The model multiplies these times by a weighting factor to better reflect how people perceive the time involved when choosing transit. People generally do not like to make transfers, so a penalty in the form of extra time is also added for each transfer. Preferred paths are developed by adding in-vehicle travel times (IVTT), plus wait and walk times,

and penalties for transfers. Illogical paths, such as loops or backtracking are eliminated where possible. Although several separate transit paths and resulting skim files are developed based on the parameters, peak and off-peak paths are defined by the same process and use the same set of parameters. Differences in peak and off-peak paths are attributable to changes in headways, route structures, available modes, and other level-of-service characteristics unique to the peak and off-peak transit networks, as well as to differences in highway speeds from free-flow and congested highway networks. **Table 60** lists the transit path parameters that are used in the TBRPM v9.0.

Table 60: 2015 Base Year Transit Operating Characteristics Summary

Parameter	Walk-Access	PNR-Access	KNR-Access	Sidewalk	Bus	New Mode	InStreet BRT	Fixed Guide-way
waitmax	60	60	60	60	60	60	60	60
waitmin	0	0	0	0	2	2	2	2
waitfac	1	1	1	1	2.25	2.25	2.25	2.25
xwaitfac	1	1	1	1	1.5, 2.25	1.5, 2.25	1.5, 2.25	1.5, 2.25
modefac	2.25	1	1	2.25	1	1	1	1
xwaitmax	60	60	60	60	60	60	60	60
xwaitmin	0	0	0	0	2	2	2	2

9.1.1 TRANSIT FARE STRUCTURE

After minimum transit travel time paths have been identified, total fares for each path are calculated. Transit fares are a function of boarding and transfer costs.

9.2 TRANSIT PATH VALIDATION

Figure 58, Figure 59, Figure 60, Figure 61, Figure 62, Figure 63, and Figure 64 in *Appendix E – Transit Path Validation* are Isochrone maps for transit which provide transit travel times in minutes to and from selected zones from all other zones in the model using the transit network. The gray zones highlight the selected zones or adjacent zones. These zones were selected to highlight major activity areas in each county. Transit travel times range from dark blue (shortest time) to red (longest time). The tan colored zones indicate those zones where transit service is not available from the selected zone.

9.3 SUMMARY

The Transit Path module develops transit skims by time period (peak and off-peak), access mode (walk, park-and-ride, and kiss-and-ride), and transit mode (bus, new mode, in-street BRT, and fixed guideway). The skims include information on access time, in-vehicle travel time, initial and transfer wait time, number of transfers, transit fare and distance traveled. The information generated in the Transit Path module is used in Mode Choice to produce mode shares.

Chapter 10 - MODE CHOICE

The Mode Choice model (MODE) estimates how many generated person trips will travel by each available mode. The Mode Choice model does this by determining the probability of using each available mode for travel between each pair of zones, and then stratifies those trips amongst all available modes using those probabilities. The TBRPM v9.0 uses a mode choice structure which was developed for FTA, AA studies. This chapter describes the Nested Logit Model structures used for Tampa Bay as part of the Mode Choice model along with the validation results for the 2015 Base Year.

10.1 MODELING PROCESS

The utility of a mode is assumed to be a function of attributes that describe the level-of-service provided by the mode, as well as a mode specific constant. The mode specific constant, also known as a mode bias constant, is an adjustment parameter that compensates for all unknown effects of variables not included in the utility computation. **Table 87** includes the complete forms of the utilities used by the TBRPM Mode Choice model by mode. **Table 88** provides a legend for these utility functions. These two tables can be found in *Appendix F – Mode Choice Tables*.

The mode specific constants and level-of-service coefficients for each Transit Agency are provided in **Table 89**, **Table 90**, **Table 91**, and **Table 92** found in *Appendix F – Mode Choice Tables*. These constants and coefficients are provided for the three Mode Choice trip purposes (HBW, HBO, NHB) by two time-of-day periods (Peak and Off-Peak). While the coefficients are listed separately for each transit agency, they are the same. The mode specific constants, however, were developed independently for each transit agency using a specially designed calibration tool which was run in the Mode Choice module based on the target matrix for the 2015 base year transit ridership and percent split between drive alone, shared ride 2, and shared ride 3+ from the 2007 household survey. For the Mode Choice calibration, Hernando and Citrus counties were treated as the same and calibrated together.

10.1.1 PERFORMING ZERO-CAR HOUSEHOLD TRIP DISTRIBUTION

Auto ownership is a key variable in defining the trip-making characteristics of travelers. As the number of automobiles per household has increased over the years, it has been necessary to increase auto ownership categories. The Mode Choice structure that has been adopted for the TBRPM has three categories of auto ownership: 0-auto households, 1-auto households, and 2+-auto households. The 2-auto household and 3+-auto household trips are combined to make the mode choice compatible with the trip generation model.

10.1.2 DEFINING CHOICE SETS

Another feature in the Mode Choice model is the concept of “Choice” ridership vs “Captive” ridership. Choice riders are those people that have one or more vehicles available for making their trips but chose to use transit. This is usually more prevalent when there is a higher or more premium mode of transit available. On the other hand, “Captive” riders are those that don’t have much of a choice in mode since they don’t have a car available or have very limited car availability. These riders are limited so that they may even depend on the local bus as their only mode for traveling.

Other studies suggest that “Choice” riders are willing to use premium transit as an alternative if that premium mode can get them more directly to their intended destination, but they are not as willing to use lower modes like a bus or if there would be even one or more transfers to other modes. Express buses do tend to attract choice riders since they usually serve Park-and-Ride lots and other major stations which allow auto access. Rail modes tend to attract even more choice riders. This has been observed in places like Charlotte, NC with their new light rail system where ridership was soon much higher than originally forecasted. To account for this phenomenon when forecasting ridership for new premium transit in the future, the mode choice module of the TBRPM can operate in two different modes: Traditional forecast and Choice Set forecast. The “Traditional” forecast would operate in much the same way as previous mode choice models, forecasting transit ridership for the entire population of the modeling area based on the Base Year conditions and mode choice calibration.

The “Choice Set” forecast splits the modeling population into the two groups; “Captive” (Choice Set 1) and “Choice” (Choice Set 2) population as described earlier. For forecasting modes like express bus, Choice Set 1 still includes a portion of the “Choice” rider population, but Choice Set 2 does not include any “Captive” rider population. Split percentages are used on the modeling population based on surveys and observations from other studies and the Charlotte area. Based on a slightly different calibration of the mode choice which was based on just the Choice Set 1 population for the Base Year 2015, a future year forecast is formulated for both population sets and combined for the total daily ridership forecasts.

10.1.3 NESTED LOGIT STRUCTURE

The Mode Choice model uses a nested logit structure that assumes alternative modes compete with each other, but only at the same level within the nest. In addition, alternative modes of a lower level are assumed to be more sensitive to changes in service attributes than those of an upper level, which causes them to be more elastic than they would be in a multinomial structure.

The sensitivity of each mode is estimated using a nesting coefficient in a range between zero and one. It is inversely proportional to the sequential product of all nesting coefficients of the upper-level nests including the current level. The nesting coefficient is used to calculate each mode’s market share relative to the other modes at the same level. Therefore, if a nesting coefficient is equal to one, the corresponding nested structure becomes identical to a multinomial structure.

The design of the TBRPM v9.0 Mode Choice model consists of a three-level nested structure as illustrated in **Figure 50**. In the primary nest, total person trips are divided into “Highway” trips and “Transit” trips. In the secondary nest, the auto trips are split into “Drive Alone” trips and “Shared Ride” trips, and the transit trips are split into “Walk Access” trips, “Park and Ride Access” trips and “Kiss and Ride Access” trips. In the third nest, shared ride trips are further divided into “One Passenger” and “Two+ Passengers.” On the transit side, the access trips are split into “Local Bus” trips, “Express Bus” trips, “Premium Bus” trips, and “Fixed Guideway” trips.

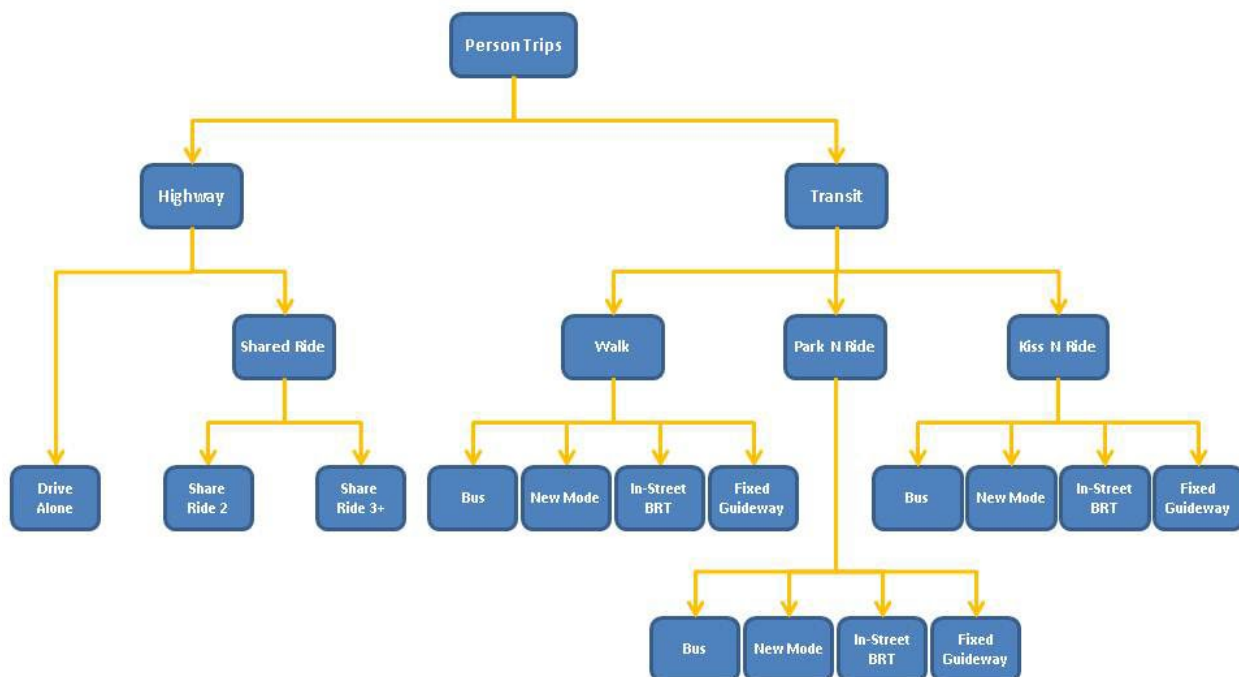


Figure 50: TBRPM v9.0 - Mode Choice Structure Diagram

10.2 MODEL VALIDATION

Table 61 and **Table 62** present the target matrices used for both highway and transit trips for the 2015 Base Year validation. Targets for the highway modes (i.e., drive alone, one passenger and two+ passengers) were derived from household surveys that were weighted and expanded by trip purpose and auto ownership. The percent split between drive alone, one passenger, and two or more passengers is targeted during mode choice calibration. The transit target matrix for the transit modes (i.e., local bus, premium mode, park-and-ride and kiss-and-ride) was prepared based upon existing transit surveys and ridership reports.

Table 61: 2015 Base Year Highway Trips Percent Split Target Matrix

Purpose	Auto Ownership	Drive Alone	Share Ride 2	Share Ride 3+
HBW	0	9.95%	54.02%	36.03%
HBW	1	90.12%	5.87%	4.01%
HBW	2+	82.63%	10.34%	7.03%
HBO	0	7.50%	55.39%	37.11%
HBO	1	42.15%	34.55%	23.30%
HBO	2+	40.21%	35.67%	24.12%
NHB	NA	40.93%	30.76%	28.31%

10.3 SUMMARY

The calibrated mode choice model provides good estimates of trips by access mode, purpose and transit agency. The ratios between the targets and the estimates for auto trips are close to 1.0 where large numbers of trips are observed. Similarly, transit trip estimates were reasonably good given their market share. As more premium services—such as fixed guideway transit—are introduced in the future, the relationship between local and premium service should be re-evaluated to ensure that the estimates from the model are consistent with observed ridership patterns. The following tables, **Table 63** through **Table 71**, depict the Mode Choice results by purpose, mode, and county for Daily, Peak and Off-Peak periods.

CHAPTER 10 – MODE CHOICE

Table 62: 2015 Base Year Mode Choice Transit Trip Target Matrix

County	Purpose	Auto Ownership	Peak				Off-Peak				Daily Total
			Walk Access	Park and Ride	Kiss and Ride	Peak Total	Walk Access	Park and Ride	Kiss and Ride	Off-Peak Total	
HART	HBW	0	4,410	0	56	4,466	3,268	0	30	3,298	7,764
	HBW	1	2,013	241	248	2,502	1,028	19	21	1,068	3,570
	HBW	2+	1,052	1,101	227	2,380	411	6	36	453	2,833
	HBO	0	3,312	0	56	3,368	4,973	0	55	5,028	8,396
	HBO	1	1,058	31	76	1,165	1,605	24	81	1,710	2,875
	HBO	2+	631	25	106	762	820	17	104	941	1,703
	NHB	0	3,034	180	206	3,420	3,201	30	232	3,463	6,883
PSTA	HBW	0	3,787	0	54	3,841	4,229	0	43	4,272	8,113
	HBW	1	1,752	12	93	1,857	2,168	10	166	2,344	4,201
	HBW	2+	801	51	68	920	1,067	52	47	1,166	2,086
	HBO	0	2,386	0	11	2,397	5,279	0	44	5,323	7,720
	HBO	1	702	10	45	757	1,774	5	33	1,812	2,569
	HBO	2+	497	14	15	526	941	5	27	973	1,499
	NHB	0	1,843	10	74	1,927	3,567	81	113	3,761	5,688
PCPT	HBW	0	191	0	20	211	247	0	10	257	468
	HBW	1	178	0	16	194	208	7	40	255	449
	HBW	2+	92	0	3	95	86	3	20	109	204
	HBO	0	300	0	7	307	339	0	16	355	662
	HBO	1	102	0	16	118	125	0	30	155	273
	HBO	2+	109	0	10	119	96	0	13	109	228
	NHB	0	194	0	23	217	251	0	16	267	484
TheBUS & Citrus County Transit	HBW	0	47	0	0	47	35	0	0	35	82
	HBW	1	33	0	0	33	10	0	0	10	43
	HBW	2+	14	0	0	14	13	0	0	13	27
	HBO	0	76	0	0	76	109	0	0	109	185
	HBO	1	26	0	0	26	73	0	0	73	99
	HBO	2+	41	0	0	41	30	0	0	30	71
	NHB	0	44	0	0	44	76	0	0	76	120

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Table 63: 2015 Base Year HBW Daily Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	773,038	91,839	62,338	927,215	773,038	45,920	19,481	838,438	1.106	14,989
Pinellas	581,025	69,106	46,890	697,022	581,025	34,553	14,653	630,231	1.106	15,179
Pasco	250,579	29,603	20,097	300,279	250,579	14,802	6,280	271,661	1.105	1,176
Hernando	86,283	9,999	6,790	103,072	86,283	4,999	2,122	93,405	1.103	151
Citrus	63,266	7,425	5,041	75,732	63,266	3,712	1,575	68,554	1.105	11
Total	1,754,192	207,971	141,156	2,103,320	1,754,192	103,986	44,111	1,902,289	1.106	31,508

Table 64: 2015 Base Year HBO Daily Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	1,174,224	1,049,891	709,089	2,933,203	1,174,224	524,945	214,875	1,914,045	1.532	13,778
Pinellas	1,040,093	932,024	629,306	2,601,422	1,040,093	466,012	190,699	1,696,803	1.533	11,814
Pasco	464,148	411,121	277,662	1,152,931	464,148	205,560	84,140	753,848	1.529	1,143
Hernando	167,710	148,486	100,287	416,483	167,710	74,243	30,390	272,343	1.529	342
Citrus	136,436	120,618	81,469	338,523	136,436	60,309	24,688	221,433	1.529	18
Total	2,982,611	2,662,139	1,797,813	7,442,563	2,982,611	1,331,069	544,792	4,858,472	1.532	27,096

Table 65: 2015 Base Year NHB Daily Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	478,146	359,355	330,667	1,168,169	478,146	179,677	97,255	755,079	1.547	7,657
Pinellas	286,542	215,353	198,161	700,056	286,542	107,676	58,283	452,501	1.547	5,686
Pasco	117,446	88,265	81,228	286,938	117,446	44,132	23,891	185,468	1.547	509
Hernando	43,427	32,638	30,033	106,098	43,427	16,319	8,833	68,580	1.547	117
Citrus	37,175	27,939	25,709	90,824	37,175	13,970	7,561	58,706	1.547	8
Total	962,736	723,550	665,798	2,352,084	962,736	361,775	195,823	1,520,334	1.547	13,977

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Table 66: 2015 Base Year HBW Peak Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	435,322	51,663	35,068	522,053	435,322	25,832	10,959	472,112	1.106	10,188
Pinellas	329,010	39,530	26,820	395,360	329,010	19,765	8,381	357,156	1.107	6,981
Pasco	141,620	16,756	11,375	169,751	141,620	8,378	3,555	153,552	1.105	543
Hernando	48,737	5,654	3,840	58,230	48,737	2,827	1,200	52,764	1.104	94
Citrus	35,738	4,196	2,849	42,783	35,738	2,098	890	38,726	1.105	7
Total	990,426	117,800	79,952	1,188,177	990,426	58,900	24,985	1,074,311	1.106	17,812

Table 67: 2015 Base Year HBO Peak Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	502,447	450,034	303,946	1,256,428	502,447	225,017	92,105	819,569	1.533	5,711
Pinellas	422,938	379,995	256,573	1,059,505	422,938	189,997	77,749	690,684	1.534	3,702
Pasco	192,557	170,749	115,321	478,627	192,557	85,374	34,946	312,877	1.530	529
Hernando	69,225	61,348	41,434	172,007	69,225	30,674	12,556	112,455	1.530	139
Citrus	54,703	48,386	32,681	135,769	54,703	24,193	9,903	88,799	1.529	7
Total	1,241,870	48,386	749,955	3,102,336	1,241,870	555,255	227,259	2,024,385	1.532	10,088

Table 68: 2015 Base Year NHB Peak Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	166,161	124,879	114,911	405,951	166,161	62,440	33,797	262,398	1.547	3,835
Pinellas	99,949	75,117	69,121	244,187	99,949	37,559	20,330	157,837	1.547	1,924
Pasco	40,677	30,569	28,138	99,384	40,677	15,284	8,276	64,238	1.547	225
Hernando	15,050	11,311	10,408	36,769	15,050	5,655	3,061	23,767	1.547	43
Citrus	12,853	9,660	8,888	31,401	12,853	4,830	2,614	20,297	1.547	3
Total	334,690	251,536	231,467	817,693	334,690	125,768	68,078	528,537	1.547	6,031

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Table 69: 2015 Base Year HBW Off-Peak Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	337,716	40,176	27,270	405,162	337,716	20,088	8,522	366,326	1.106	4,802
Pinellas	252,015	29,576	20,070	301,661	252,015	14,788	6,272	273,075	1.105	8,199
Pasco	108,959	12,847	8,722	130,529	108,959	6,424	2,726	118,109	1.105	633
Hernando	37,547	4,344	2,950	44,841	37,547	2,172	922	40,641	1.103	58
Citrus	27,529	3,228	2,192	32,949	27,529	1,614	685	29,828	1.105	4
Total	763,766	90,171	61,205	915,142	763,766	45,086	19,126	827,978	1.105	13,696

Table 70: 2015 Base Year HBO Off-Peak Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	671,776	599,857	405,142	1,676,775	671,776	299,928	122,770	1,094,475	1.532	8,067
Pinellas	617,155	552,029	372,733	1,541,917	617,155	276,014	112,949	1,006,119	1.533	8,112
Pasco	271,591	240,372	162,341	674,304	271,591	120,186	49,194	440,971	1.529	614
Hernando	98,485	87,138	58,853	244,476	98,485	43,569	17,834	159,889	1.529	203
Citrus	81,733	72,232	48,788	202,754	81,733	36,116	14,784	132,634	1.529	11
Total	1,740,741	48,386	1,047,858	4,340,226	1,740,741	775,814	317,533	2,834,087	1.531	17,008

Table 71: 2015 Base Year NHB Off-Peak Person Trip - Mode Split

County	Highway Person Trips				Highway Vehicle Trips				Auto Occupancy	Transit
	Drive Alone	Share Ride 2	Share Ride 3+	Total	Drive Alone	Share Ride 2	Share Ride 3+	Total		
Hillsborough	311,985	234,475	215,756	762,217	311,985	117,238	63,458	492,681	1.547	3,821
Pinellas	186,593	140,235	129,040	455,868	186,593	70,118	37,953	294,664	1.547	3,762
Pasco	76,768	57,696	53,090	187,554	76,768	28,848	15,615	121,231	1.547	284
Hernando	28,377	21,327	19,625	69,329	28,377	10,664	5,772	44,813	1.547	73
Citrus	24,322	18,280	16,820	59,423	24,322	9,140	4,947	38,410	1.547	5
Total	628,046	472,014	434,331	1,534,391	628,046	236,007	127,745	991,797	1.547	7,946

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The transit assignment (TASSIGN) process allocates transit trips estimated in the Mode Choice model to the transit network. The assigned transit trips can be identified by each transit mode used in traveling to a destination. Transit trips are measured by route and represent unlinked trips by each transit mode. Transit trips are assigned independently of highway trips.

11.1 MODEL PROCESS

Transit is assigned for both off-peak and peak periods for all trip purposes. The Peak period network contains all the transit service routes and associated characteristics for transit services provided during peak commuting periods. The Off-Peak period network contains all the transit service routes and associated characteristics for transit services during the midday, evening and overnight periods if service exists. Transit unlinked trips are summarized by the TASSIGN module based on output from the TNET, TPATH and MODE modules.

11.2 MODEL VALIDATION

To assign the fourteen different types of transit trips, as described in *Chapter 10 – Mode Choice*, for both work and non-work trip purposes, a total of twenty-eight transit assignments are necessary. In the 2015 Base Year validation, as **Table 72** illustrates, model estimates of transit assignment are reasonably close to observed ridership. The model output of transit unlinked trips is only overestimated by approximately 5 percent of the observed trips for the TBRPM area. Express bus ridership and ridership on transit in Hernando and Citrus Counties are overestimated by the highest margin, though these represent the smallest portion of the overall transit ridership total. A more detailed route by route comparison of estimated and observed boarding is provided in **Table 73**.

Table 72: 2015 Base Year Observed vs. Estimated Ridership

Agency	Type	Observed	Estimated	Ratio
HART	Local Bus	47,750	50,670	1.06
HART	Express Bus	1,080	865	0.80
HART	Premium In-Street BRT	2,360	3,080	1.31
PSTA	Local Bus	45,515	46,113	1.01
PSTA	Express Bus	381	592	1.55
PCPT	Local Bus	2,852	3,301	1.16
TheBUS	Local Bus	373	622	1.67
Citrus	Local Bus	253	26	0.10
Grand Total		100,564	105,269	1.05

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Table 73: 2015 Base Year Estimated vs. Observed Daily Boarding by Route

Route	Name	Type	Obs.	Est.	Ratio
HART					
HART_001	Route 1 Florida Ave (Downtown to UATC)	Local	4,070	3,779	0.93
HART_002	Route 2 Nebraska Ave (Downtown to UATC)	Local	2,400	638	0.27
HART_004	Route 4 MacDill (Downtown to MacDill)	Local	490	894	1.82
HART_005	Route 5 40th St (Downtown to UATC)	Local	1,890	2,177	1.15
HART_006	Route 6 56th St (Downtown to UATC)	Local	4,460	4,302	0.96
HART_007	Route 7 Citrus Park (Downtown to Citrus Park)	Local	1,940	2,228	1.15
HART_008	Route 8 Brandon (Downtown to Brandon)	Local	1,820	1,813	1.00
HART_009	Route 9 15th St (Downtown to UATC)	Local	2,720	1,167	0.43
HART_010	Route 10 Cypress St (Downtown to Social Security)	Local	320	303	0.95
HART_012	Route 12 22nd St (Downtown to Univ. Mall)	Local	2,930	2,184	0.75
HART_014	Route 14 Armenia Ave (Downtown to Yukon)	Local	610	1,105	1.81
HART_015	Route 15 Columbus Dr (Westshore to Netpark)	Local	1,350	1,198	0.89
HART_016	Route 16 Waters Ave (TNC Hospital to Yukon)	Local	970	869	0.90
HART_018	Route 18 30th St (Downtown to UATC)	Local	1,660	1,343	0.81
HART_019	Route 19 Westshore (Downtown to Port)	Local	1,490	2,645	1.78
HART_020X	Route 20X (Lutz to Downtown)	Express	70	40	0.57
HART_021X	Route 21X (Temple Terr to Downtown)	Express	40	24	0.60
HART_022X	Route 22X (Brandon to Downtown)	Express	60	85	1.42
HART_024X	Route 24X (Riverview to MacDill)	Express	260	141	0.54
HART_025X	Route 25X (Brandon to MacDill)	Express	200	220	1.10
HART_027X	Route 27X (Fishhawk to Downtown)	Express	80	44	0.55
HART_028X	Route 28X (Dover to Downtown)	Express	40	8	0.20
HART_030	Route 30 Westshore (Downtown to Tampa Airport)	Local	2,270	3,966	1.75
HART_031	Route 31 Brandon (Downtown to Ruskin)	Local	250	235	0.94
HART_032	Route 32 MLK (WTC to Mango)	Local	1,880	1,609	0.86
HART_033	Route 33 Fletcher Ave (UATC to Carrollwood)	Local	950	1,167	1.23
HART_034	Route 34 Hillsborough Ave (TNC to Netpark)	Local	2,980	3,891	1.31
HART_036	Route 36 Himes (South Tampa to Carrollwood)	Local	2,090	4,156	1.99
HART_037	Route 37 Grand Regency Plaza (Brandon to Netpark)	Local	1,320	886	0.67
HART_039	Route 39 Busch (TNC to Citrus Park)	Local	3,070	2,880	0.94
HART_041	Route 41 Sligh Ave (Waters to Netpark)	Local	520	91	0.18
HART_045	Route 45 Rome Ave (UATC to Westshore)	Local	1,820	2,032	1.12
HART_046	Route 46 Downtown (Davis Islands to Brandon)	Local	570	1,672	2.93
HART_047LX	Route 47LX (Southshore to Downtown)	Express	80	132	1.65
HART_051X	Route 51X New Tampa - Pasco	Express	50	40	0.80
HART_053LX	Route 53LX South County - Brandon via US301	Express	80	7	0.09
HART_057	Route 57 Temple Terr (Netpark to UATC)	Local	810	296	0.37
HART_061X	Route 61LX Northwest Limited Express	Express	50	67	1.34
HART_086	Brandon Flex Service	Local		210	n/a
HART_087	Sun City Southshore Flex Service	Local		108	n/a
HART_088	Town N Country Flex Service	Local		190	n/a
HART_089	S Tampa Flex Service	Local		247	n/a
HART_090	Northdale Flex Service	Local		232	n/a
HART_096TLY	Route 96 Trolley (Purple Line MTC to Harbor Island)	Local	100	15	0.15
HART_200X	Route 200X (MTC Tampa to Clearwater)	Express	70	57	0.81
HART_500	MetroRapid North-South Nebraska Ave	In-Street BRT	2,360	3,080	1.31
HART_700	HART Streetcar 1	Local		142	n/a
PSTA					
PSTA_001	Route 1 (Tyrone Square to Gateway Mall)	Local	87	212	2.43
PSTA_004	Route 4 (Royhanna to Goodwill)	Local	3,524	5,010	1.42
PSTA_005	Route 5 (Tyrone Square Mall to Williams Park)	Local	710	291	0.41

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Route	Name	Type	Obs.	Est.	Ratio
PSTA_007	Route 7 (Williams Park to Tyrone Square)	Local	521	237	0.45
PSTA_011	Route 11 (Pinellas SW Mall to Pinellas Point)	Local	854	445	0.52
PSTA_014	Route 14 (Williams Park to Pasadena Hospital)	Local	1,337	696	0.52
PSTA_015	Route 15 (Downtown St.Pete. to Gulfport)	Local	561	168	0.30
PSTA_018	Route 18 (Williams Park to Park Street)	Local	4,120	3,888	0.94
PSTA_019	Route 19 (Tarpon Springs to St.Pete.)	Local	5,328	4,652	0.87
PSTA_020	Route 20 (TYRONE SQ. MALL-SKYWAY PLAZA)	Local	539	316	0.59
PSTA_023	Route 23 (Williams Park to Tyrone Square Mall)	Local	872	840	0.96
PSTA_030	Route 30 (Tyrone Square Mall to NE Shopping Ctr)	Local	54	12	0.22
PSTA_032	Route 32 (Downtown St.Pete Circulator)	Local	171	119	0.69
PSTA_035	Route 35 (Central Avenue Trolley)	Local	2,061	2,303	1.12
PSTA_038	Route 38 (Tyrone Square Mall to Williams Park)	Local	587	228	0.39
PSTA_052	Route 52 (Williams Park to Clearwater CBD)	Local	4,500	3,887	0.86
PSTA_058	Route 58 (Gateway Mall to Reddington shores)	Local	156	481	3.08
PSTA_059	Route 59 (Williams Park to Indian Rocks)	Local	2,540	4,462	1.76
PSTA_060	Route 60 (Clearwater Downtown to Bayview)	Local	1,670	1,437	0.86
PSTA_061	Route 61 (Indian Rocks to Dunedin)	Local	678	412	0.61
PSTA_062	Route 62 (Shoppes of Boot to Tyrone Square Mall)	Local	625	845	1.35
PSTA_066	Route 66 (Tarpon Springs to Indian Rocks)	Local	935	921	0.99
PSTA_067	Route 67 (Park St to Downtown Oldsmar)	Local	435	508	1.17
PSTA_068	Route 68 (Tyrone Square to Johns Pass)	Local	329	191	0.58
PSTA_073	Route 73 (Park St to Tyrone Square)	Local	385	540	1.40
PSTA_074	Route 74 (Williams Park to Indian Rocks)	Local	1,942	3,148	1.62
PSTA_075	Route 75 (Tyrone Square Mall to Gateway Mall)	Local	555	359	0.65
PSTA_076	Route 76 (Park St to Countryside Mall)	Local	452	340	0.75
PSTA_078	Route 78 (Downtown Clearwater to Countryside Mall)	Local	796	772	0.97
PSTA_079	Route 79 (Tyrone to Bay Area)	Local	1,913	2,637	1.38
PSTA_090	Route 90 (Central Plaza)	Local	93	645	6.94
PSTA_097	Route 97 (Williams Park to 49th St)	Local	173	272	1.58
PSTA_098	Route 98 (Downtown Clearwater to Carillon Office Complex)	Local	114	719	6.28
PSTA_100X	Route 100X (Pinellas to Downtown Tampa)	Express	243	480	1.98
PSTA_300X	Route 300X (Ulmerton to MTC Tampa)	Express	139	112	0.81
PSTA_355	Route 355 (Beach)	Local	859	106	0.12
PSTA_444	Route 444 (Trolley)	Local	38	0	0.00
PSTA_777	Route 777 (Clearwater Beach to Pass a Grille)	Local	1,500	1,291	0.86
PSTA_811	Route 811 (East Lake)	Local	25	114	4.61
PSTA_812	Route 812 (Westfield Countryside to HART NW Transfer Center)	Local	83	519	6.27
PSTA_813	Route 813 (Westfield Countryside to Walmart Palm Harbor)	Local	47	473	10.15
PSTA_888	Route 888 (Beach)	Local	589	508	0.86
PSTA_JTCB	Jolley Trolley	Local		162	n/a
PSTA_JTTS	Jolley Trolley	Local		845	n/a
PSTA_JTWA	Jolley Trolley	Local		102	n/a
PCPT					
PCPT_014	Route 14 (Southgate to Universal Plaza)	Local	270	193	0.71
PCPT_016	Route 16 (Bayonet Point to Gulf View Square)	Local	161	198	1.23
PCPT_018	Route 18 (KMART to Tarpon Springs Docks)	Local	70	76	1.09
PCPT_019	Route 19 (Bayonet Pt to Huey Ave)	Local	1,098	1,319	1.20
PCPT_021	Route 21 (Scheer Comm. center to Gulfview Square Mall)	Local	437	419	0.96
PCPT_023	Route 23 (Gulfview Square Mall to Universal Plaza)	Local	151	358	2.37
PCPT_025	Route 25 (Gulfview Square Mall to Chelsea Plaza)	Local	111	148	1.33
PCPT_030	Route 30 (Cummer Rd to Zephyrhills City Hall)	Local	272	217	0.80
PCPT_031	Route 31 (PHCC to Adair Rd)	Local	30	42	1.40
PCPT_041	Route 41 (Central Blvd to US 41 Walmart)	Local	7	40	5.71

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Route	Name	Type	Obs.	Est.	Ratio
PCPT_054	Route 54 (US 19 to Zephyrhills)	Local	245	291	1.19
TBUS					
THEBUS_BLUE	Blue Route (Spring Hill Route 2)	Local	373	154	1.67
THEBUS_PUR	Purple Route (Brooksville Route 3)	Local		242	
THEBUS_RED	Red Route (Spring Hill Route 1)	Local		226	
Citrus					
CITR_BH	Citrus Beverly Hills	Local	253	8	0.10
CITR_CR	Citrus Crystal River	Local		5	
CITR_HOMO	Citrus Homosassa	Local		6	
CITR_INV	Citrus Inverness	Local		7	

11.3 SUMMARY

Table 74 provides a summary of the 2015 Base Year model ridership as produced for the validation run. These numbers match very closely to the target ridership observations used for calibration shown back in **Table 72**.

Table 74: 2015 Base Year Unlinked Trips by Mode and Owner

Period	Mode	Owner Agency				
		HART	PSTA	PCPT	TheBUS / Citrus	Total
Peak Period	Local Bus	27,005	18,005	1,478	290	46,778
	Express Bus	860	541	0	0	1,401
	Other Transit	1,455	0	0	0	1,455
	Total	29,320	18,546	1,478	290	49,634
Off-Peak Period	Local Bus	23,508	28,108	1,823	358	53,797
	Express Bus	5	51	0	0	56
	Other Transit	1,782	0	0	0	1,782
	Total	25,295	28,159	1,823	358	55,635
Daily	Local Bus	50,513	46,113	3,301	648	100,575
	Express Bus	865	592	0	0	1,457
	Other Transit	3,237	0	0	0	3,237
	Total	54,615	46,705	3,301	648	105,269

Chapter 12 -HIGHWAY ASSIGNMENT

The Highway Assignment (HASSIGN) module first determines the routes for which automobile and a truck trip follow from TAZ to TAZ and then assigns those trips to the highway network. The HASSIGN module allocates vehicle trips to the minimum impedance path between each pair of zones in the highway network. This is accomplished through an equilibrium assignment process. This process utilizes a series of iterations until equilibrium is achieved when additional trips can no longer be made without increasing the total travel time of all trips in the network. The evaluation of the highway assignment model is based on comparisons between observed traffic counts and estimated model volumes.

Simulated traffic volumes are compared to traffic counts in several different ways to determine whether the coded highway network accurately represents the highway system, and to determine whether the various assumptions used in the model chain are reasonable. Highway assignment evaluation reports are also generated to compare simulated volumes with traffic counts.

12.1 MODEL PROCESS AND ENHANCEMENTS

Several enhancements along the way have been made to the TBRPM highway assignment model over the years. These enhancements include application of time-period assignments, variable UROAD factors, CONFAC factors, a managed lane process, and an optional truck assignment process.

12.1.1 PERIOD ASSIGNMENT

TBRPM v9.0 continues with Time of Day (TOD) highway assignment from the previous TBRPM version. Traffic is assigned separately for each of the four periods including two peak periods (AM and PM) and two off-peak periods (Mid-day and Evening). **Table 75** depicts each of the four time periods for the daily totals.

Table 75: TBRPM v9.0 - Time of Day (TOD) Period Descriptions

Period	Hours of Operation	Number of Hours
AM Peak (AM)	6:30 AM to 9:00 AM	2.5
Mid-day (MD)	9:00 AM to 3:30 PM	6.5
PM Peak (PM)	3:30 PM to 6:30 PM	3.0
Evening (EV)	6:30 PM to 6:30 AM	12.0

12.1.2 UROAD FACTORS AND CONFAC FACTORS

The capacity table used for the 2015 Base Year validation assumes actual capacity at LOS E. The capacity values were updated based on the 2013 FDOT Quality / LOS Handbook Generalized Capacity Tables into the SPDCAP file originally formatted by FDOT Central Office. The application of variable UROAD factors by facility type allows the approximation of LOS C for each highway link, a condition at which people taking trips generally begin diverting to less congested facilities.

In previous daily models, the CONFAC parameter was used in the highway assignment process to factor roadway capacities from hourly to a daily equivalent to calculate daily volume/capacity ratios. These volume / capacity ratios were representative of the peak or worst hour of the day but in terms of daily volumes. In the Time-of-Day (TOD) based TBRPM v9.0, highway capacities are converted from hourly to period equivalent capacities using one of four period based CONFACs, but the input capacities still remain the peak hourly capacities by facility type. The period based CONFAC parameters enables the TBRPM v9.0 to compute period volume/capacity ratios

that are used in the BPR volume-delay function for each period assignment. Daily volumes are totaled from the period assigned networks by summarizing the four TOD assignment networks into one final, Daily network which is also used for reporting purposes. **Table 93** in *Appendix G – Highway Assignment Validation Tables* includes a summary of the VFACTORS file by facility type group with the variable BPR LOS Coefficient, BPR Exponent and UROAD values by facility type used for the TBRPM v9.0.

12.1.3 EXPRESS LANES ASSIGNMENT PROCESS

One of the current issues for the Tampa Bay area is the development of Express Lanes along the various interstate and toll facilities in the region. The TBRPM v9.0 has a process installed called “Diversion Curve” assignment which is among the leading processes by which most toll and revenue studies are currently being evaluated. The process reevaluates route choice within the normal user equilibrium assignment based on a cost / travel time savings. The cost is generally the toll being assessed along the “Express Lanes” in comparison to the congested travel time of the path on the Express Lanes vs. the congested travel time of the general-purpose lanes along a comparative route. This is different from the adopted CTOLL methodology used for validation which basically converts tolls along a path to equivalent travel time which in turn diverts travel based on the congested travel times. Although the new process is available for use, it has not been fully validated at a regional or sub-area level and would be up to the end user to validate the necessary inputs if they were to use it in a project setting.

12.1.4 TRUCK ASSIGNMENT

Several different techniques were considered to implement a truck assignment including pre-loading and a truck-only assignment. The technique that was selected assigns truck traffic simultaneously with the general assignment. The key benefit to this approach is that only one assignment process is required. Other benefits include a single output loaded historical network file and shortened model run times. One goal of the truck assignment is to minimize the impact of truck analyses on the overall model stream. As a result, to perform an analysis of truck assignment, only one script file in the standard model stream was changed to accommodate the refined assignment and reporting for trucks.

Early versions of the TBRPM assigned only two trip modes, also referred to as trip purposes: single occupancy vehicle (SOV) and high occupancy vehicle (HOV). Truck trips were treated as a component of SOV travel. To isolate truck trips, the more modern TBRPMs use three trip modes: Truck, SOV and HOV.

The first change to the highway assignment process required the isolation of the truck trip table. This table identifies the number of truck trips among all traffic analysis zones (TAZs) in the network. Since the original TBRPM approach included truck trips as part of the SOV trip purpose, truck trips had to be identified and then subtracted from SOV trips to create a special truck purpose. Now that truck trips are their own purpose as *medium* and *heavy* trucks from the beginning of the model stream, they are kept separated from the other person trips as vehicle trips. Truck trips are then merged back with the rest of the vehicle trips generated after the Mode Choice process is completed. The combined vehicle trip table is used in the final assignment.

During the highway assignment process, the Cube Voyager Highway module utilizes a hierarchy of modes ranging from the lowest mode (Purpose 1) to the highest mode (the maximum purpose number). The TBRPM hierarchy is set such that Purpose 1 is Truck, Purpose 2 is SOV, and Purpose 3 is HOV. Truck trips are assigned by free flow time paths whereas SOV and HOV trips are assigned with respect to congested travel time at each iteration of the equilibrium process. There are some adjustments made to truck free flow travel times on the highway networks especially for the CBD areas to prevent truck traffic from using these areas for pass through trips which are generally illogical. SOV trips cannot use facilities that are designated as truck only or HOV. Conversely, truck trips can use most all facilities available to SOV trips, but not certain truck restricted facilities, such as those exclusively reserved for HOV trips, Reversible Elevated Lanes (FT 96, 97) and Express Lanes (FT 94). HOV trips can use any facility in the highway network except the Truck Only ramps (FT 76) that are now providing direct access for trucks to the port area in Tampa without having to use local roads.

The assignment process is based upon the minimum path between a pair of zones, which is a function of congested travel time, user costs such as tolls, and any time penalties or turn prohibitors. The result of this process is a three purpose loaded historical Voyager formatted binary network file. By assigning all three purposes simultaneously, the TBRPM maintains the ability to perform selected link and turning movement analysis. As stated before, each of the period, assigned networks are then combined into a single loaded binary network. This network maintains the necessary volume and count information for the validation network for each period, as

well as the daily totals for each link. Each of the period attributes are given a period designation to start the attribute name to identify the period to which it belongs. These attributes will be described in more detail in the *User's Procedural Guide*, the companion report to this one.

12.2 HIGHWAY ASSIGNMENT VALIDATION

Highway assignment validation reports were developed to perform systems-level evaluation activities to assist in the model validation process. These reports have been programmed using the Cube Voyager scripting language to produce reports in a HTML format that can be viewed initial using Internet Explorer or any modern browser. HTML formatted reporting functionality was developed initially for the TBRPM v7.0 and has been enhanced to include time of day reporting both for validation and analysis reporting.

12.2.1 SYSTEM-WIDE STATISTICS

A summary of overall system statistics from the highway assignment is provided in **Table 76**. This summary includes the four time periods and daily statistics.

Table 76: 2015 Base Year Overall System Statistics for Highway Assignment

OVERALL STATISTICS	Daily	AM PK	MD OP	PM PK	EV OP
TOTAL NUMBER OF LINKS	12,229	12,229	12,229	12,229	12,229
TOTAL SYSTEM MILES	3,986.26	3,986.26	3,986.26	3,986.26	3,986.26
TOTAL LANE MILES	10,980.48	10,980.48	10,980.48	10,980.48	10,980.48
TOTAL DIRECTIONAL MILES	7,050.54	7,041.60	7,041.60	7,041.60	7,041.60
TOTAL VMT USING VOLUMES (LINKS WITH COUNTS)	20,849,349	2,279,494	5,204,882	3,216,993	3,243,212
TOTAL VMT USING COUNTS (LINKS WITH COUNTS)	20,907,748	2,413,631	5,346,541	3,238,189	3,377,022
TOTAL VMT V/C (LINKS WITH COUNTS)	1.00	0.94	0.97	0.99	0.96
TOTAL VHT USING VOLUMES (LINKS WITH COUNTS)	602,165	74,126	141,484	101,166	83,451
TOTAL VHT USING COUNTS (LINKS WITH COUNTS)	608,183	77,060	147,420	101,895	87,424
TOTAL VHT V/C (LINKS WITH COUNTS)	0.99	0.96	0.96	0.99	0.95
TOTAL VOLUMES ALL LINKS	213,328,017	35,629,460	77,836,967	51,339,561	48,522,029
AVERAGE TOTAL VOLUME	17,444	2,914	6,365	4,198	3,968
TOTAL VMT ALL LINKS	66,837,000	10,997,525	24,917,242	15,665,812	15,256,421
TOTAL VHT ALL LINKS	1,940,857	359,980	682,706	499,671	398,499
TOTAL ORIGINAL SPEED (MPH)	35.38	35.35	35.35	35.35	35.35
TOTAL CONGESTED SPEED (MPH)	33.59	33.25	34.18	32.89	34.79

Note: Links with counts for the periods are only Time of Day counts; the daily links with counts include all AADT counts as well. So, period results don't add up exactly to the daily results for links with counts.

CHAPTER 12 – HIGHWAY ASSIGNMENT

Table 77 provides a listing of the highway assignment validation tables. These tables can be found in *Appendix G – Highway Assignment Validation Tables* at the end of this document.

Table 77: 2015 Base Year Highway Assignment Validation Reports

Table #	Report Name
Network Statistics by Links	
Table 94	2015 Base Year Total Number of Links by Facility Type and Area Type
Table 95	2015 Base Year Percentage Links by Facility Type and Area Type
Table 96	2015 Base Year Total Number of Links with Counts by Facility Type and Area Type
Table 97	2015 Base Year Percentage of Links with Counts by Facility Type and Area Type
Table 98	2015 Base Year Total Truck Counts
Volume to Count	
Table 99	2015 Base Year Volume to Count Ratios for Links with Counts by Time Period and Facility Type
Table 100	2015 Base Year Volume to Count Ratios for Links with Counts by Time Period and Area Type
Table 101	2015 Base Year Daily Volume to Count Ratios for Links with Counts by Facility and Area Types
Table 102	2015 Base Year Total Truck Volume on all Links with Truck Counts
Table 103	2015 Base Year Ratio of Truck Volumes of Truck Counts
Table 104	2015 Base Year Percent of Truck Volume over Total Volume
Table 105	2015 Base Year AM Period Volume to Count Ratios for Links with Counts by Facility and Area Types
Table 106	2015 Base Year MD Period Volume to Count Ratios for Links with Counts by Facility and Area Types
Table 107	2015 Base Year PM Period Volume to Count Ratios for Links with Counts by Facility and Area Types
Table 108	2015 Base Year EV Period Volume to Count Ratios for Links with Counts by Facility and Area Types
VMT/VHT	
Table 109	2015 Base Year Total Volume on All Links
Table 110	2015 Base Year Volume Percentages on All Links
Table 111	2015 Base Year Average Total Volume on all Links
Table 112	2015 Base Year Total VMT for all Links Using Volumes
Table 113	2015 Base Year Total VHT for all Links Using Volumes
Table 114	2015 Base Year Total VMT Using Volumes on Links with Counts
Table 115	2015 Base Year Total VMT Using Counts on Links with Counts
Table 116	2015 Base Year Ratio of Volume over Count VMT
Table 117	2015 Base Year Total VHT Using Volumes on Links with Counts
Table 118	2015 Base Year Total VHT Using Counts on Links with Counts
Table 119	2015 Base Year Ratio of Volume over Count VHT
Table 120	2015 Base Year Total Volume on Links with Counts
Table 121	2015 Base Year Total of Counts on Links with Counts
Table 122	2015 Base Year Ratio of Volume over Count
Network Speeds	
Table 123	2015 Base Year Original Speeds (MPH)
Table 124	2015 Base Year Congested Speeds (MPH)
Table 125	2015 Base Year Percent Change in Speed
RMSE	
Table 126	2015 Base Year Daily RMSE Error Percentages
Screenline Validation	
Table 127	2015 Base Year Screenline Validation Summary – AM Period
Table 128	2015 Base Year Screenline Validation Summary – MD Period
Table 129	2015 Base Year Screenline Validation Summary – PM Period
Table 130	2015 Base Year Screenline Validation Summary – EV Period
Table 131	2015 Base Year Screenline Validation Summary – Daily

12.3 SUMMARY

Overall highway evaluation measures indicate a high degree of correlation between observed and estimated traffic volumes as forecasted by the TBRPM for the Base Year 2015 network. Input and output model speeds are reasonable and reflect appropriate relationships to one another. Screenline summaries; volume to count ratios by facility type and area type; and percent root mean square error summaries all indicate that the model is a reliable tool for system level transportation planning analyses.

Chapter 13 -SUMMARY

The validation of the TBRPM v9.0 as documented in this report demonstrates the strengths and some weaknesses of the model. **Table 78** summarizes the model results as compared with the validation criteria established for the model. The table suggests that the overall performance of the model meets most of the established criteria.

Table 78: Base Year 2015 Model Performance Summary

Criteria	Model Requirement	Model Performance
Ratio of region-wide Home-Based Work productions to Home-Based Work attractions from the Trip Generation Model (prior to any adjustments).	0.90 to 1.10	1.00
Ratio of region-wide productions to attractions for all other purposes (prior to any adjustments).	0.90 to 1.20	0.99
Total area-wide ratio of assigned traffic volumes to traffic counts (for all links with counts) for total volumes.	0.95 to 1.05	0.98
Total area-wide ratio of assigned traffic volumes to traffic counts (for all links with counts) for total Vehicle Miles Traveled (VMT).	0.95 to 1.05	1.00
Total area-wide ratio of assigned traffic volumes to traffic counts (for all links with counts) for total Vehicle Hours Traveled (VHT).	0.95 to 1.05	0.99
Root Mean Square Error for all links	0.32 to 0.39	0.33
Total area-wide ratio of assigned traffic volumes to traffic counts for the following facility types:		
• Freeways	0.93 to 1.07	1.00
• Divided Arterials	0.90 to 1.10	1.01
• Undivided Arterials	0.85 to 1.15	1.00
• Collectors	0.75 to 1.25	0.83
• One-Way Streets	0.75 to 1.25	1.06
Total area-wide ratio of assigned traffic volumes to traffic counts for broad groups of area types should be within the following ranges:		
• Central Business Districts (CBDs)	0.75 to 1.25	1.10
• CBD Fringe Areas	0.75 to 1.25	0.95
• Residential (Other Urban Area)	0.90 to 1.10	0.97
• Outlying Business Districts	0.90 to 1.10	0.99
• Rural Areas	0.80 to 1.20	1.14
Ratio of assigned traffic volumes to traffic counts for each internal screenline should be within the following ranges:		
• Less than 50,000 VPD	0.80 to 1.20	8 of 14 within range
• 50,000 to 100,000 VPD	0.85 to 1.15	6 of 8 within range
• Greater than 100,000 VPD	0.90 to 1.10	24 of 34 within range
Ratio of assigned traffic volumes to traffic counts for each external cordon line.	0.99 to 1.01	0.90 to 0.97
Percentage distribution of total assigned Vehicle Miles Traveled (VMT) among the broad classes of facility types:		
• Freeways	20% to 35%	27.8%
• Divided Arterials	25% to 40%	41.5%
• Undivided Arterials	20% to 30%	10.4%
• Collectors	10% to 20%	11.7%
Total assigned Vehicle Miles Traveled (VMT) for the following:		
• Per person	17 to 24 miles	21.9
• Per household	40 to 60 miles	52.4
Ratio of transit user trips calculated by the Modal Split model to actual transit ridership.	0.85 to 1.15	1.05

APPENDIX A – EXTERNAL TRIP TABLE

Chapter 14 - APPENDIX

APPENDIX A – EXTERNAL TRIP TABLE

Table 79: Base Year 2015 EE Auto Trip End Summary

Zone	Origin/ Productions	Destination/ Attractions	Total Production & Attractions
3001	205	205	410
3002	478	478	956
3003	410	410	820
3004	286	286	572
3005	114	114	228
3006	101	101	202
3007	3,707	3,707	7,414
3008	176	176	352
3009	228	228	456
3010	330	330	660
3011	260	260	520
3012	10,790	10,790	21,580
3013	337	337	674
3014	81	81	162
3015	251	251	502
3016	50	50	100
3017	166	166	332
3018	285	285	570
3019	540	540	1,080
3020	840	840	1,680
3021	58	58	116
3022	180	180	360
3023	70	70	140
3024	60	60	120
3025	15	15	30
3026	261	261	522
3027	7,682	7,682	15,364
3028	1,407	1,407	2,814
3029	1,072	1,072	2,144
3030	20	20	40
3031	0	0	0
3032	0	0	0
External Totals	30,460	30,460	60,920

APPENDIX A – EXTERNAL TRIP TABLE

Table 80: Base Year 2015 EE Medium Truck Trip End Summary

Zone	Origin/ Productions	Destination/ Attractions	Total Production & Attractions
3001	15	15	30
3002	13	13	26
3003	10	10	20
3004	14	14	28
3005	6	6	12
3006	4	4	8
3007	247	247	494
3008	5	5	10
3009	19	19	38
3010	20	20	40
3011	7	7	14
3012	436	436	872
3013	10	10	20
3014	8	8	16
3015	5	5	10
3016	1	1	2
3017	3	3	6
3018	12	12	24
3019	3	3	6
3020	31	31	62
3021	4	4	8
3022	7	7	14
3023	2	2	4
3024	4	4	8
3025	1	1	2
3026	10	10	20
3027	351	351	702
3028	49	49	98
3029	19	19	38
3030	0	0	0
3031	0	0	0
3032	0	0	0
External Totals	1,316	1,316	2,632

APPENDIX A – EXTERNAL TRIP TABLE

Table 81: Base Year 2015 EE Heavy Truck Trip End Summary

Zone	Origin/ Productions	Destination/ Attractions	Total Production & Attractions
3001	3	3	6
3002	1	1	2
3003	5	5	10
3004	5	5	10
3005	6	6	12
3006	10	10	20
3007	1,299	1,299	2,598
3008	27	27	54
3009	51	51	102
3010	64	64	128
3011	17	17	34
3012	624	624	1,248
3013	32	32	64
3014	8	8	16
3015	10	10	20
3016	1	1	2
3017	5	5	10
3018	47	47	94
3019	8	8	16
3020	40	40	80
3021	14	14	28
3022	28	28	56
3023	3	3	6
3024	20	20	40
3025	3	3	6
3026	35	35	70
3027	817	817	1,634
3028	53	53	106
3029	50	50	100
3030	0	0	0
3031	0	0	0
3032	0	0	0
External Totals	3,286	3,286	6,572

APPENDIX A – EXTERNAL TRIP TABLE

Table 82: Base Year 2015 EE Total Trip End Summary

Zone	Origin/ Productions	Destination/ Attractions	Total Production & Attractions
3001	223	223	446
3002	492	492	984
3003	425	425	850
3004	305	305	610
3005	126	126	252
3006	115	115	230
3007	5,253	5,253	10,506
3008	208	208	416
3009	298	298	596
3010	414	414	828
3011	284	284	568
3012	11,850	11,850	23,700
3013	379	379	758
3014	97	97	194
3015	266	266	532
3016	52	52	104
3017	174	174	348
3018	344	344	688
3019	551	551	1,102
3020	911	911	1,822
3021	76	76	152
3022	215	215	430
3023	75	75	150
3024	84	84	168
3025	19	19	38
3026	306	306	612
3027	8,850	8,850	17,700
3028	1,509	1,509	3,018
3029	1,141	1,141	2,282
3030	20	20	40
3031	0	0	0
3032	0	0	0
External Totals	35,062	35,062	70,124

APPENDIX B – TRIP GENERATION

APPENDIX B – TRIP GENERATION

Table 83: TBRPM v9.0 - Production Equations and Rates

Purpose	Production	Description	Area Type
HBW	PRODUCTIONS	= (0.590000000 * NUMBER OF BUSINESS TYPE HOTEL UNITS	+
		0.490000000 * NUMBER OF ECONOMY TYPE HOTEL UNITS	+
		0.630000000 * NUMBER OF RESORT TYPE HOTEL UNITS	+
		0.060000000 * GROUP QUARTER POPULATION	+
		0.190000000 * SEASONAL HOUSEHOLDS	+
		0.070000000 * # 0 AUTO DU'S - RETIRED	+
		1.330000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.640000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.390000000 * # 1 AUTO DU'S - RETIRED	+
		1.660000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		2.250000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.560000000 * # 2 AUTO DU'S - RETIRED	+
		2.760000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		2.690000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.890000000 * # 3+ AUTO DU'S - RETIRED	+
		3.350000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		2.850000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
HBSH	PRODUCTIONS	= (0.120000000 * NUMBER OF BUSINESS TYPE HOTEL UNITS	+
		0.340000000 * NUMBER OF ECONOMY TYPE HOTEL UNITS	+
		0.140000000 * NUMBER OF RESORT TYPE HOTEL UNITS	+
		1.590000000 * GROUP QUARTER POPULATION	+
		1.430000000 * SEASONAL HOUSEHOLDS	+
		0.290000000 * # 0 AUTO DU'S - RETIRED	+
		0.090000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.110000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.880000000 * # 1 AUTO DU'S - RETIRED	+
		0.360000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.510000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		1.230000000 * # 2 AUTO DU'S - RETIRED	+
		0.670000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.860000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		1.360000000 * # 3+ AUTO DU'S - RETIRED	+
		0.850000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		0.990000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
HBSR	PRODUCTIONS	= (1.660000000 * NUMBER OF BUSINESS TYPE HOTEL UNITS	+

APPENDIX B – TRIP GENERATION

Purpose	Production	Description	Area Type
		2.720000000 * NUMBER OF ECONOMY TYPE HOTEL UNITS	+
		2.150000000 * NUMBER OF RESORT TYPE HOTEL UNITS	+
		0.720000000 * GROUP QUARTER POPULATION	+
		3.550000000 * SEASONAL HOUSEHOLDS	+
		1.390000000 * # 0 AUTO DU'S - RETIRED	+
		0.440000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.780000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		2.190000000 * # 1 AUTO DU'S - RETIRED	+
		1.090000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		1.710000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		3.390000000 * # 2 AUTO DU'S - RETIRED	+
		1.830000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		2.890000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		3.670000000 * # 3+ AUTO DU'S - RETIRED	+
		2.350000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		3.150000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
HBSC	PRODUCTIONS	= (0.080000000 * # 0 AUTO DU'S - RETIRED	+
		0.080000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		1.800000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.090000000 * # 1 AUTO DU'S - RETIRED	+
		0.130000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		3.330000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.100000000 * # 2 AUTO DU'S - RETIRED	+
		0.200000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		3.730000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.120000000 * # 3+ AUTO DU'S - RETIRED	+
		0.280000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		3.900000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
HBO	PRODUCTIONS	= (0.070000000 * NUMBER OF BUSINESS TYPE HOTEL UNITS	+
		0.130000000 * NUMBER OF ECONOMY TYPE HOTEL UNITS	+
		0.060000000 * NUMBER OF RESORT TYPE HOTEL UNITS	+
		0.890000000 * GROUP QUARTER POPULATION	+
		1.320000000 * SEASONAL HOUSEHOLDS	+
		0.530000000 * # 0 AUTO DU'S - RETIRED	+
		0.390000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		1.100000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		1.760000000 * # 1 AUTO DU'S - RETIRED	+
		0.600000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+

APPENDIX B – TRIP GENERATION

Purpose	Production	Description	Area Type
		1.610000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		2.050000000 * # 2 AUTO DU'S - RETIRED	+
		1.270000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		2.740000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		2.240000000 * # 3+ AUTO DU'S - RETIRED	+
		1.430000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		3.290000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
AIRPORT	PRODUCTIONS	= (0.250000000 * NUMBER OF BUSINESS TYPE HOTEL UNITS	+
		0.250000000 * NUMBER OF ECONOMY TYPE HOTEL UNITS	+
		0.375000000 * NUMBER OF RESORT TYPE HOTEL UNITS	+
		0.002500000 * TOTAL EMPLOYMENT	+
		0.002500000 * # 0 AUTO DU'S - RETIRED	+
		0.002500000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.004000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.002500000 * # 1 AUTO DU'S - RETIRED	+
		0.003500000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.004000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.002500000 * # 2 AUTO DU'S - RETIRED	+
		0.003500000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.004500000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.003000000 * # 3+ AUTO DU'S - RETIRED	+
		0.004000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		0.004500000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
COL/UNV	PRODUCTIONS	= (2.000000000 * GROUP QUARTER POPULATION	+
		0.010000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.160000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.010000000 * # 1 AUTO DU'S - RETIRED	+
		0.014000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.160000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.010000000 * # 2 AUTO DU'S - RETIRED	+
		0.140000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.420000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.012000000 * # 3+ AUTO DU'S - RETIRED	+
		0.320000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		0.400000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE

APPENDIX B – TRIP GENERATION

Table 84: TBRPM v9.0 - Attraction Equations and Rates

Purpose	Attraction	Description	Area Type
HBW	ATTRACTIONS	= (0.955900000 * INDUSTRIAL EMPLOYMENT	+
		1.076900000 * COMMERCIAL REGIONAL	+
		1.415700000 * COMMERCIAL LOCAL	+
		1.681900000 * SERVICE REGIONAL	+
		1.585100000 * SERVICE LOCAL	) * AREA TYPE
HBSH	ATTRACTIONS	= (0.018600000 * INDUSTRIAL EMPLOYMENT	+
		4.036200000 * COMMERCIAL REGIONAL	+
		2.681500000 * COMMERCIAL LOCAL	+
		0.071300000 * SERVICE REGIONAL	+
		0.356500000 * SERVICE LOCAL	) * AREA TYPE
HBSR	ATTRACTIONS	= (0.028800000 * INDUSTRIAL EMPLOYMENT	+
		7.534800000 * COMMERCIAL REGIONAL	+
		9.086000000 * COMMERCIAL LOCAL	+
		0.079200000 * SERVICE REGIONAL	+
		2.725200000 * SERVICE LOCAL	+
		0.180000000 * # 0 AUTO DU'S - RETIRED	+
		0.180000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.180000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.180000000 * # 1 AUTO DU'S - RETIRED	+
		0.180000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.180000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.180000000 * # 2 AUTO DU'S - RETIRED	+
		0.180000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.180000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.180000000 * # 3+ AUTO DU'S - RETIRED	+
		0.180000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		0.180000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
HBSC	ATTRACTIONS	= (2.200000000 * K-12 SCHOOL ENROLLMENT	) * AREA TYPE
HBO	ATTRACTIONS	= (0.134400000 * INDUSTRIAL EMPLOYMENT	+
		2.124000000 * COMMERCIAL REGIONAL	+
		3.465600000 * COMMERCIAL LOCAL	+
		0.088800000 * SERVICE REGIONAL	+
		4.557600000 * SERVICE LOCAL	) * AREA TYPE
NHBW	ATTRACTIONS	= (0.391000000 * INDUSTRIAL EMPLOYMENT	+
		0.714000000 * COMMERCIAL REGIONAL	+
		0.977500000 * COMMERCIAL LOCAL	+
		0.025500000 * SERVICE REGIONAL	+

APPENDIX B – TRIP GENERATION

Purpose	Attraction	Description	Area Type
		0.765000000 * SERVICE LOCAL	) * AREA TYPE
NHBO	ATTRACTIONS	= (0.162500000 * INDUSTRIAL EMPLOYMENT	+
		2.737500000 * COMMERCIAL REGIONAL	+
		3.750000000 * COMMERCIAL LOCAL	+
		0.062500000 * SERVICE REGIONAL	+
		2.200000000 * SERVICE LOCAL	) * AREA TYPE
LTRK	ATTRACTIONS	= (0.110000000 * INDUSTRIAL EMPLOYMENT	+
		0.060000000 * COMMERCIAL REGIONAL	+
		0.140000000 * COMMERCIAL LOCAL	+
		0.050000000 * SERVICE REGIONAL	+
		0.030000000 * SERVICE LOCAL	+
		0.110000000 * # 0 AUTO DU'S - RETIRED	+
		0.110000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.110000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.110000000 * # 1 AUTO DU'S - RETIRED	+
		0.110000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.110000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.110000000 * # 2 AUTO DU'S - RETIRED	+
		0.110000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.110000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.110000000 * # 3+ AUTO DU'S - RETIRED	+
		0.110000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+
		0.110000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	) * AREA TYPE
HTRK	ATTRACTIONS	= (0.061000000 * INDUSTRIAL EMPLOYMENT	+
		0.039000000 * COMMERCIAL REGIONAL	+
		0.015000000 * COMMERCIAL LOCAL	+
		0.002000000 * SERVICE REGIONAL	+
		0.008000000 * SERVICE LOCAL	+
		0.031000000 * # 0 AUTO DU'S - RETIRED	+
		0.031000000 * # 0 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.031000000 * # 0 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.031000000 * # 1 AUTO DU'S - RETIRED	+
		0.031000000 * # 1 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.031000000 * # 1 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.031000000 * # 2 AUTO DU'S - RETIRED	+
		0.031000000 * # 2 AUTO DU'S - WORKERS W/O CHILDREN	+
		0.031000000 * # 2 AUTO DU'S - WORKERS W/ CHILDREN	+
		0.031000000 * # 3+ AUTO DU'S - RETIRED	+

APPENDIX B – TRIP GENERATION

Purpose	Attraction		Description		Area Type
			0.031000000 * # 3+ AUTO DU'S - WORKERS W/O CHILDREN	+	
			0.031000000 * # 3+ AUTO DU'S - WORKERS W/ CHILDREN	)	* AREA TYPE
TAXI	ATTRACTIONS	=	(0.045000000 * NUMBER OF BUSINESS TYPE HOTEL UNITS	+	
			0.024000000 * NUMBER OF ECONOMY TYPE HOTEL UNITS	+	
			0.030000000 * NUMBER OF RESORT TYPE HOTEL UNITS	+	
			0.030000000 * GROUP QUARTER POPULATION	+	
			0.020000000 * TOTAL EMPLOYMENT	+	
			0.027000000 * NUMBER OF DISADVANTAGED DU'S	)	* AREA TYPE
EI	ATTRACTIONS	=	(0.011000000 * NUMBER OF BUSINESS TYPE HOTEL UNITS	+	
			0.011000000 * NUMBER OF ECONOMY TYPE HOTEL UNITS	+	
			0.011000000 * NUMBER OF RESORT TYPE HOTEL UNITS	+	
			0.011000000 * GROUP QUARTER POPULATION	+	
			0.055000000 * TOTAL EMPLOYMENT	)	* AREA TYPE
AIRPORT	ATTRACTIONS	=	() * AREA TYPE COEF		
COL/UNV	ATTRACTIONS	=	(1.800000000 * HIGHER EDUCATION ENROLLMENT	)	* AREA TYPE

APPENDIX C – HIGHWAY NETWORK TABLES

APPENDIX C – HIGHWAY NETWORK TABLES

Table 85: 2015 Base Year Validation Speeds by Area Type and Facility Type

	AT11	AT12	AT13	AT14	AT21	AT31	AT32	AT33	AT34	AT41	AT42	AT43	AT51	AT52	AVG
FT11	45.00	0	0	0	50.00	50.00	0	0	0	50.00	0	0	0	0	48.75
FT12	0	0	0	0	0	55.00	70.00	60.00	0	0	50.00	0	65.00	70.00	61.67
FT15	40.00	0	0	0	0	47.00	0	0	0	46.00	0	0	0	0	44.33
FT16	0	0	0	0	0	0	0	0	0	0	45.00	0	0	0	45.00
FT17	0	0	0	0	0	50.00	0	0	0	46.00	47.00	0	0	0	47.67
FT21	0	0	0	0	0	42.00	42.00	43.00	0	0	42.00	42.00	50.00	55.00	45.14
FT22	0	0	0	0	0	40.00	41.00	0	0	0	39.00	0	45.00	45.00	42.00
FT23	0	0	0	34.00	29.00	38.00	39.00	39.00	38.00	35.00	38.00	38.00	42.00	40.00	37.27
FT24	23.00	0	0	28.00	25.00	34.00	0	36.00	0	33.00	36.00	36.00	0	0	31.38
FT25	20.00	0	22.00	0	23.00	33.00	0	0	0	30.00	33.00	0	0	0	26.83
FT26	0	0	0	0	0	45.00	0	0	0	0	45.00	0	0	0	45.00
FT31	0	0	0	0	0	38.00	37.00	42.00	0	0	37.00	0	45.00	46.00	40.83
FT32	0	0	0	0	0	36.00	36.00	36.00	36.00	33.00	34.00	0	40.00	41.00	36.50
FT33	0	0	0	27.00	0	33.00	0	0	0	0	32.00	33.00	36.00	0	32.20
FT34	18.00	0	0	0	20.00	31.00	0	0	0	0	31.00	0	0	0	25.00
FT35	0	0	0	0	0	37.00	36.00	36.00	0	0	36.00	0	0	44.00	37.80
FT36	0	0	0	0	24.00	33.00	0	0	0	0	0	0	39.00	0	32.00
FT37	0	0	0	0	21.00	30.00	30.00	30.00	0	29.00	29.00	0	0	36.00	29.29
FT38	16.00	0	0	0	18.00	28.00	0	0	0	0	0	0	0	0	20.67
FT41	21.00	0	0	0	0	32.00	32.00	0	0	31.00	32.00	0	0	0	29.60
FT42	0	0	21.00	0	0	31.00	31.00	31.00	30.00	0	30.00	0	37.00	35.00	30.75
FT43	0	0	0	0	20.00	30.00	30.00	30.00	0	0	30.00	0	36.00	39.00	30.71
FT44	19.00	0	0	23.00	19.00	28.00	28.00	0	0	28.00	29.00	0	0	36.00	26.25
FT45	17.00	0	0	22.00	16.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	30.00	33.00	25.58
FT46	14.00	0	18.00	0	16.00	25.00	25.00	25.00	0	25.00	25.00	0	29.00	30.00	23.20
FT47	0	0	14.00	17.00	13.00	24.00	24.00	24.00	0	0	24.00	0	24.00	25.00	21.00
FT48	13.00	0	0	0	13.00	24.00	24.00	24.00	0	23.00	24.00	0	24.00	25.00	21.56
FT49	14.00	0	0	0	0	0	0	0	0	0	0	0	0	0	14.00
FT51	2.00	2.00	4.50	8.00	4.50	16.00	16.00	24.00	16.00	15.00	16.00	16.00	25.00	25.00	0
FT52	0	0	0	0	0	50.00	0	50.00	0	0	0	0	65.00	65.00	0
FT61	0	0	0	0	0	40.00	0	0	0	0	40.00	0	0	0	40.00
FT62	21.00	0	0	0	24.00	33.00	0	0	0	0	33.00	0	0	0	27.75
FT63	19.00	0	0	27.00	22.00	32.00	0	0	0	0	30.00	30.00	0	0	26.67
FT64	15.00	0	0	0	17.00	30.00	0	0	0	0	27.00	0	0	0	22.25
FT66	0	0	0	0	25.00	0	0	0	0	40.00	41.00	0	0	0	35.33
FT67	0	0	0	0	22.00	25.00	0	0	0	0	35.00	0	0	0	27.33
FT68	0	0	0	0	0	29.00	0	0	0	0	0	0	0	0	29.00
FT71	19.00	0	0	0	20.00	30.00	30.00	30.00	0	28.00	28.00	0	0	40.00	28.13
FT72	14.00	0	0	0	15.00	25.00	0	0	0	23.00	23.00	0	0	35.00	22.50
FT73	0	0	0	0	0	29.00	0	0	29.00	27.00	27.00	0	0	0	28.00
FT74	0	0	0	0	0	0	0	0	0	0	22.00	0	0	0	22.00
FT75	37.00	0	0	0	0	45.00	0	0	0	40.00	0	0	0	55.00	44.25
FT76	0	0	0	0	0	45.00	0	0	0	0	0	0	0	0	45.00
FT91	55.00	0	0	0	55.00	65.00	0	0	0	0	50.00	0	0	0	56.25
FT92	0	0	0	0	0	65.00	70.00	70.00	0	60.00	0	0	0	70.00	67.00
FT96	0	0	0	0	55.00	65.00	0	0	0	0	0	0	0	0	60.00
FT97	0	0	0	0	0	65.00	0	0	0	0	0	0	0	0	65.00
FT98	0	0	0	0	0	42.00	42.00	0	0	41.00	0	0	0	45.00	42.50
FT99	0	0	0	0	17.50	20.00	20.00	23.00	20.00	19.00	0	0	0	25.00	20.64
AVG SPEED	22.00	0	15.00	22.25	23.18	35.69	34.00	31.89	25.71	32.45	32.89	29.43	33.88	37.83	26.87

APPENDIX C – HIGHWAY NETWORK TABLES

Table 86: 2015 Base Year Validation Capacities by Area Type and Facility Type

	AT11	AT12	AT13	AT14	AT21	AT31	AT32	AT33	AT34	AT41	AT42	AT43	AT51	AT52	AVG CAP
FT11	2,045	0	0	0	2,041	2,135	0	0	0	2,220	0	0	0	0	2,110
FT12	0	0	0	0	0	2,060	2,065	1,832	0	0	1,716	0	1,797	1,787	1,876
FT15	1,777	0	0	0	0	1,723	0	0	0	1,722	0	0	0	0	1,741
FT16	0	0	0	0	0	0	0	0	0	0	1,719	0	0	0	1,719
FT17	0	0	0	0	0	1,723	0	0	0	1,722	1,718	0	0	0	1,721
FT21	0	0	0	0	0	1,791	1,628	1,696	0	0	1,791	1,738	1,458	1,505	1,658
FT22	0	0	0	0	0	1,627	1,628	0	0	0	1,628	0	1,531	1,525	1,588
FT23	0	0	0	867	997	999	957	867	957	1,083	1,076	833	803	1,433	988
FT24	860	0	0	801	869	871	0	735	0	913	910	866	0	0	853
FT25	855	0	845	0	826	846	0	0	0	851	846	0	0	0	845
FT26	0	0	0	0	0	915	0	0	0	0	915	0	0	0	915
FT31	0	0	0	0	0	1,656	1,505	1,656	0	0	1,656	0	1,449	1,430	1,559
FT32	0	0	0	0	0	948	948	825	948	790	949	0	767	689	858
FT33	0	0	0	754	0	933	0	0	0	0	935	823	725	0	834
FT34	685	0	0	0	719	809	0	0	0	0	794	0	0	0	752
FT35	0	0	0	0	0	1,207	1,204	1,152	0	0	1,204	0	0	1,045	1,162
FT36	0	0	0	0	749	727	0	0	0	0	0	0	945	0	807
FT37	0	0	0	0	652	622	592	603	0	593	593	0	0	950	658
FT38	636	0	0	0	657	632	0	0	0	0	0	0	0	0	642
FT41	750	0	0	0	0	826	740	0	0	758	789	0	0	0	773
FT42	0	0	770	0	0	813	811	721	779	0	779	0	665	1,000	792
FT43	0	0	0	0	592	593	592	550	0	0	593	0	546	470	562
FT44	557	0	0	515	572	591	557	0	0	569	570	0	0	1,045	622
FT45	557	0	0	490	563	558	537	515	530	557	562	565	480	477	532
FT46	426	0	426	0	446	446	424	392	0	427	445	0	378	452	426
FT47	0	0	424	392	427	424	424	392	0	0	425	0	378	452	415
FT48	428	0	0	0	424	424	424	392	0	429	424	0	378	452	419
FT49	424	0	0	0	0	0	0	0	0	0	0	0	0	0	424
FT51	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	0
FT52	0	0	0	0	0	10,000	0	10,000	0	0	0	0	10,000	10,000	0
FT61	0	0	0	0	0	1,758	0	0	0	0	1,758	0	0	0	1,758
FT62	1,200	0	0	0	1,199	1,197	0	0	0	0	1,198	0	0	0	1,198
FT63	1,033	0	0	960	1,027	1,033	0	0	0	0	1,035	1,034	0	0	1,020
FT64	1,021	0	0	0	1,020	1,001	0	0	0	0	1,025	0	0	0	1,017
FT66	0	0	0	0	758	0	0	0	0	751	750	0	0	0	753
FT67	0	0	0	0	711	711	0	0	0	0	711	0	0	0	711
FT68	0	0	0	0	0	691	0	0	0	0	0	0	0	0	691
FT71	1,445	0	0	0	1,445	1,445	1,445	1,382	0	1,445	1,445	0	0	1,206	1,407
FT72	658	0	0	0	710	758	0	0	0	710	710	0	0	645	699
FT73	0	0	0	0	0	1,445	0	0	1,445	1,445	1,445	0	0	0	1,445
FT74	0	0	0	0	0	0	0	0	0	0	710	0	0	0	710
FT75	1,445	0	0	0	0	1,445	0	0	0	1,445	0	0	0	1,206	1,385
FT76	0	0	0	0	0	1,445	0	0	0	0	0	0	0	0	1,445
FT91	2,042	0	0	0	2,044	2,042	0	0	0	0	1,775	0	0	0	1,976
FT92	0	0	0	0	0	2,070	1,725	1,650	0	1,724	0	0	0	1,600	1,754
FT96	0	0	0	0	1,783	1,783	0	0	0	0	0	0	0	0	1,783
FT97	0	0	0	0	0	1,723	0	0	0	0	0	0	0	0	1,723
FT98	0	0	0	0	0	1,725	2,070	0	0	2,070	0	0	0	1,760	1,906
FT99	0	0	0	0	2,070	2,068	2,070	1,815	2,065	2,070	0	0	0	1,760	1,988
AVG CAP	942	0	493	597	932	1,139	1,064	904	961	1,104	1,017	837	769	995	904

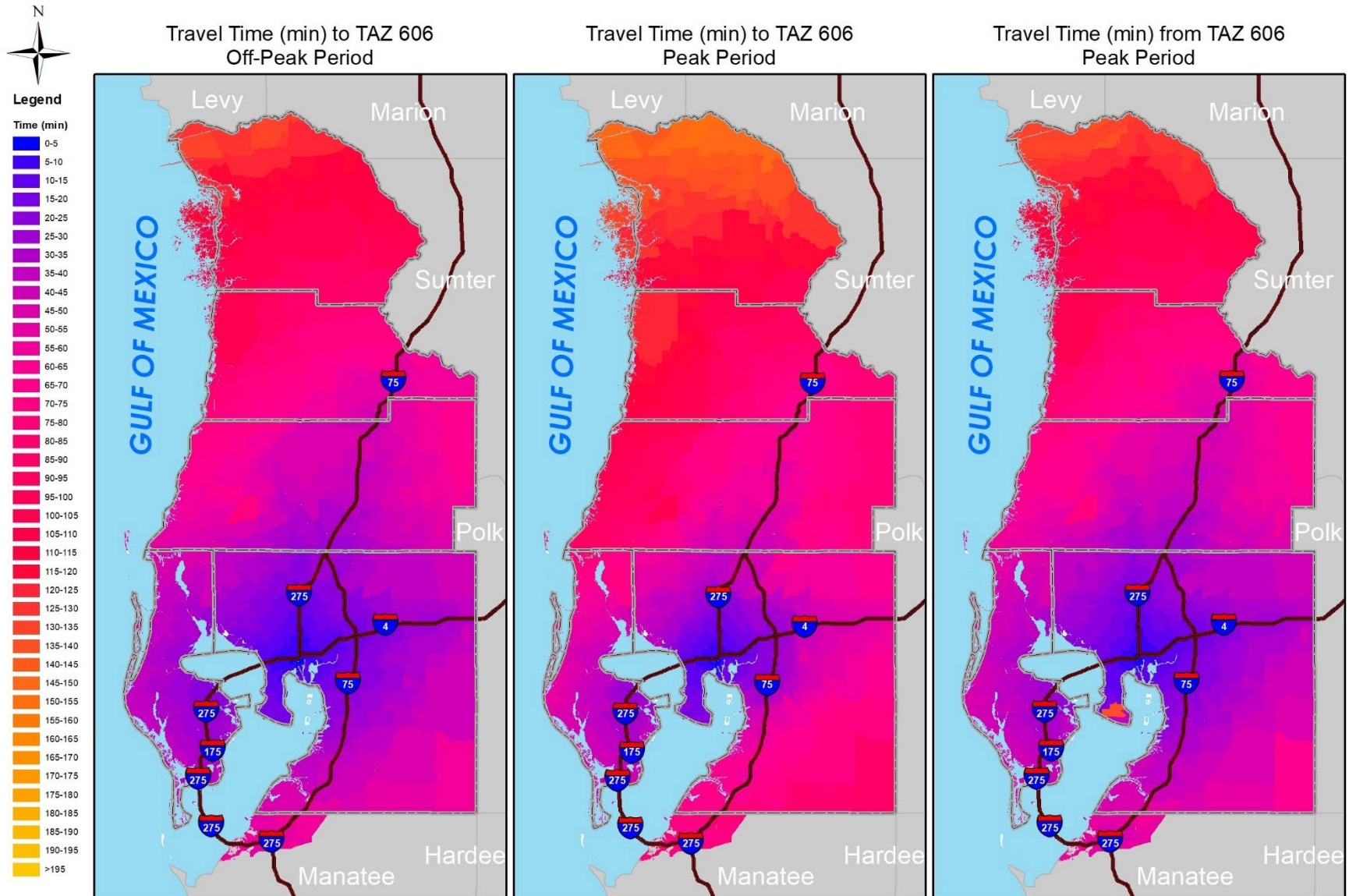


Figure 52: 2015 Base Year Travel Time Isochrone Maps – TAZ 606 – Downtown Tampa, Hillsborough

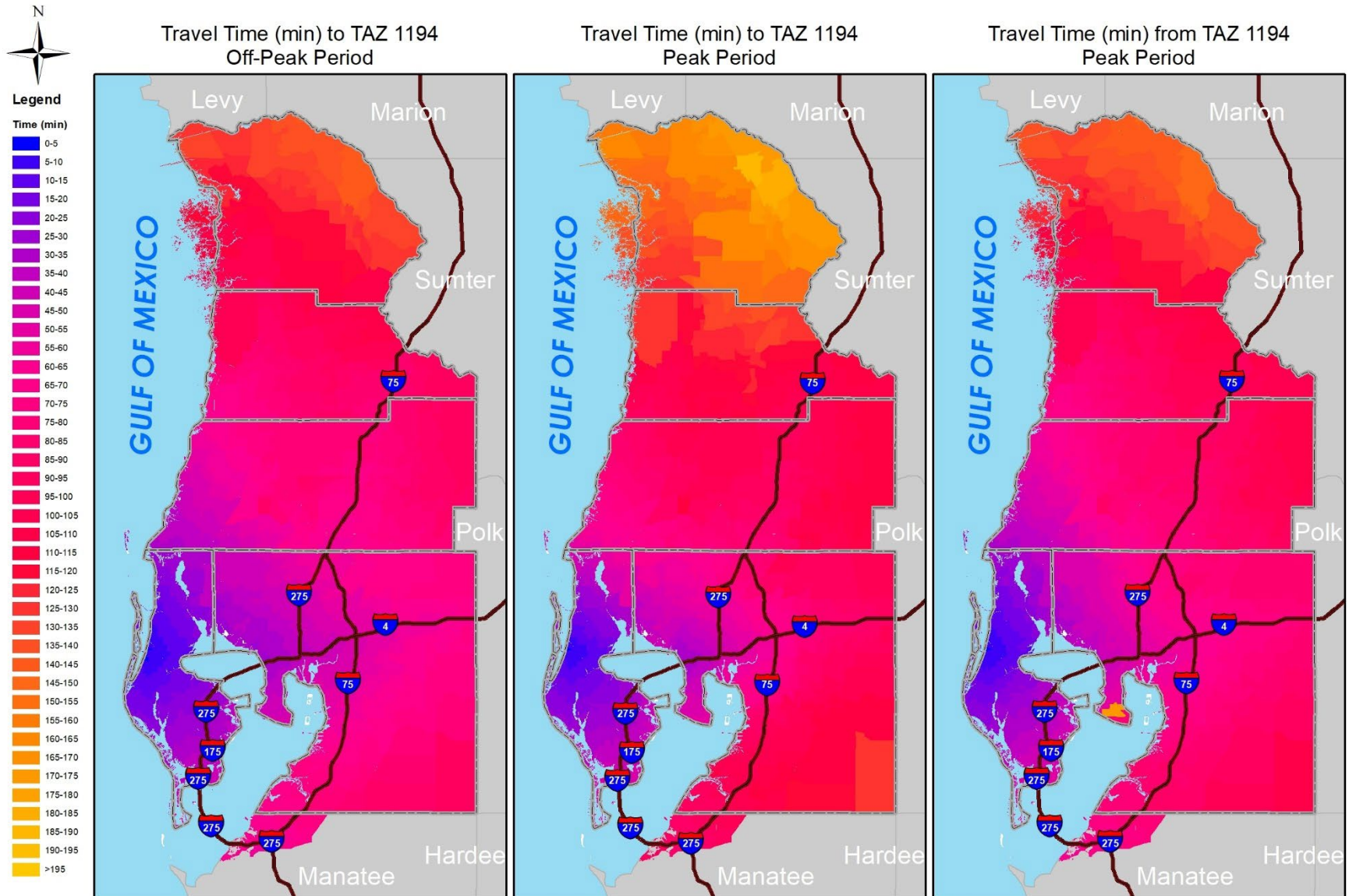


Figure 53: 2015 Base Year Travel Time Isochrone Maps – TAZ 1194 – Clearwater, Pinellas

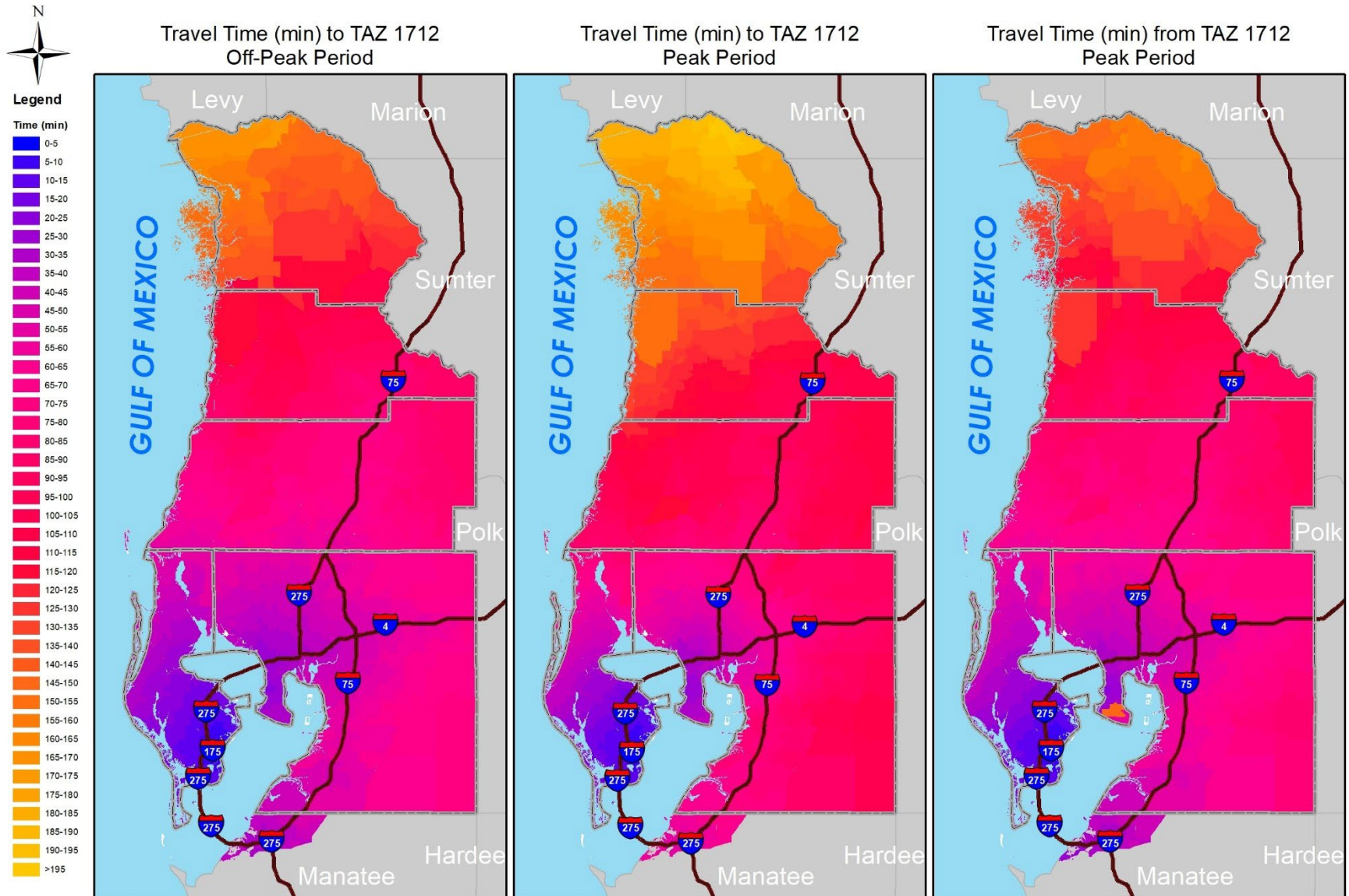


Figure 54: 2015 Base Year Travel Time Isochrone Maps – TAZ 1712 – St. Petersburg, Pinellas

APPENDIX D – HIGHWAY NETWORK TRAVEL TIMES

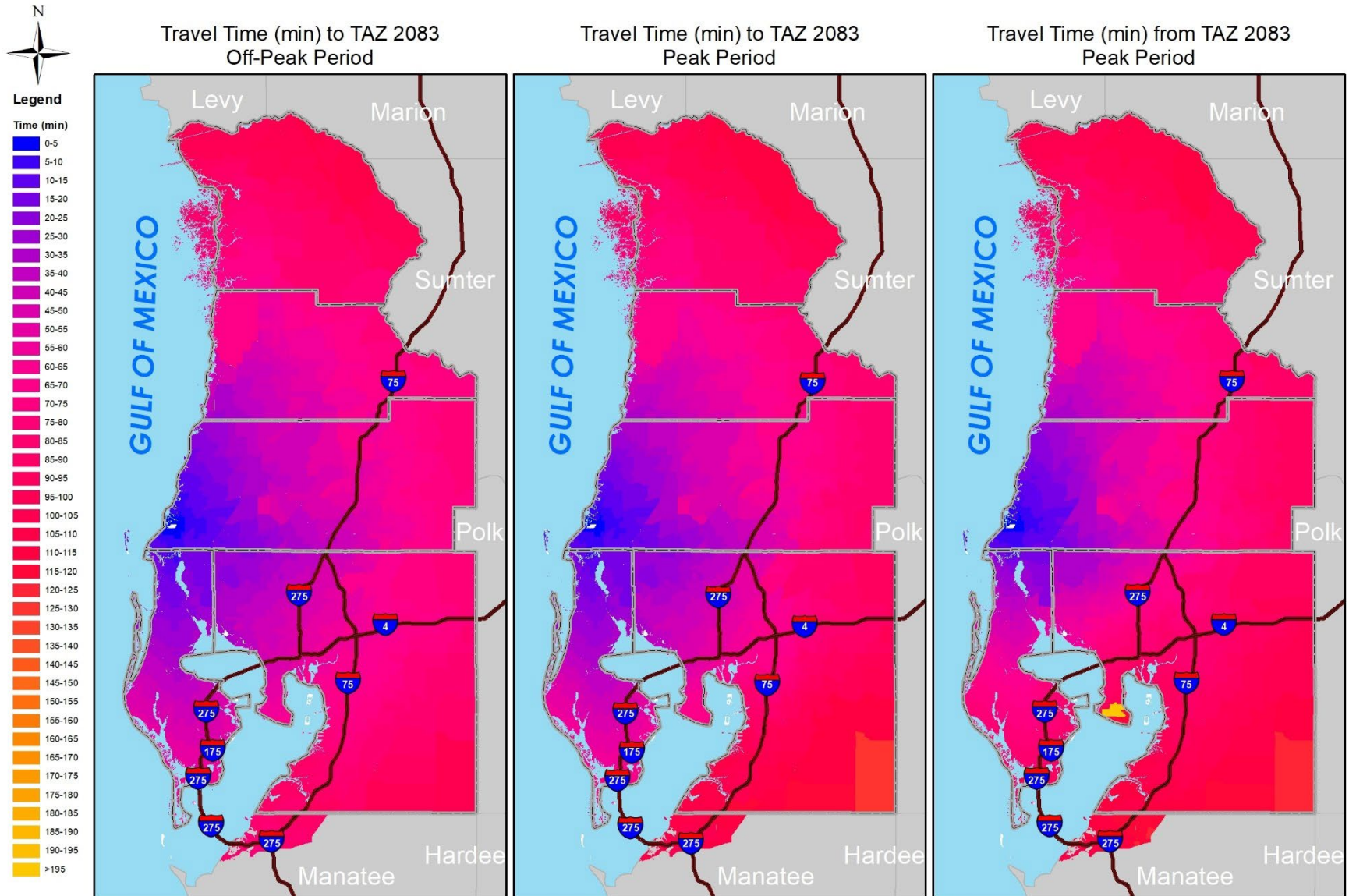


Figure 55: 2015 Base Year Travel Time Isochrone Maps – TAZ 2083 – New Port Richey, Pasco

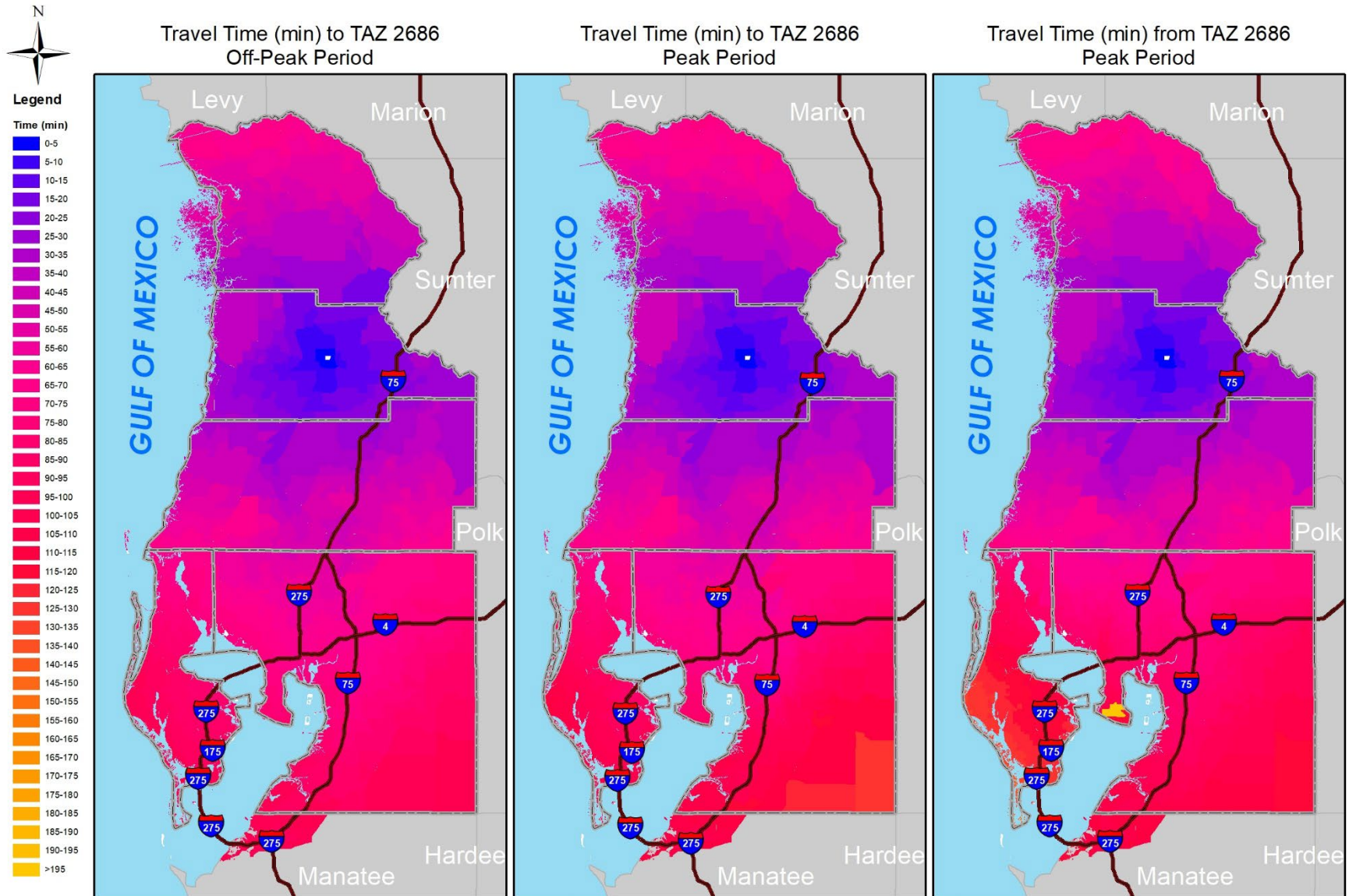


Figure 56: 2015 Base Year Travel Time Isochrone Maps – TAZ 2686 – Brooksville, Hernando

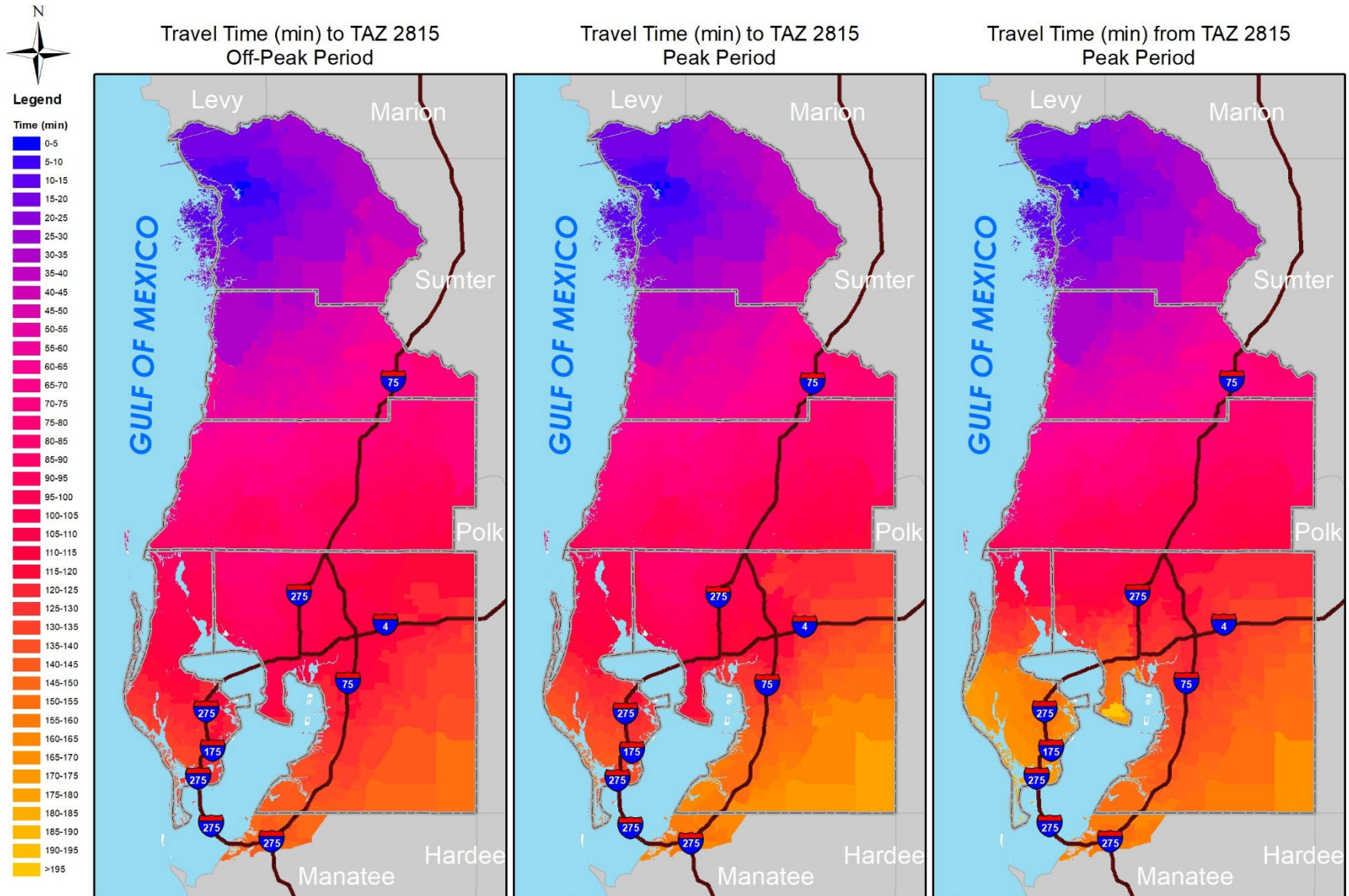


Figure 57: 2015 Base Year Travel Time Isochrone Maps – TAZ 2815 – Crystal River, Citrus

APPENDIX E – TRANSIT PATH VALIDATION

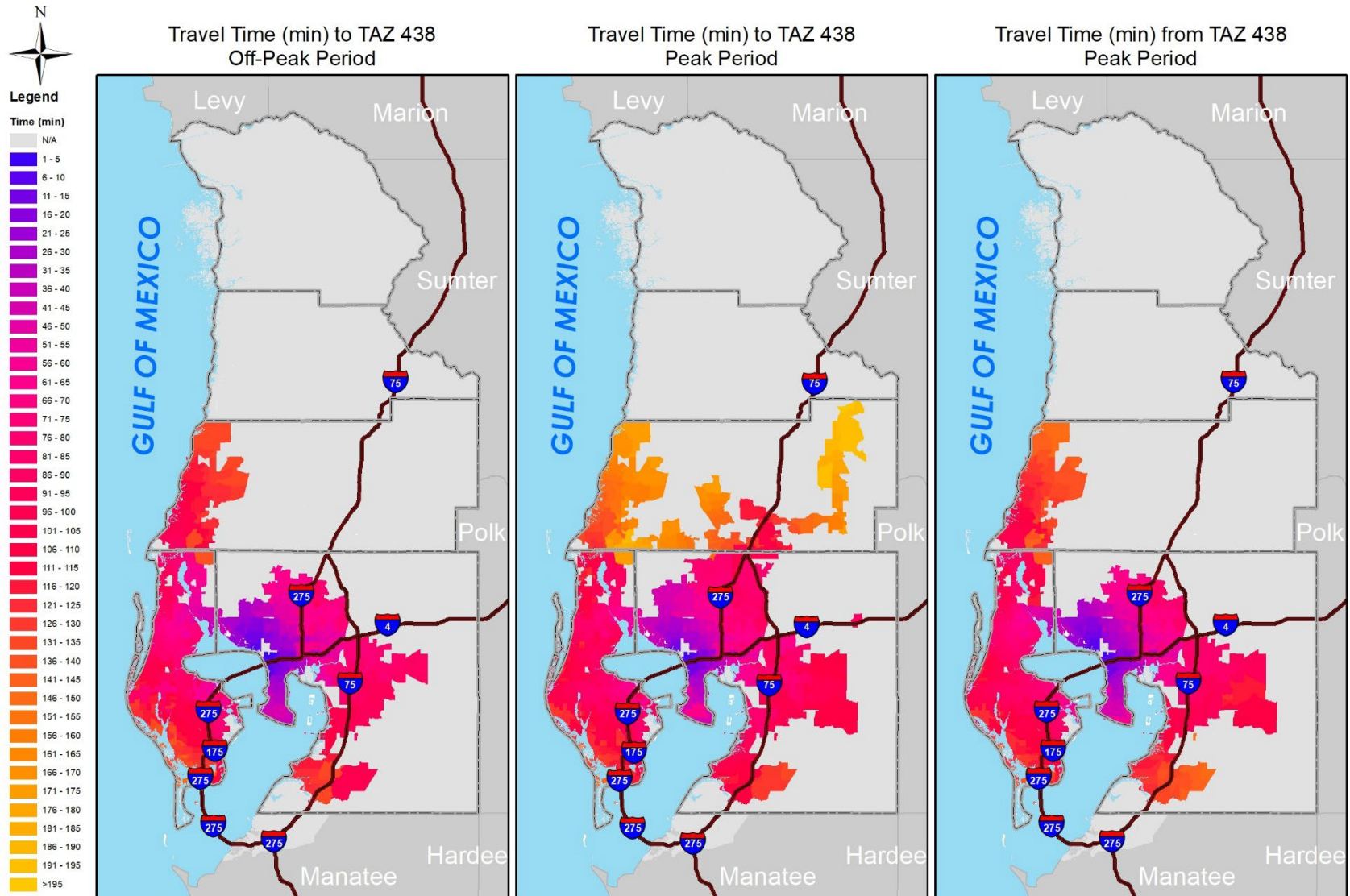


Figure 58: 2015 Base Year Bus Transit Travel Time Isochrone Maps – TAZ 438 – Westshore, Hillsborough

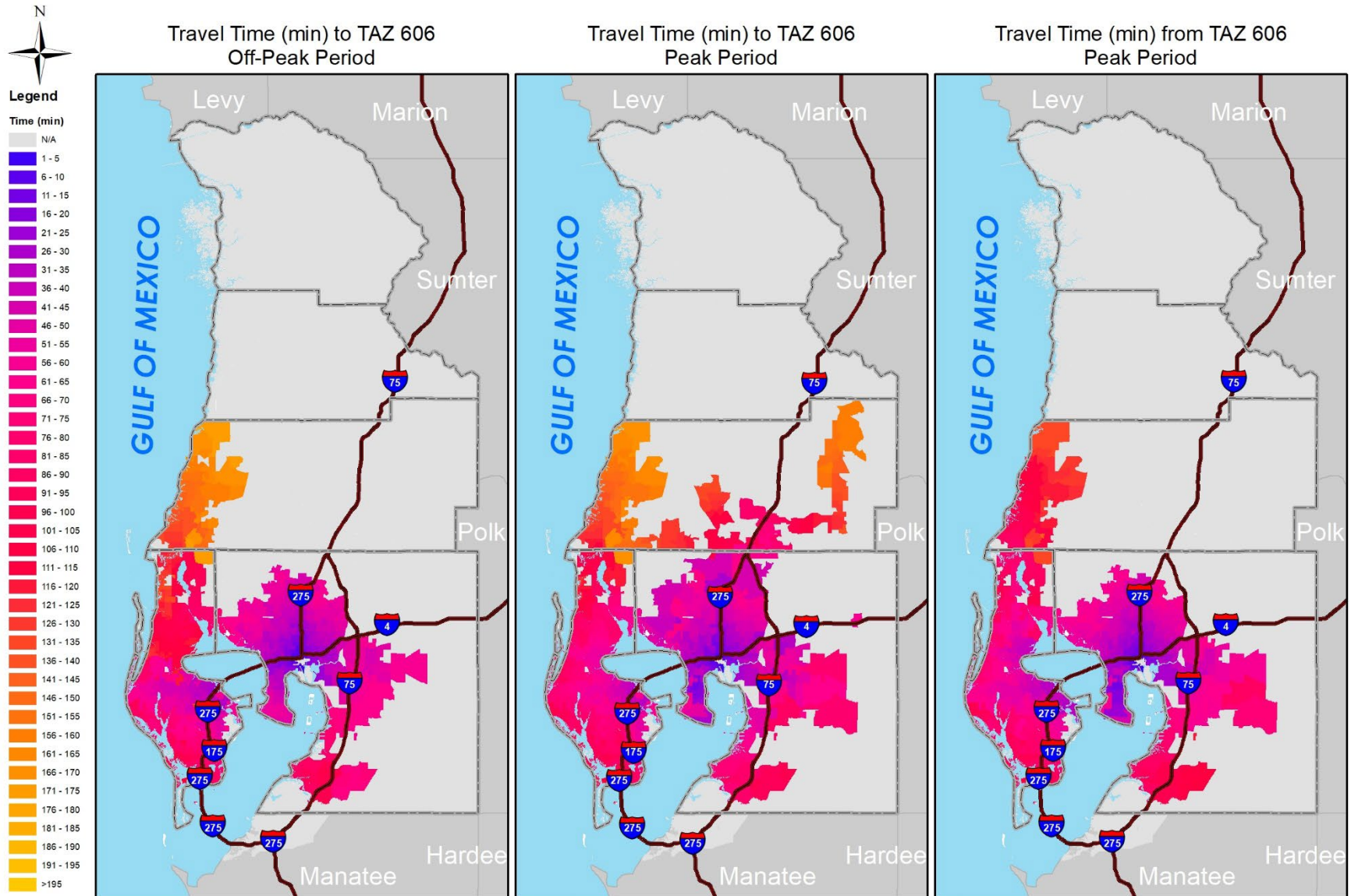


Figure 59: 2015 Base Year Bus Transit Travel Time Isochrone Maps – TAZ 606 – Downtown Tampa, Hillsborough

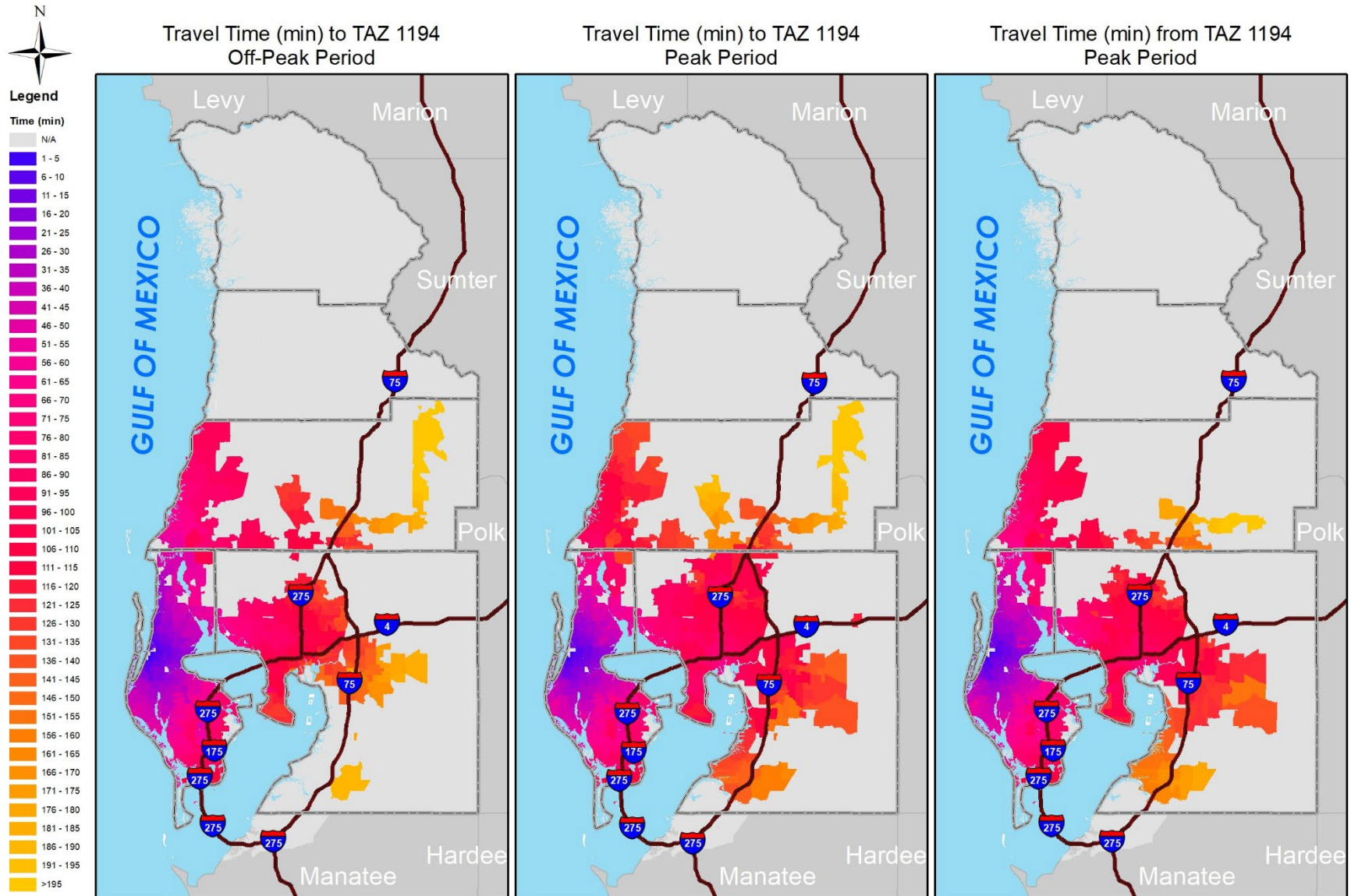


Figure 60: 2015 Base Year Bus Transit Travel Time Isochrone Maps – TAZ 1194 – Clearwater, Pinellas

APPENDIX E – TRANSIT PATH VALIDATION

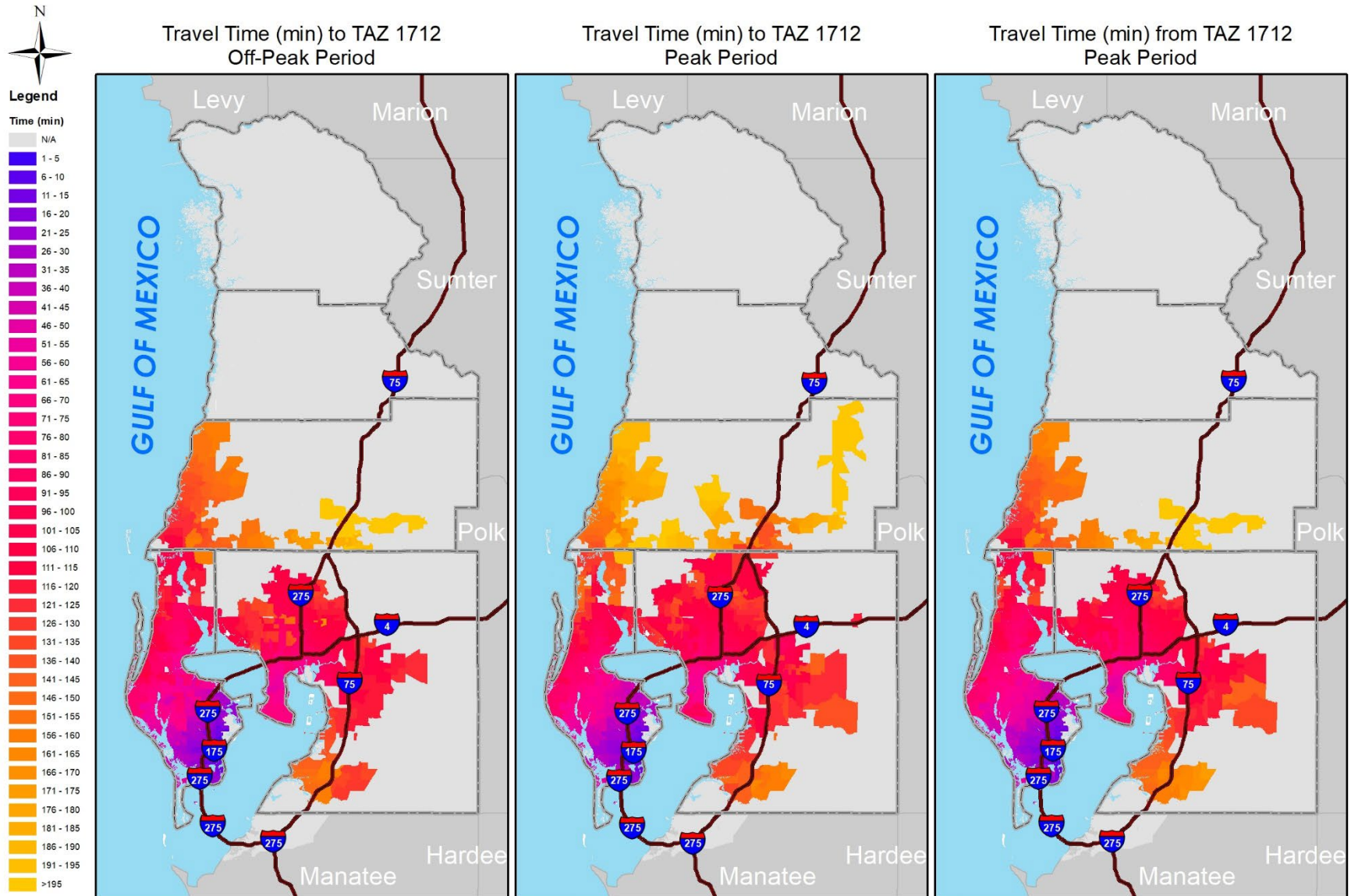


Figure 61: 2015 Base Year Bus Transit Travel Time Isochrone Maps – TAZ 1712 – St. Petersburg, Pinellas

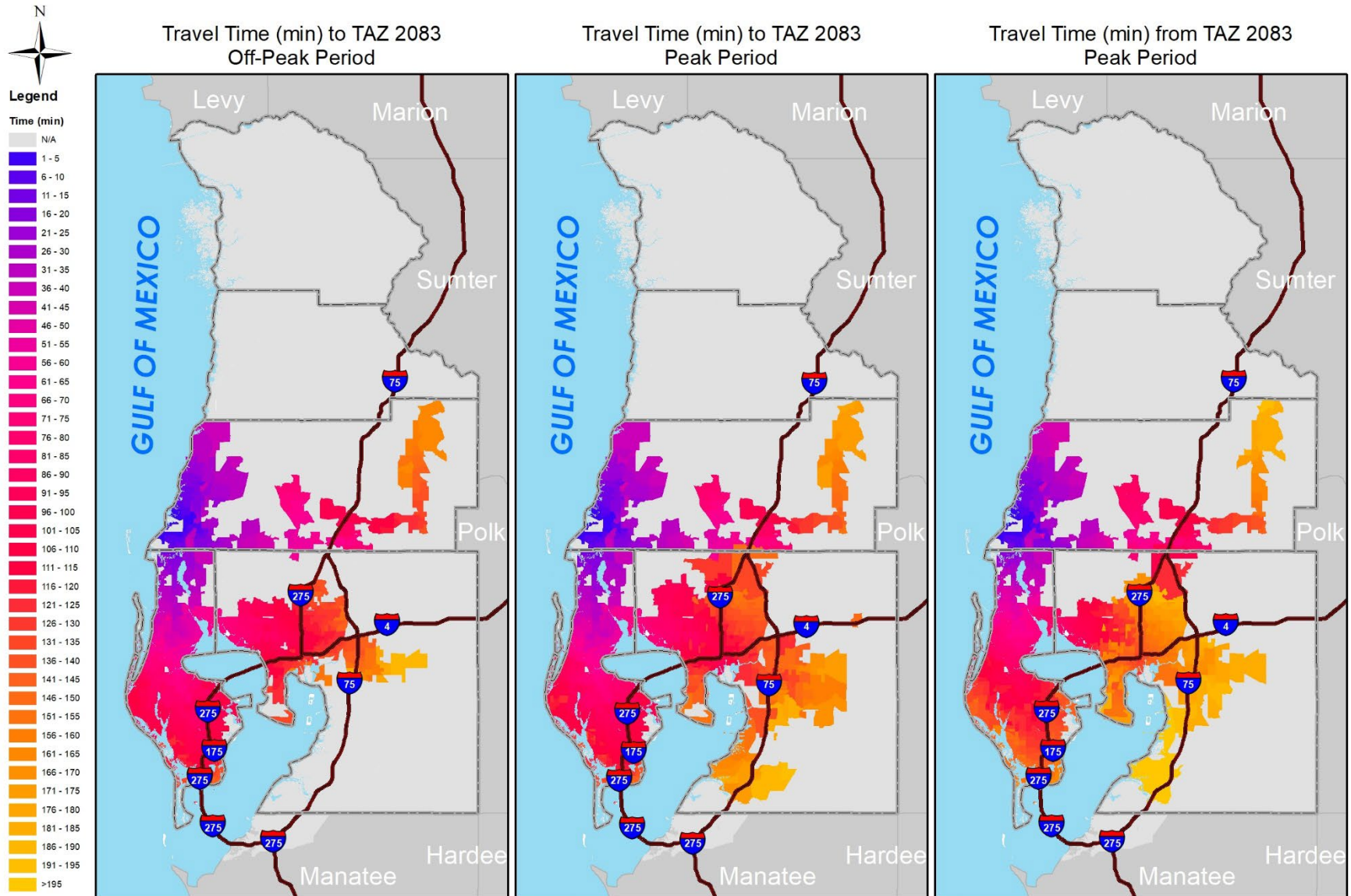


Figure 62: 2015 Base Year Bus Transit Travel Time Isochrone Maps – TAZ 2083 – New Port Richey, Pasco

APPENDIX E – TRANSIT PATH VALIDATION

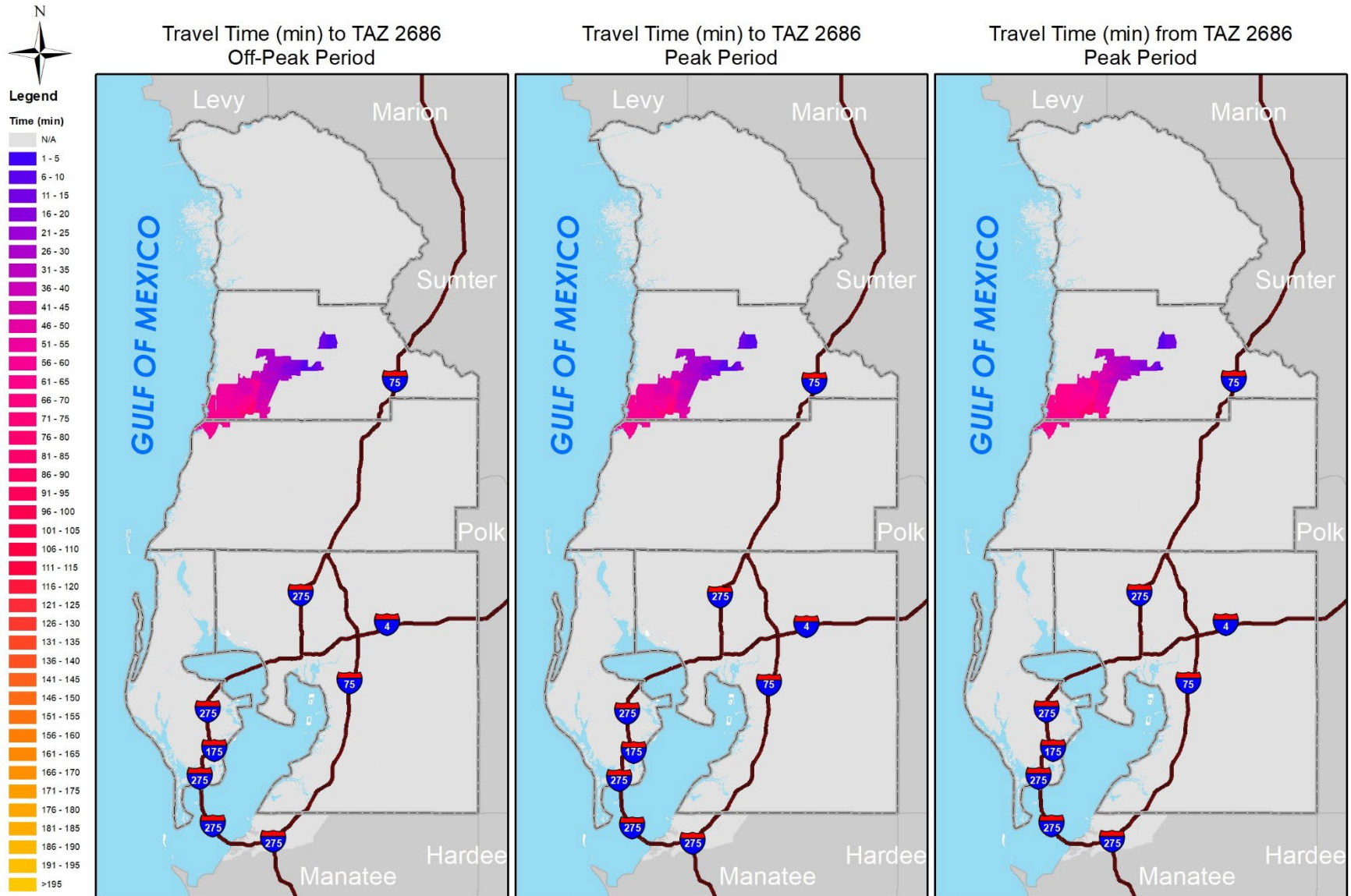


Figure 63: 2015 Base Year Bus Transit Travel Time Isochrone Maps – TAZ 2686 – Brookville, Hernando

APPENDIX E – TRANSIT PATH VALIDATION

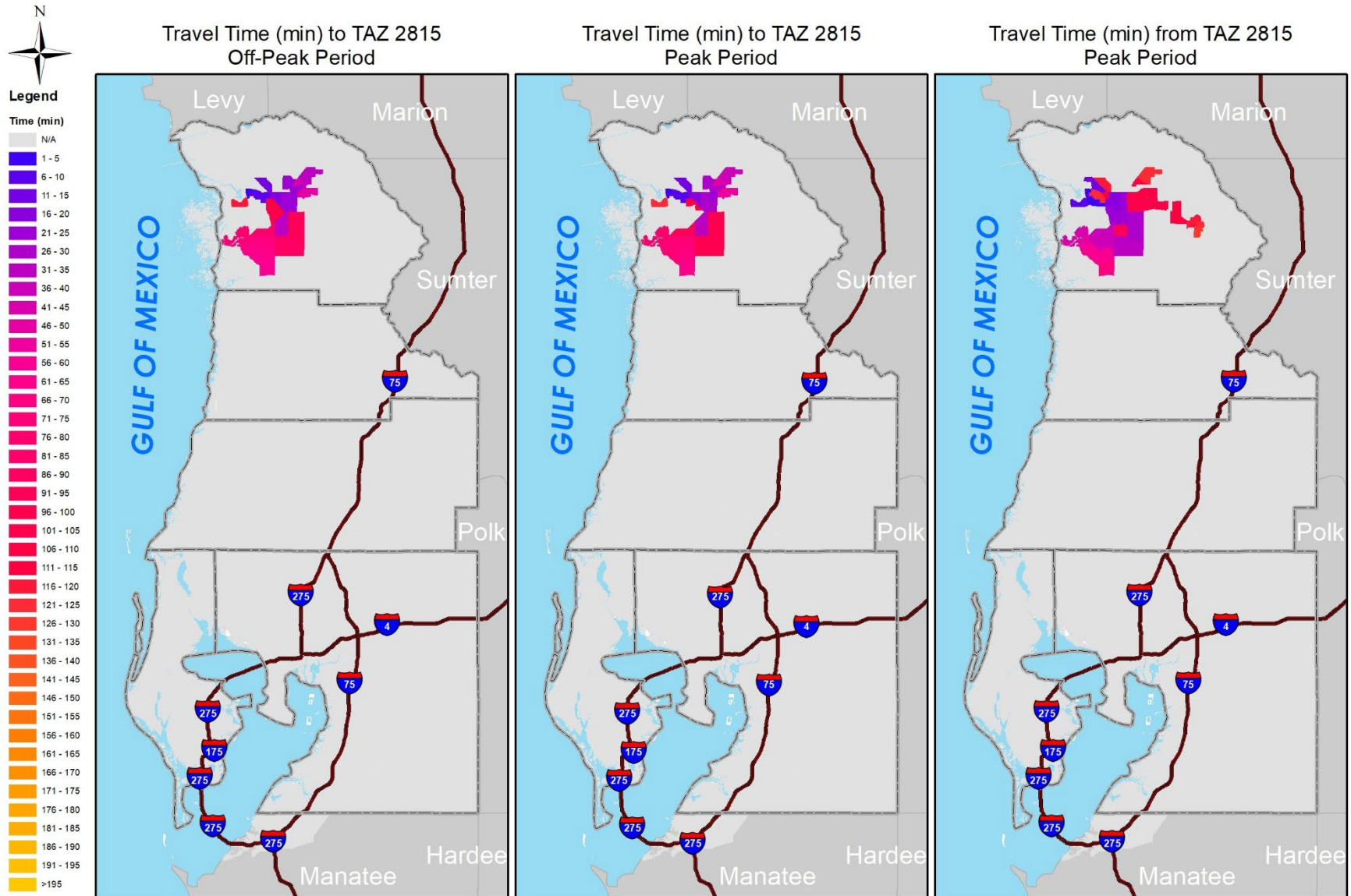


Figure 64: 2015 Base Year Bus Transit Travel Time Isochrone Maps – TAZ 2815 – Crystal River, Citrus

APPENDIX F – MODE CHOICE TABLES

APPENDIX F – MODE CHOICE TABLES

Table 87: TBRPM v9.0 - Nested Logit Model Utility Equations

Mode	Utility
Drive Alone (DA)	$(a_1 \text{ATRM} + a_3 \text{ARUN} + a_9 \text{INFL}_1 \text{ACST} + a_{10} \text{INFL}_2 \text{APRK} + \text{AU1CRC}) / n_{au}$
One Passenger (SH2)	$(a_1 \text{ATRM} + a_3 \text{ARUN} + a_9 \text{INFL}_1 \text{ACST} + a_{10} \text{INFL}_2 \text{APRK} + \text{AU2CRC}) / n_{au} n_{sh}$
Two+ Passengers (SH3)	$(a_1 \text{ATRM} + a_3 \text{ARUN} + a_9 \text{INFL}_1 \text{ACST} + a_{10} \text{INFL}_2 \text{APRK} + \text{AU3CRC}) / n_{au} n_{sh}$
Walk to Local Bus	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TWLCRC}) / n_{tr} n_{wa}$
Walk to Express Bus	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TWECRC}) / n_{tr} n_{wa}$
Walk to Local Rail	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TWRCRC}) / n_{tr} n_{wa}$
Walk to Commuter Rail	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TWCCRC}) / n_{tr} n_{wa}$
Walk to Street Car	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TWSCRC}) / n_{tr} n_{wa}$
Park & Ride to Local Bus	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TPLCRC}) / n_{tr} n_{pr}$
Park & Ride to Express Bus	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TPECRC}) / n_{tr} n_{pr}$
Park & Ride to Local Rail	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TPRCRC}) / n_{tr} n_{pr}$
Park & Ride to Commuter Rail	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TPCCRC}) / n_{tr} n_{pr}$
Kiss & Ride to Local Bus	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TKLCRC}) / n_{tr} n_{kr}$
Kiss & Ride to Express Bus	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TKECRC}) / n_{tr} n_{kr}$
Kiss & Ride to Local Rail	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TKRCRC}) / n_{tr} n_{kr}$
Kiss & Ride to Commuter Rail	$(a_1 \text{WALK} + a_2 \text{AUTO} + a_3 \text{TRUN} + a_4 \text{WTTA} + a_5 \text{WTTB} + a_6 \text{XFT} + a_7 \text{NXF} + a_8 \text{INFL}_1 (\text{FARE} + \text{PKCST}) + a_9 \text{INFL}_2 \text{TAOC} + \text{TKCCRC}) / n_{tr} n_{kr}$

APPENDIX F – MODE CHOICE TABLES

Table 88: TBRPM v9.0 - Nested Logit Utility Function Attribute Descriptions

LOS Variables	Bias Constants
ATRM: auto terminal time;	AU1CRC: bias constant of DA mode;
ARUN: auto run time;	AU2CRC: bias constant of SH2 mode;
ACST: auto operating cost;	AU3CRC: bias constant of SH3 mode;
APRK: auto parking cost;	TWLCRC: bias constant of walk to local bus;
INFL1: inflation rate for auto operating cost;	TWECRC: bias constant of walk to express bus;
INFL2: inflation rate for auto parking cost;	TWRCRC: bias constant of walk to local rail;
AUTO: transit auto access time;	TWCCRC: bias constant of walk to commuter rail;
FARE: transit fare;	TWSCRC: bias constant of walk to street car;
XFT: transit transfer time;	TPLCRC: bias constant of PnR to local bus;
TRUN: transit run time;	TPECRC: bias constant of PnR to express bus;
PKCST: transit access - auto parking cost;	TPRCRC: bias constant of PnR to local rail;
WTTA: transit first waiting time less than 7 min.;	TPCCRC: bias constant of PnR to commuter rail;
WALK: transit walk time;	TKLCRC: bias constant of KnR to local bus;
WTTB: transit first waiting time more than 7 min.;	TKECRC: bias constant of KnR to express bus;
NXF: number of transit transfer;	TKRCRC: bias constant of KnR to local rail;
TAOC: transit access - auto operating cost.	TKCCRC: bias constant of KnR to commuter rail;
Nesting Coefficients	
n_{au}: first-level auto nest;	
n_{tr}: top-level transit nest;	
n_{sh}: second-level shared ride nest;	
n_{wa}: second-level walk access nest;	
N_{pr}: second-level PnR access nest	
N_{kr}: second-level KnR access nest	

APPENDIX F – MODE CHOICE TABLES

Table 89: TBRPM v9.0 - Mode Choice Attribute Values - Hillsborough

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 0 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 1 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 2 CAR HHS
0.9736	1.128	0.0203	0.9737	1.128	0.0203	SHARED RIDE 2 CONSTANT - 0 CAR HHS
-1.2355	0.0294	0.0203	-1.2355	0.0294	0.0203	SHARED RIDE 2 CONSTANT - 1 CAR HHS
-0.9095	0.0692	0.0203	-0.9095	0.0692	0.0203	SHARED RIDE 2 CONSTANT - 2 CAR HHS
0.8724	1.0278	-0.0005	0.8724	1.0279	-0.0005	SHARED RIDE 3+ CONSTANT - 0 CAR HHS
-1.3308	-0.0691	-0.0005	-1.3307	-0.0691	-0.0005	SHARED RIDE 3+ CONSTANT - 1 CAR HHS
-1.006	-0.0286	-0.0005	-1.006	-0.0286	-0.0005	SHARED RIDE 3+ CONSTANT - 2 CAR HHS
3.1079	2.0438	-1.7236	3.3956	2.4129	-2.1049	WALK - LOCAL BUS CONSTANT - 0 CAR HHS
-1.5962	-2.6276	-1.7236	-1.709	-2.3539	-2.1049	WALK - LOCAL BUS CONSTANT - 1 CAR HHS
-2.3532	-3.3354	-1.7236	-2.8305	-3.2029	-2.1049	WALK - LOCAL BUS CONSTANT - 2 CAR HHS
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
3.1079	2.0438	-1.7236	3.3956	2.4129	-2.1049	WALK - NEW MODE CONSTANT - 0 CAR HHS
-1.5962	-2.6276	-1.7236	-1.709	-2.3539	-2.1049	WALK - NEW MODE CONSTANT - 1 CAR HHS
-2.3532	-3.3354	-1.7236	-2.8305	-3.2029	-2.1049	WALK - NEW MODE CONSTANT - 2 CAR HHS
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
3.1079	2.0438	-1.7236	3.3956	2.4129	-2.1049	WALK - IN-STREET BRT CONSTANT - 0 CAR HHS
-1.5962	-2.6276	-1.7236	-1.709	-2.3539	-2.1049	WALK - IN-STREET BRT CONSTANT - 1 CAR HHS
-2.3532	-3.3354	-1.7236	-2.8305	-3.2029	-2.1049	WALK - IN-STREET BRT CONSTANT - 2 CAR HHS
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
3.2579	2.1938	-1.5736	3.5456	2.5629	-1.9549	WALK - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-1.4462	-2.4776	-1.5736	-1.559	-2.2039	-1.9549	WALK - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-2.2032	-3.1884	-1.5736	-2.6805	-3.0529	-1.9549	WALK - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-2.5661	-999	-999	-4.0117	PNR - LOCAL BUS CONSTANT - 0 CAR HHS
-0.4114	-2.1736	-2.5661	-2.0427	-2.2883	-4.0117	PNR - LOCAL BUS CONSTANT - 1 CAR HHS
0.2691	-3.087	-2.5661	-3.5237	-3.0722	-4.0117	PNR - LOCAL BUS CONSTANT - 2 CAR HHS
-0.25	-0.25	0	-0.25	-0.25	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-2.5661	-999	-999	-4.0117	PNR - NEW MODE CONSTANT - 0 CAR HHS
-0.4114	-2.1736	-2.5661	-2.0427	-2.2883	-4.0117	PNR - NEW MODE CONSTANT - 1 CAR HHS
0.2691	-3.087	-2.5661	-3.5237	-3.0722	-4.0117	PNR - NEW MODE CONSTANT - 2 CAR HHS
-0.25	-0.25	0	-0.25	-0.25	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-2.5661	-999	-999	-4.0117	PNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-0.4114	-2.1736	-2.5661	-2.0427	-2.2883	-4.0117	PNR - IN-STREET BRT CONSTANT - 1 CAR HHS
0.2691	-3.087	-2.5661	-3.5237	-3.0722	-4.0117	PNR - IN-STREET BRT CONSTANT - 2 CAR HHS
-0.25	-0.25	0	-0.25	-0.25	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-998.85	-998.851	-2.4161	-998.848	-998.85	-3.8617	PNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-0.2614	-2.0236	-2.4161	-1.8927	-2.1383	-3.8617	PNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
0.4191	-2.937	-2.4161	-3.3737	-2.9222	-3.8617	PNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
-0.25	-0.25	0	-0.25	-0.25	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.2551	-0.9873	-3.7348	-0.3355	-1.0713	-4.1817	KNR - LOCAL BUS CONSTANT - 0 CAR HHS
-3.5107	-4.8117	-3.7348	-4.9541	-4.8285	-4.1817	KNR - LOCAL BUS CONSTANT - 1 CAR HHS
-4.0598	-5.2139	-3.7348	-5.3215	-5.3219	-4.1817	KNR - LOCAL BUS CONSTANT - 2 CAR HHS
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.2551	-0.9873	-3.7348	-0.3355	-1.0713	-4.1817	KNR - NEW MODE CONSTANT - 0 CAR HHS
-3.5107	-4.8117	-3.7348	-4.9541	-4.8285	-4.1817	KNR - NEW MODE CONSTANT - 1 CAR HHS
-4.0598	-5.2139	-3.7348	-5.3215	-5.3219	-4.1817	KNR - NEW MODE CONSTANT - 2 CAR HHS
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.2551	-0.9873	-3.7348	-0.3355	-1.0713	-4.1817	KNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-3.5107	-4.8117	-3.7348	-4.9541	-4.8285	-4.1817	KNR - IN-STREET BRT CONSTANT - 1 CAR HHS
-4.0598	-5.2139	-3.7348	-5.3215	-5.3219	-4.1817	KNR - IN-STREET BRT CONSTANT - 2 CAR HHS

APPENDIX F – MODE CHOICE TABLES

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.1051	-0.8373	-3.5848	-0.1855	-0.9213	-4.0317	KNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-3.3607	-4.6617	-3.5848	-4.8041	-4.6785	-4.0317	KNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-3.9098	-5.0639	-3.5848	-5.1715	-5.1719	-4.0317	KNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
-0.013	-0.013	-0.013	-0.013	-0.013	-0.013	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.5	0.5	0.5	0.5	0.5	0.5	TRANSIT NESTING
0.5	0.5	0.5	0.5	0.5	0.5	WALK ACCESS NESTING
0.5	0.5	0.5	0.5	0.5	0.5	PARK N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	KISS N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	HIGHWAY NESTING
0.5	0.5	0.5	0.5	0.5	0.5	SHARED RIDE NESTING
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT RUN TIME, HIGHWAY RUN TIME
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT AUTO ACCESS TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WALK TIME, HIGHWAY TERMINAL TIME
-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	TRANSIT TRANSFER TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WAIT TIME
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (WALK ACCESS)
-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	TRANSIT NUMBER OF TRANSFERS (PARK-RIDE ACCESS)
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (DROP-OFF ACCESS)
-0.0188	-0.0083	-0.0175	-0.0188	-0.0083	-0.0175	HOV TIME DIFFERENCE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	TRANSIT FARE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY AUTO OPERATING COSTS
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY PARKING COSTS
0	0	0	0	0	0	BRT bonus for 'premium-only' riders
4	4	4	4	4	4	FG bonus for 'premium-only' riders

APPENDIX F – MODE CHOICE TABLES

Table 90: TBRPM v9.0 – Mode Choice Attribute Values – Pinellas

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 0 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 1 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 2 CAR HHS
0.9739	1.1279	0.0203	0.9738	1.128	0.0203	SHARED RIDE 2 CONSTANT - 0 CAR HHS
-1.2355	0.0294	0.0203	-1.2355	0.0294	0.0203	SHARED RIDE 2 CONSTANT - 1 CAR HHS
-0.9095	0.0692	0.0203	-0.9095	0.0692	0.0203	SHARED RIDE 2 CONSTANT - 2 CAR HHS
0.8726	1.0278	-0.0005	0.8725	1.0278	-0.0005	SHARED RIDE 3+ CONSTANT - 0 CAR HHS
-1.3308	-0.0691	-0.0005	-1.3308	-0.0691	-0.0005	SHARED RIDE 3+ CONSTANT - 1 CAR HHS
-1.0059	-0.0286	-0.0005	-1.006	-0.0286	-0.0005	SHARED RIDE 3+ CONSTANT - 2 CAR HHS
2.5568	1.116	-2.4497	3.7156	1.8628	-2.1491	WALK - LOCAL BUS CONSTANT - 0 CAR HHS
-2.1126	-3.6779	-2.4497	-1.3021	-2.9902	-2.1491	WALK - LOCAL BUS CONSTANT - 1 CAR HHS
-3.1485	-4.2344	-2.4497	-2.2932	-3.8302	-2.1491	WALK - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.5568	1.116	-2.4497	3.7156	1.8628	-2.1491	WALK - NEW MODE CONSTANT - 0 CAR HHS
-2.1126	-3.6779	-2.4497	-1.3021	-2.9902	-2.1491	WALK - NEW MODE CONSTANT - 1 CAR HHS
-3.1485	-4.2344	-2.4497	-2.2932	-3.8302	-2.1491	WALK - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.5568	1.116	-2.4497	3.7156	1.8628	-2.1491	WALK - IN-STREET BRT CONSTANT - 0 CAR HHS
-2.1126	-3.6779	-2.4497	-1.3021	-2.9902	-2.1491	WALK - IN-STREET BRT CONSTANT - 1 CAR HHS
-3.1485	-4.2344	-2.4497	-2.2932	-3.8302	-2.1491	WALK - IN-STREET BRT CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.7068	1.266	-2.2997	3.8656	2.0128	-1.9991	WALK - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-1.9626	-3.5279	-2.2997	-1.1521	-2.8402	-1.9991	WALK - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-2.9985	-4.0859	-2.2997	-2.1432	-3.6802	-1.9991	WALK - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-5.048	-999	-999	-3.6349	PNR - LOCAL BUS CONSTANT - 0 CAR HHS
-10.1605	-5.6402	-5.048	-3.8525	-5.9491	-3.6349	PNR - LOCAL BUS CONSTANT - 1 CAR HHS
-5.6937	-5.9201	-5.048	-3.6166	-6.4618	-3.6349	PNR - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-5.048	-999	-999	-3.6349	PNR - NEW MODE CONSTANT - 0 CAR HHS
-10.1605	-5.6402	-5.048	-3.8525	-5.9491	-3.6349	PNR - NEW MODE CONSTANT - 1 CAR HHS
-5.6937	-5.9201	-5.048	-3.6166	-6.4618	-3.6349	PNR - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-5.048	-999	-999	-3.6349	PNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-10.1605	-5.6402	-5.048	-3.8525	-5.9491	-3.6349	PNR - IN-STREET BRT CONSTANT - 1 CAR HHS
-5.6937	-5.9201	-5.048	-3.6166	-6.4618	-3.6349	PNR - IN-STREET BRT CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-998.856	-998.85	-4.898	-998.86	-998.85	-3.4849	PNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-10.0105	-5.4902	-4.898	-3.7025	-5.7991	-3.4849	PNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-5.5437	-5.7701	-4.898	-3.4666	-6.3118	-3.4849	PNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.6004	-2.7798	-4.715	0.0735	-1.753	-4.5602	KNR - LOCAL BUS CONSTANT - 0 CAR HHS
-4.4877	-5.8735	-4.715	-3.463	-6.0269	-4.5602	KNR - LOCAL BUS CONSTANT - 1 CAR HHS
-5.353	-7.0297	-4.715	-4.8853	-6.7147	-4.5602	KNR - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.6004	-2.7798	-4.715	0.0735	-1.753	-4.5602	KNR - NEW MODE CONSTANT - 0 CAR HHS
-4.4877	-5.8735	-4.715	-3.463	-6.0269	-4.5602	KNR - NEW MODE CONSTANT - 1 CAR HHS
-5.353	-7.0297	-4.715	-4.8853	-6.7147	-4.5602	KNR - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.6004	-2.7798	-4.715	0.0735	-1.753	-4.5602	KNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-4.4877	-5.8735	-4.715	-3.463	-6.0269	-4.5602	KNR - IN-STREET BRT CONSTANT - 1 CAR HHS
-5.353	-7.0297	-4.715	-4.8853	-6.7147	-4.5602	KNR - IN-STREET BRT CONSTANT - 2 CAR HHS

APPENDIX F – MODE CHOICE TABLES

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.4504	-2.6298	-4.565	0.2235	-1.603	-4.4102	KNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-4.3377	-5.7235	-4.565	-3.313	-5.8769	-4.4102	KNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-5.203	-6.8797	-4.565	-4.7353	-6.5647	-4.4102	KNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.5	0.5	0.5	0.5	0.5	0.5	TRANSIT NESTING
0.5	0.5	0.5	0.5	0.5	0.5	WALK ACCESS NESTING
0.5	0.5	0.5	0.5	0.5	0.5	PARK N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	KISS N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	HIGHWAY NESTING
0.5	0.5	0.5	0.5	0.5	0.5	SHARED RIDE NESTING
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT RUN TIME, HIGHWAY RUN TIME
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT AUTO ACCESS TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WALK TIME, HIGHWAY TERMINAL TIME
-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	TRANSIT TRANSFER TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WAIT TIME
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (WALK ACCESS)
-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	TRANSIT NUMBER OF TRANSFERS (PARK-RIDE ACCESS)
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (DROP-OFF ACCESS)
-0.0188	-0.0083	-0.0175	-0.0188	-0.0083	-0.0175	HOV TIME DIFFERENCE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	TRANSIT FARE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY AUTO OPERATING COSTS
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY PARKING COSTS
0	0	0	0	0	0	BRT bonus for 'premium-only' riders
4	4	4	4	4	4	FG bonus for 'premium-only' riders

APPENDIX F – MODE CHOICE TABLES

Table 91: TBRPM v9.0 - Mode Choice Attribute Values - Pasco

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 0 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 1 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 2 CAR HHS
0.9743	1.1277	0.0203	0.9732	1.1279	0.0203	SHARED RIDE 2 CONSTANT - 0 CAR HHS
-1.2354	0.0294	0.0203	-1.2354	0.0294	0.0203	SHARED RIDE 2 CONSTANT - 1 CAR HHS
-0.9095	0.0692	0.0203	-0.9095	0.0692	0.0203	SHARED RIDE 2 CONSTANT - 2 CAR HHS
0.873	1.0275	-0.0004	0.872	1.0278	-0.0005	SHARED RIDE 3+ CONSTANT - 0 CAR HHS
-1.3307	-0.0691	-0.0004	-1.3308	-0.0691	-0.0005	SHARED RIDE 3+ CONSTANT - 1 CAR HHS
-1.0059	-0.0286	-0.0004	-1.0059	-0.0286	-0.0005	SHARED RIDE 3+ CONSTANT - 2 CAR HHS
2.0558	1.8226	-2.2672	2.5708	1.4822	-2.6457	WALK - LOCAL BUS CONSTANT - 0 CAR HHS
-1.727	-3.0275	-2.2672	-1.2347	-3.2518	-2.6457	WALK - LOCAL BUS CONSTANT - 1 CAR HHS
-2.6722	-3.2936	-2.2672	-2.3944	-3.7884	-2.6457	WALK - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.0558	1.8226	-2.2672	2.5708	1.4822	-2.6457	WALK - NEW MODE CONSTANT - 0 CAR HHS
-1.727	-3.0275	-2.2672	-1.2347	-3.2518	-2.6457	WALK - NEW MODE CONSTANT - 1 CAR HHS
-2.6722	-3.2936	-2.2672	-2.3944	-3.7884	-2.6457	WALK - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.0558	1.8226	-2.2672	2.5708	1.4822	-2.6457	WALK - IN-STREET BRT CONSTANT - 0 CAR HHS
-1.727	-3.0275	-2.2672	-1.2347	-3.2518	-2.6457	WALK - IN-STREET BRT CONSTANT - 1 CAR HHS
-2.6722	-3.2936	-2.2672	-2.3944	-3.7884	-2.6457	WALK - IN-STREET BRT CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.2058	1.9726	-2.1172	2.7208	1.6322	-2.4957	WALK - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-1.577	-2.8775	-2.1172	-1.0847	-3.1018	-2.4957	WALK - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-2.5222	-3.1401	-2.1172	-2.2444	-3.6384	-2.4957	WALK - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-3.7143	-999	-999	-3.8996	PNR - LOCAL BUS CONSTANT - 0 CAR HHS
-999	-999	-3.7143	-3.2562	-4.8242	-3.8996	PNR - LOCAL BUS CONSTANT - 1 CAR HHS
-999.009	-999	-3.7143	-4.4639	-5.2805	-3.8996	PNR - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-3.7143	-999	-999	-3.8996	PNR - NEW MODE CONSTANT - 0 CAR HHS
-999	-999	-3.7143	-3.2562	-4.8242	-3.8996	PNR - NEW MODE CONSTANT - 1 CAR HHS
-999.009	-999	-3.7143	-4.4639	-5.2805	-3.8996	PNR - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-3.7143	-999	-999	-3.8996	PNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-999	-999	-3.7143	-3.2562	-4.8242	-3.8996	PNR - IN-STREET BRT CONSTANT - 1 CAR HHS
-999.009	-999	-3.7143	-4.4639	-5.2805	-3.8996	PNR - IN-STREET BRT CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-998.851	-998.85	-3.5643	-998.851	-998.85	-3.7496	PNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-998.85	-998.85	-3.5643	-3.1062	-4.6742	-3.7496	PNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-998.859	-998.85	-3.5643	-4.3139	-5.1305	-3.7496	PNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.1381	-1.1972	-3.7212	-0.1834	-0.9626	-4.5728	KNR - LOCAL BUS CONSTANT - 0 CAR HHS
-3.9475	-4.7033	-3.7212	-2.9028	-4.4572	-4.5728	KNR - LOCAL BUS CONSTANT - 1 CAR HHS
-6.3421	-5.3093	-3.7212	-3.847	-5.3934	-4.5728	KNR - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.1381	-1.1972	-3.7212	-0.1834	-0.9626	-4.5728	KNR - NEW MODE CONSTANT - 0 CAR HHS
-3.9475	-4.7033	-3.7212	-2.9028	-4.4572	-4.5728	KNR - NEW MODE CONSTANT - 1 CAR HHS
-6.3421	-5.3093	-3.7212	-3.847	-5.3934	-4.5728	KNR - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.1381	-1.1972	-3.7212	-0.1834	-0.9626	-4.5728	KNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-3.9475	-4.7033	-3.7212	-2.9028	-4.4572	-4.5728	KNR - IN-STREET BRT CONSTANT - 1 CAR HHS
-6.3421	-5.3093	-3.7212	-3.847	-5.3934	-4.5728	KNR - IN-STREET BRT CONSTANT - 2 CAR HHS

APPENDIX F – MODE CHOICE TABLES

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.2881	-1.0472	-3.5712	-0.0334	-0.8126	-4.4228	KNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-3.7975	-4.5533	-3.5712	-2.7528	-4.3072	-4.4228	KNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-6.1921	-5.1593	-3.5712	-3.697	-5.2434	-4.4228	KNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.5	0.5	0.5	0.5	0.5	0.5	TRANSIT NESTING
0.5	0.5	0.5	0.5	0.5	0.5	WALK ACCESS NESTING
0.5	0.5	0.5	0.5	0.5	0.5	PARK N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	KISS N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	HIGHWAY NESTING
0.5	0.5	0.5	0.5	0.5	0.5	SHARED RIDE NESTING
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT RUN TIME, HIGHWAY RUN TIME
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT AUTO ACCESS TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WALK TIME, HIGHWAY TERMINAL TIME
-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	TRANSIT TRANSFER TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WAIT TIME
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (WALK ACCESS)
-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	TRANSIT NUMBER OF TRANSFERS (PARK-RIDE ACCESS)
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (DROP-OFF ACCESS)
-0.0188	-0.0083	-0.0175	-0.0188	-0.0083	-0.0175	HOV TIME DIFFERENCE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	TRANSIT FARE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY AUTO OPERATING COSTS
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY PARKING COSTS
0	0	0	0	0	0	BRT bonus for 'premium-only' riders
4	4	4	4	4	4	FG bonus for 'premium-only' riders

APPENDIX F – MODE CHOICE TABLES

Table 92: TBRPM v9.0 - Mode Choice Attribute Values – Hernando and Citrus

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 0 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 1 CAR HHS
0	0	0	0	0	0	DRIVE ALONE CONSTANT - 2 CAR HHS
0.9724	1.1279	0.0203	0.9738	1.1281	0.0203	SHARED RIDE 2 CONSTANT - 0 CAR HHS
-1.2354	0.0294	0.0203	-1.2354	0.0294	0.0203	SHARED RIDE 2 CONSTANT - 1 CAR HHS
-0.9095	0.0692	0.0203	-0.9095	0.0692	0.0203	SHARED RIDE 2 CONSTANT - 2 CAR HHS
0.8713	1.0278	-0.0005	0.8726	1.028	-0.0005	SHARED RIDE 3+ CONSTANT - 0 CAR HHS
-1.3307	-0.0691	-0.0005	-1.3307	-0.0691	-0.0005	SHARED RIDE 3+ CONSTANT - 1 CAR HHS
-1.006	-0.0286	-0.0005	-1.0059	-0.0286	-0.0005	SHARED RIDE 3+ CONSTANT - 2 CAR HHS
2.965	2.3144	-2.0343	2.9605	2.2906	-2.1123	WALK - LOCAL BUS CONSTANT - 0 CAR HHS
-1.3608	-2.5811	-2.0343	-2.2493	-1.9306	-2.1123	WALK - LOCAL BUS CONSTANT - 1 CAR HHS
-2.5517	-2.4658	-2.0343	-2.3422	-3.1267	-2.1123	WALK - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.965	2.3144	-2.0343	2.9605	2.2906	-2.1123	WALK - NEW MODE CONSTANT - 0 CAR HHS
-1.3608	-2.5811	-2.0343	-2.2493	-1.9306	-2.1123	WALK - NEW MODE CONSTANT - 1 CAR HHS
-2.5517	-2.4658	-2.0343	-2.3422	-3.1267	-2.1123	WALK - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
2.965	2.3144	-2.0343	2.9605	2.2906	-2.1123	WALK - IN-STREET BRT CONSTANT - 0 CAR HHS
-1.3608	-2.5811	-2.0343	-2.2493	-1.9306	-2.1123	WALK - IN-STREET BRT CONSTANT - 1 CAR HHS
-2.5517	-2.4658	-2.0343	-2.3422	-3.1267	-2.1123	WALK - IN-STREET BRT CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
3.115	2.4644	-1.8843	3.1105	2.4406	-1.9623	WALK - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-1.2108	-2.4311	-1.8843	-2.0993	-1.7806	-1.9623	WALK - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-2.4017	-2.3158	-1.8843	-2.1922	-2.9767	-1.9623	WALK - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - LOCAL BUS CONSTANT - 0 CAR HHS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - LOCAL BUS CONSTANT - 1 CAR HHS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - NEW MODE CONSTANT - 0 CAR HHS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - NEW MODE CONSTANT - 1 CAR HHS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - IN-STREET BRT CONSTANT - 1 CAR HHS
-999	-999	-4.1432	-999	-999	-4.2849	PNR - IN-STREET BRT CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-998.85	-998.85	-3.9932	-998.85	-998.85	-4.1349	PNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-998.85	-998.85	-3.9932	-998.85	-998.85	-4.1349	PNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-998.85	-998.85	-3.9932	-998.85	-998.85	-4.1349	PNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.1118	-1.7457	-4.6102	-1.1137	-1.8202	-5.4139	KNR - LOCAL BUS CONSTANT - 0 CAR HHS
-3.7179	-5.1068	-4.6102	-4.5589	-5.3579	-5.4139	KNR - LOCAL BUS CONSTANT - 1 CAR HHS
-4.9891	-5.592	-4.6102	-5.4833	-6.5359	-5.4139	KNR - LOCAL BUS CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.1118	-1.7457	-4.6102	-1.1137	-1.8202	-5.4139	KNR - NEW MODE CONSTANT - 0 CAR HHS
-3.7179	-5.1068	-4.6102	-4.5589	-5.3579	-5.4139	KNR - NEW MODE CONSTANT - 1 CAR HHS
-4.9891	-5.592	-4.6102	-5.4833	-6.5359	-5.4139	KNR - NEW MODE CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
-0.1118	-1.7457	-4.6102	-1.1137	-1.8202	-5.4139	KNR - IN-STREET BRT CONSTANT - 0 CAR HHS
-3.7179	-5.1068	-4.6102	-4.5589	-5.3579	-5.4139	KNR - IN-STREET BRT CONSTANT - 1 CAR HHS
-4.9891	-5.592	-4.6102	-5.4833	-6.5359	-5.4139	KNR - IN-STREET BRT CONSTANT - 2 CAR HHS

APPENDIX F – MODE CHOICE TABLES

HBWPK	HBOPK	NHBPK	HBWOP	HBOOP	NHBOP	Description
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.0382	-1.5957	-4.4602	-0.9637	-1.6702	-5.2639	KNR - FIXED-GUIDEWAY CONSTANT - 0 CAR HHS
-3.5679	-4.9568	-4.4602	-4.4089	-5.2079	-5.2639	KNR - FIXED-GUIDEWAY CONSTANT - 1 CAR HHS
-4.8391	-5.442	-4.4602	-5.3333	-6.3859	-5.2639	KNR - FIXED-GUIDEWAY CONSTANT - 2 CAR HHS
0	0	0	0	0	0	FOR MAJOR ACTIVITY CENTER ATTRACTIONS
0.5	0.5	0.5	0.5	0.5	0.5	TRANSIT NESTING
0.5	0.5	0.5	0.5	0.5	0.5	WALK ACCESS NESTING
0.5	0.5	0.5	0.5	0.5	0.5	PARK N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	KISS N RIDE NESTING
0.5	0.5	0.5	0.5	0.5	0.5	HIGHWAY NESTING
0.5	0.5	0.5	0.5	0.5	0.5	SHARED RIDE NESTING
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT RUN TIME, HIGHWAY RUN TIME
-0.025	-0.025	-0.025	-0.025	-0.025	-0.025	TRANSIT AUTO ACCESS TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WALK TIME, HIGHWAY TERMINAL TIME
-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	-0.0375	TRANSIT TRANSFER TIME
-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	-0.0563	TRANSIT WAIT TIME
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (WALK ACCESS)
-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	TRANSIT NUMBER OF TRANSFERS (PARK-RIDE ACCESS)
-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	TRANSIT NUMBER OF TRANSFERS (DROP-OFF ACCESS)
-0.0188	-0.0083	-0.0175	-0.0188	-0.0083	-0.0175	HOV TIME DIFFERENCE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	TRANSIT FARE
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY AUTO OPERATING COSTS
-0.0015	-0.003	-0.002	-0.0015	-0.003	-0.002	HIGHWAY PARKING COSTS
0	0	0	0	0	0	BRT bonus for 'premium-only' riders
4	4	4	4	4	4	FG bonus for 'premium-only' riders

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APPENDIX G – HIGHWAY ASSIGNMENT VALIDATION TABLES

Table 93: TBRPM v9.0 - VFACTORS File Summary

Facility Type	UROAD Factor	BPR Coefficient	BPR Exponent	AM Period CONFAC	PM Period CONFAC	MD Period CONFAC	EV Period CONFAC
11	0.90	0.28	6.9	0.4521	0.3602	0.1838	0.2425
12	0.85	0.35	5.1	0.4521	0.3602	0.1838	0.2425
13-14	0.90	0.20	3.5	0.4521	0.3602	0.1838	0.2425
15	0.90	0.40	6.1	0.4521	0.3602	0.1838	0.2425
16-17	0.90	0.30	5.1	0.4521	0.3602	0.1838	0.2425
18-19	0.90	0.20	3.5	0.4521	0.3602	0.1838	0.2425
21-22	0.72	0.25	8.5	0.4521	0.3602	0.1838	0.2425
23	0.72	0.26	8.1	0.4521	0.3602	0.1838	0.2425
24	0.72	0.24	7.8	0.4521	0.3602	0.1838	0.2425
25	0.72	0.26	7.5	0.4521	0.3602	0.1838	0.2425
26	0.80	0.22	8.5	0.4521	0.3602	0.1838	0.2425
27-29	0.75	0.30	3.5	0.4521	0.3602	0.1838	0.2425
31	0.75	0.26	8.5	0.4521	0.3602	0.1838	0.2425
32	0.75	0.28	7.9	0.4521	0.3602	0.1838	0.2425
33	0.75	0.30	7.9	0.4521	0.3602	0.1838	0.2425
34	0.75	0.35	7.5	0.4521	0.3602	0.1838	0.2425
35	0.75	0.30	8.1	0.4521	0.3602	0.1838	0.2425
36	0.75	0.32	7.9	0.4521	0.3602	0.1838	0.2425
37	0.75	0.34	7.5	0.4521	0.3602	0.1838	0.2425
38	0.75	0.36	7.1	0.4521	0.3602	0.1838	0.2425
39	0.75	0.25	4.0	0.4521	0.3602	0.1838	0.2425
41	0.90	0.26	8.5	0.4521	0.3602	0.1838	0.2425
42	0.90	0.28	7.9	0.4521	0.3602	0.1838	0.2425
43	0.90	0.30	7.9	0.4521	0.3602	0.1838	0.2425
44	0.90	0.35	7.9	0.4521	0.3602	0.1838	0.2425
45-46	0.90	0.50	4.1	0.4521	0.3602	0.1838	0.2425
47-48	0.90	0.35	6.5	0.4521	0.3602	0.1838	0.2425
49	0.90	0.20	4.0	0.4521	0.3602	0.1838	0.2425
50-52	1.00	0.20	4.0	0.4521	0.3602	0.1838	0.2425
53-59	0.75	0.20	4.0	0.4521	0.3602	0.1838	0.2425
61	0.70	0.26	8.5	0.4521	0.3602	0.1838	0.2425
62	0.70	0.28	7.9	0.4521	0.3602	0.1838	0.2425
63	0.70	0.35	6.5	0.4521	0.3602	0.1838	0.2425
64	0.70	0.40	5.9	0.4521	0.3602	0.1838	0.2425
65	0.70	0.25	8.5	0.4521	0.3602	0.1838	0.2425
66	0.70	0.24	8.1	0.4521	0.3602	0.1838	0.2425
67	0.70	0.22	8.1	0.4521	0.3602	0.1838	0.2425
68	0.70	0.21	7.9	0.4521	0.3602	0.1838	0.2425
69	0.70	0.25	4.0	0.4521	0.3602	0.1838	0.2425
71	0.75	0.50	6.5	0.4521	0.3602	0.1838	0.2425
72	0.75	0.50	5.1	0.4521	0.3602	0.1838	0.2425

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Facility Type	UROAD Factor	BPR Coefficient	BPR Exponent	AM Period CONFAC	PM Period CONFAC	MD Period CONFAC	EV Period CONFAC
73	0.75	0.50	6.5	0.4521	0.3602	0.1838	0.2425
74	0.75	0.50	5.1	0.4521	0.3602	0.1838	0.2425
75	0.80	0.15	8.5	0.4521	0.3602	0.1838	0.2425
76	0.75	0.20	4.0	0.4521	0.3602	0.1838	0.2425
77-79	0.75	0.20	4.0	0.4521	0.3602	0.1838	0.2425
81-89	0.66	0.32	8.5	0.4521	0.3602	0.1838	0.2425
91-92	0.85	0.16	8.9	0.4521	0.3602	0.1838	0.2425
93-95	0.70	0.20	3.5	0.4521	0.3602	0.1838	0.2425
96	0.75	0.16	8.9	0.4521	0.3602	0.1838	0.2425
97	0.75	0.25	8.5	0.4521	0.3602	0.1838	0.2425
98	0.85	0.16	8.9	0.4521	0.3602	0.1838	0.2425
99	0.99	0.01	3.5	0.4521	0.3602	0.1838	0.2425

Table 94: 2015 Base Year Total Number of Links by Facility Type and Area Type

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	15	7	443	185	41	691
Divided Arterial	77	56	1,667	1,726	41	3,567
Undivided Arterial	20	37	1,023	220	128	1,428
Collector	175	117	3,730	431	247	4,700
Oneway Facilities	258	149	196	188	0	791
Ramps	20	42	436	199	20	717
Toll Facilities	10	21	273	20	11	335
Total	575	429	7,768	2,969	488	12,229

Table 95: 2015 Base Year Percentage Links by Facility Type and Area Type

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	0.12%	0.06%	3.62%	1.51%	0.34%	5.65%
Divided Arterial	0.63%	0.46%	13.63%	14.11%	0.34%	29.17%
Undivided Arterial	0.16%	0.30%	8.37%	1.80%	1.05%	11.68%
Collector	1.43%	0.96%	30.50%	3.52%	2.02%	38.43%
Oneway Facilities	2.11%	1.22%	1.60%	1.54%	0.00%	6.47%
Ramps	0.16%	0.34%	3.57%	1.63%	0.16%	5.86%
Toll Facilities	0.08%	0.17%	2.23%	0.16%	0.09%	2.74%
Total	4.70%	3.51%	63.52%	24.28%	3.99%	100.00%

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Table 96: 2015 Base Year Total Number of Links with Counts by Facility Type and Area Type

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	12	4	123	40	18	197
Divided Arterial	20	12	369	362	9	772
Undivided Arterial	3	9	215	48	40	315
Collector	60	29	792	76	65	1,022
Oneway Facilities	65	25	45	13	0	148
Ramps	14	26	299	53	18	410
Toll Facilities	4	7	62	3	2	78
Total	178	112	1,905	595	152	2,942

Table 97: 2015 Base Year Percentage of Links with Counts by Facility Type and Area Type

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	80.0%	57.1%	27.8%	21.6%	43.9%	28.5%
Divided Arterial	26.0%	21.4%	22.1%	21.0%	22.0%	21.6%
Undivided Arterial	15.0%	24.3%	21.0%	21.8%	31.3%	22.1%
Collector	34.3%	24.8%	21.2%	17.6%	26.3%	21.7%
Oneway Facilities	25.2%	16.8%	23.0%	6.9%	0%	18.7%
Ramps	70.0%	61.9%	68.6%	26.6%	90.0%	57.2%
Toll Facilities	40.0%	33.3%	22.7%	15.0%	18.2%	23.3%
Total	31.0%	26.1%	24.5%	20.0%	31.1%	24.1%

Table 98: 2015 Base Year Total Truck Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	0	39,635	168,614	67,680	2,240	0
Divided Arterial	9,506	266,739	181,575	9,521	0	0
Undivided Arterial	71,039	39,035	2,511	0	0	0
Collector	134,587	47,938	731	0	0	0
Oneway Facilities	0	5,961	7,865	5,383	0	0
Ramps	3,706	1,230	0	0	0	0
Toll Facilities	0	13,906	4,907	0	0	0
Total	218,838	414,444	366,203	82,584	2,240	0

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Table 99: 2015 Base Year Volume to Count Ratios for Links with Counts by Time Period and Facility Type

Facility Type	AM PK	MD OP	PM PK	EV OP	Daily
Freeway	0.90	1.06	1.01	0.96	1.00
Divided Arterial	1.00	0.94	1.02	1.03	1.01
Undivided Arterial	1.00	0.91	1.01	0.96	1.00
Collector	0.93	0.69	0.95	0.66	0.83
Oneway Facilities	1.10	0.94	1.17	1.07	1.06
Ramps	0.86	0.96	1.03	0.86	1.05
Toll Facilities	0.84	1.05	1.01	0.73	1.01
Average	0.97	0.94	1.01	0.96	0.98

Table 100: 2015 Base Year Volume to Count Ratios for Links with Counts by Time Period and Area Type

Facility Type	AM PK	MD OP	PM PK	EV OP	Daily
CBD	1.07	0.98	1.17	1.12	1.10
CBD Fringe	0.93	0.91	1.02	0.89	0.95
Residential	0.95	0.95	1.01	0.91	0.97
OBD	0.99	0.91	1.01	1.03	0.99
Rural	0.97	1.12	1.00	1.08	1.14
Average	0.97	0.94	1.01	0.96	0.98

Table 101: 2015 Base Year Daily Volume to Count Ratios for Links with Counts by Facility and Area Types

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Average
Freeway	1.01	1.15	1.00	0.96	1.12	1.00
Divided Arterial	1.16	1.04	1.01	1.00	1.13	1.01
Undivided Arterial	0.58	0.55	1.01	0.99	1.07	1.00
Collector	1.29	0.75	0.81	0.76	1.07	0.83
Oneway Facilities	1.09	0.80	1.18	1.14	0	1.06
Ramps	1.44	1.06	1.02	1.00	1.55	1.05
Toll Facilities	0.74	0.94	1.03	0.59	1.30	1.01
Average	1.10	0.95	0.97	0.99	1.14	0.98

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Table 102: 2015 Base Year Total Truck Volume on all Links with Truck Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	3,050	0	379,772	29,031	0	411,853
Divided Arterial	3,315	5,863	175,767	270,556	722	456,223
Undivided Arterial	154	558	62,998	14,117	10,090	87,917
Collector	2,228	705	13,458	4,496	539	21,426
Oneway Facilities	5,074	895	6,003	3,043	0	15,015
Ramps	0	0	2,245	2,064	0	4,310
Toll Facilities	0	1,863	19,984	0	0	21,847
Total	13,820	9,885	660,227	323,308	11,351	1,018,590

Table 103: 2015 Base Year Ratio of Truck Volumes of Truck Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	2.93	0	1.42	2.91	0	1.48
Divided Arterial	1.00	1.21	0.79	1.15	1.29	0.98
Undivided Arterial	0.80	0.28	0.77	0.72	1.10	0.78
Collector	0.61	0.15	0.11	0.20	0.02	0.12
Oneway Facilities	0.68	0.22	0.94	2.24	0	0.78
Ramps	0	0	0.54	2.79	0	0.87
Toll Facilities	0	0.91	1.19	0	0	1.16
Total	0.88	0.56	0.91	1.12	0.31	0.94

Table 104: 2015 Base Year Percent of Truck Volume over Total Volume

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	0.90%	0%	5.18%	1.78%	0%	3.95%
Divided Arterial	0.98%	2.23%	1.71%	2.10%	0.59%	1.91%
Undivided Arterial	0.74%	0.91%	2.08%	1.69%	2.71%	2.03%
Collector	0.60%	0.49%	0.29%	0.73%	0.33%	0.36%
Oneway Facilities	0.68%	0.35%	1.26%	1.90%	0%	0.91%
Ramps	0%	0%	0.11%	0.37%	0%	0.14%
Toll Facilities	0%	1.08%	1.58%	0%	0%	1.35%
Total	0.68%	0.64%	2.26%	1.94%	0.72%	2.00%

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Table 105: 2015 Base Year AM Period Volume to Count Ratios for Links with Counts by Facility and Area Types

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Average
Freeway	1.02	1.11	0.89	0.87	0	0.90
Divided Arterial	1.21	1.09	0.99	1.00	1.48	1.00
Undivided Arterial	0.74	0.64	1.00	1.07	1.01	1.00
Collector	1.28	0.89	0.92	0.84	0.71	0.93
Oneway Facilities	1.08	0.86	1.28	1.08	0	1.10
Ramps	0.54	0.78	0.88	0.67	0	0.86
Toll Facilities	0.68	0.79	0.89	0	0	0.84
Average	1.07	0.93	0.95	0.99	0.97	0.97

Table 106: 2015 Base Year MD Period Volume to Count Ratios for Links with Counts by Facility and Area Types

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Average
Freeway	1.01	1.19	1.06	1.00	0	1.06
Divided Arterial	0.99	1.02	0.96	0.92	0.88	0.94
Undivided Arterial	0.42	0.46	0.94	0.85	1.26	0.91
Collector	1.25	0.56	0.67	0.61	0.69	0.69
Oneway Facilities	0.90	0.73	1.13	0.99	0	0.94
Ramps	1.07	0.75	0.98	0.83	0	0.96
Toll Facilities	0.82	0.97	1.12	0	0	1.05
Average	0.98	0.91	0.95	0.91	1.12	0.94

Table 107: 2015 Base Year PM Period Volume to Count Ratios for Links with Counts by Facility and Area Types

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Average
Freeway	1.09	1.25	1.01	0.96	0	1.01
Divided Arterial	1.16	1.14	1.01	1.02	1.17	1.02
Undivided Arterial	0.80	0.63	1.00	1.09	1.05	1.01
Collector	1.54	0.86	0.94	0.83	0.77	0.95
Oneway Facilities	1.16	0.83	1.40	1.22	0	1.17
Ramps	1.66	0.79	1.05	0.85	0	1.03
Toll Facilities	0.82	1.05	1.04	0	0	1.01
Average	1.17	1.02	1.01	1.01	1.00	1.01

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Table 108: 2015 Base Year EV Period Volume to Count Ratios for Links with Counts by Facility and Area Types

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Average
Freeway	0.95	1.06	0.95	0.98	0	0.96
Divided Arterial	1.40	1.10	0.99	1.06	1.49	1.03
Undivided Arterial	0.52	0.58	0.96	1.00	1.16	0.96
Collector	1.71	0.64	0.60	0.67	0.60	0.66
Oneway Facilities	1.05	0.74	1.26	1.38	0	1.07
Ramps	1.08	0.57	0.86	1.00	0	0.86
Toll Facilities	0.55	0.74	0.76	0	0	0.73
Average	1.12	0.89	0.91	1.03	1.08	0.96

Table 109: 2015 Base Year Total Volume on All Links

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	631,612	773,318	24,762,794	7,391,612	1,398,386	34,957,722
Divided Arterial	1,263,890	1,126,784	46,124,766	62,381,967	615,624	111,513,032
Undivided Arterial	150,419	282,619	14,558,330	3,902,421	1,138,148	20,031,936
Collector	848,366	440,398	21,941,511	3,351,093	725,676	27,307,045
One Way Facilities	2,866,470	1,208,963	2,004,953	1,885,570	0	7,965,956
Ramps	166,654	255,353	2,936,563	1,551,188	170,342	5,080,101
Toll Facilities	219,589	496,991	4,889,189	421,246	445,209	6,472,224
Total	6,147,000	4,584,426	117,218,107	80,885,097	4,493,387	213,328,017

Table 110: 2015 Base Year Volume Percentages on All Links

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	0.30%	0.36%	11.61%	3.46%	0.66%	16.39%
Divided Arterial	0.59%	0.53%	21.62%	29.24%	0.29%	52.27%
Undivided Arterial	0.07%	0.13%	6.82%	1.83%	0.53%	9.39%
Collector	0.40%	0.21%	10.29%	1.57%	0.34%	12.80%
One Way Facilities	1.34%	0.57%	0.94%	0.88%	0%	3.73%
Ramps	0.08%	0.12%	1.38%	0.73%	0.08%	2.38%
Toll Facilities	0.10%	0.23%	2.29%	0.20%	0.21%	3.03%
Total	2.88%	2.15%	54.95%	37.92%	2.11%	100.00%

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Table 111: 2015 Base Year Average Total Volume on all Links

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	42,107	110,474	55,898	39,955	34,107	50,590
Divided Arterial	16,414	20,121	27,669	36,143	15,015	31,262
Undivided Arterial	7,521	7,638	14,231	17,738	8,892	14,028
Collector	4,848	3,764	5,882	7,775	2,938	5,810
One Way Facilities	11,110	8,114	10,229	10,030	0	10,071
Ramps	8,333	6,080	6,735	7,795	8,517	7,085
Toll Facilities	21,959	23,666	17,909	21,062	40,474	19,320
Average	10,690	10,686	15,090	27,243	9,208	17,444

Table 112: 2015 Base Year Total VMT for all Links Using Volumes

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	133,161	119,612	15,029,796	1,910,226	1,405,533	18,598,327
Divided Arterial	121,866	123,477	14,279,334	12,949,293	268,061	27,742,030
Undivided Arterial	17,268	33,013	5,177,349	675,024	1,080,910	6,983,564
Collector	51,567	49,037	6,482,670	622,311	616,520	7,822,105
One Way Facilities	165,267	100,872	268,757	294,614	0	829,510
Ramps	36,143	61,431	1,016,467	422,489	110,181	1,646,711
Toll Facilities	37,680	130,071	2,369,154	123,498	554,349	3,214,752
Total	562,952	617,513	44,623,526	16,997,455	4,035,554	66,837,000

Table 113: 2015 Base Year Total VHT for all Links Using Volumes

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	4,497	3,507	316,866	42,252	21,834	388,955
Divided Arterial	7,396	5,421	441,146	419,827	5,446	879,235
Undivided Arterial	1,057	1,749	165,650	23,815	27,813	220,084
Collector	3,759	3,067	241,009	25,591	18,982	292,408
One Way Facilities	10,396	5,626	9,459	9,828	0	35,309
Ramps	1,903	3,262	40,052	18,748	2,950	66,916
Toll Facilities	826	2,529	38,650	3,263	12,682	57,950
Total	29,835	25,161	1,252,831	543,323	89,707	1,940,857

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Table 114: 2015 Base Year Total VMT Using Volumes on Links with Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	86,400	57,900	5,664,700	549,500	466,400	6,824,800
Divided Arterial	42,000	36,400	4,074,900	3,282,100	64,100	7,499,500
Undivided Arterial	3,400	9,200	1,306,700	170,600	396,700	1,886,600
Collector	23,400	19,600	1,832,300	137,100	180,700	2,193,200
Oneway Facilities	55,700	24,600	73,400	27,500	0	181,200
Ramps	32,300	52,500	790,200	216,300	110,100	1,201,300
Toll Facilities	24,300	62,800	903,700	2,400	69,400	1,062,700
Total	267,600	262,900	14,645,800	4,385,600	1,287,400	20,849,300

Table 115: 2015 Base Year Total VMT Using Counts on Links with Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	85,900	49,700	5,505,800	580,100	420,600	6,642,100
Divided Arterial	40,400	35,800	3,990,900	3,306,400	54,700	7,428,100
Undivided Arterial	5,800	18,000	1,284,900	172,600	342,500	1,823,800
Collector	21,900	30,600	2,280,800	193,900	170,200	2,697,500
Oneway Facilities	57,200	31,600	67,800	23,300	0	179,800
Ramps	26,000	53,100	794,400	214,100	79,700	1,167,300
Toll Facilities	32,700	52,400	826,800	3,900	53,300	969,200
Total	269,900	271,200	14,751,300	4,494,200	1,121,100	20,907,700

Table 116: 2015 Base Year Ratio of Volume over Count VMT

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	1.01	1.16	1.03	0.95	1.11	1.03
Divided Arterial	1.04	1.02	1.02	0.99	1.17	1.01
Undivided Arterial	0.59	0.51	1.02	0.99	1.16	1.03
Collector	1.07	0.64	0.80	0.71	1.06	0.81
Oneway Facilities	0.97	0.78	1.08	1.18	0	1.01
Ramps	1.24	0.99	0.99	1.01	1.38	1.03
Toll Facilities	0.74	1.20	1.09	0.62	1.30	1.10
Total	0.99	0.97	0.99	0.98	1.15	1.00

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Table 117: 2015 Base Year Total VHT Using Volumes on Links with Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	2,414	1,866	123,123	11,869	7,302	146,576
Divided Arterial	2,448	1,776	125,445	109,051	1,288	240,010
Undivided Arterial	235	479	41,362	5,917	10,216	58,210
Collector	1,734	1,206	66,205	5,351	5,577	80,075
Oneway Facilities	3,514	1,327	2,680	952	0	8,474
Ramps	1,687	2,779	32,533	10,362	2,947	50,309
Toll Facilities	480	1,175	15,255	46	1,549	18,507
Total	12,515	10,610	406,607	143,551	28,882	602,165

Table 118: 2015 Base Year Total VHT Using Counts on Links with Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	2,356	1,558	119,314	12,529	6,598	142,357
Divided Arterial	2,231	1,701	123,326	108,873	1,096	237,227
Undivided Arterial	375	932	40,435	5,832	8,750	56,326
Collector	1,545	1,829	80,802	7,372	5,171	96,720
Oneway Facilities	3,582	1,685	2,356	805	0	8,429
Ramps	1,084	2,729	33,180	10,854	1,947	49,795
Toll Facilities	631	1,046	14,382	72	1,191	17,324
Total	11,807	11,483	413,798	146,338	24,755	608,182

Table 119: 2015 Base Year Ratio of Volume over Count VHT

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	1.02	1.20	1.03	0.95	1.11	1.03
Divided Arterial	1.10	1.04	1.02	1.00	1.18	1.01
Undivided Arterial	0.63	0.51	1.02	1.01	1.17	1.03
Collector	1.12	0.66	0.82	0.73	1.08	0.83
Oneway Facilities	0.98	0.79	1.14	1.18	0	1.01
Ramps	1.56	1.02	0.98	0.95	1.51	1.01
Toll Facilities	0.76	1.12	1.06	0.65	1.30	1.07
Total	1.06	0.92	0.98	0.98	1.17	0.99

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Table 120: 2015 Base Year Total Volume on Links with Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	338,900	470,823	7,326,311	1,626,653	665,438	10,428,124
Divided Arterial	338,654	262,652	10,298,345	12,868,813	122,240	23,890,704
Undivided Arterial	20,688	60,988	3,035,204	835,110	371,741	4,323,731
Collector	371,310	143,818	4,691,166	612,889	164,631	5,983,814
Oneway Facilities	749,529	255,391	475,756	160,552	0	1,641,228
Ramps	129,466	172,168	2,134,318	551,919	160,992	3,148,863
Toll Facilities	84,586	172,798	1,266,555	7,951	81,044	1,612,934
Total	2,033,132	1,538,639	29,227,655	16,663,888	1,566,086	51,029,399

Table 121: 2015 Base Year Total of Counts on Links with Counts

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	335,004	409,002	7,352,525	1,702,501	592,000	10,391,032
Divided Arterial	291,100	252,001	10,214,808	12,840,196	107,800	23,705,905
Undivided Arterial	35,599	110,700	3,004,201	842,500	348,399	4,341,399
Collector	288,402	191,402	5,784,945	801,251	154,550	7,220,550
Oneway Facilities	688,950	318,100	403,200	140,900	0	1,551,150
Ramps	89,800	161,800	2,088,250	549,350	103,750	2,992,950
Toll Facilities	114,501	184,443	1,228,925	13,500	62,500	1,603,869
Total	1,843,356	1,627,448	30,076,854	16,890,198	1,368,999	51,806,855

Table 122: 2015 Base Year Ratio of Volume over Count

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	1.01	1.15	1.00	0.96	1.12	1.00
Divided Arterial	1.16	1.04	1.01	1.00	1.13	1.01
Undivided Arterial	0.58	0.55	1.01	0.99	1.07	1.00
Collector	1.29	0.75	0.81	0.76	1.07	0.83
Oneway Facilities	1.09	0.80	1.18	1.14	0	1.06
Ramps	1.44	1.06	1.02	1.00	1.55	1.05
Toll Facilities	0.74	0.94	1.03	0.59	1.30	1.01
Total	1.10	0.95	0.97	0.99	1.14	0.98

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Table 123: 2015 Base Year Original Speeds (MPH)

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	41.4	50.0	55.1	47.1	69.2	55.5
Divided Arterial	24.2	26.1	37.9	36.9	48.6	37.6
Undivided Arterial	17.9	20.5	35.8	32.5	43.9	37.2
Collector	15.6	16.6	29.3	27.8	34.8	29.8
Oneway Facilities	16.7	21.3	31.7	36.8	0	28.8
Ramps	23.1	19.9	32.3	28.4	46.4	31.4
Toll Facilities	55.0	55.0	66.8	55.1	69.8	66.2
Total	20.6	23.0	34.9	35.4	40.7	35.4

Table 124: 2015 Base Year Congested Speeds (MPH)

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	37.3	37.0	50.1	45.5	64.9	50.9
Divided Arterial	21.5	24.8	35.4	33.4	48.6	34.8
Undivided Arterial	17.4	20.1	33.9	30.4	42.3	35.3
Collector	14.0	15.2	28.5	26.1	34.5	29.1
Oneway Facilities	16.3	19.0	30.4	34.1	0	27.1
Ramps	21.9	19.0	30.4	26.3	39.9	29.3
Toll Facilities	52.3	52.4	64.9	48.7	49.5	62.7
Total	19.0	21.3	33.3	32.4	39.4	33.6

Table 125: 2015 Base Year Percent Change in Speed

Facility Type	CBD	CBD Fringe	Residential	OBD	Rural	Total
Freeway	-9.8%	-25.9%	-9.1%	-3.2%	-6.2%	-8.1%
Divided Arterial	-11.1%	-5.1%	-6.5%	-9.4%	-0.0%	-7.4%
Undivided Arterial	-2.5%	-2.0%	-5.5%	-6.5%	-3.6%	-5.0%
Collector	-10.2%	-8.8%	-2.7%	-6.2%	-1.0%	-2.6%
Oneway Facilities	-2.1%	-10.8%	-4.0%	-7.3%	-0.0%	-6.0%
Ramps	-5.4%	-4.3%	-6.1%	-7.3%	-13.9%	-6.8%
Toll Facilities	-4.9%	-4.8%	-2.8%	-11.7%	-29.1%	-5.2%
Total	-7.6%	-7.2%	-4.7%	-8.3%	-3.3%	-5.1%

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Table 126: 2015 Base Year Daily RMSE Error Percentages

GROUP	LOW RANGE	HIGH RANGE	Hillsborough	Pinellas	Pasco	Hernando	Citrus	District Area	Manatee	Study Area
<= 5K VPD	45.00	100.00	72.79	65.53	56.81	92.01	103.85	73.76	91.70	74.10
5K - 10K VPD	35.00	45.00	44.10	36.79	36.72	38.04	54.01	41.48	67.84	41.73
10K - 15K VPD	27.00	35.00	35.85	29.41	32.58	20.29	22.15	32.51	23.56	32.46
15K - 20K VPD	25.00	35.00	25.38	24.06	27.47	28.07	41.43	25.76	2.68	25.69
20K - 30K VPD	15.00	27.00	20.28	20.71	16.72	13.38	4.99	19.90	37.81	20.31
30K - 50K VPD	15.00	25.00	17.69	15.59	17.41	0	0	16.87	19.65	17.01
50K - 60K VPD	10.00	20.00	12.54	7.51	0	0	0	10.92	0	10.92
60K+ VPD	10.00	19.00	12.82	13.73	16.66	0	0	13.04	0	13.04
Areawide	35.00	45.00	32.88	28.95	32.23	44.37	57.13	32.82	40.51	32.95

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Table 127: 2015 Base Year Screenline Validation Summary – AM Period

Screenline	Number of Links	Estimated Volume	Count	V/C Ratio	Truck Volume	Truck Count	Truck V/C Ratio
1	4	472	1,440	0.33	761	94	8.10
2	6	17,291	14,391	1.20	2,691	1,530	1.76
3	6	41,526	40,215	1.03	1,644	862	1.91
4	4	1,735	1,271	1.37	306	161	1.90
5	4	10,918	12,621	0.87	219	205	1.07
6	4	10,430	10,815	0.96	107	181	0.59
7	6	23,120	22,137	1.04	327	418	0.78
8	6	3,903	4,220	0.92	63	123	0.51
9	8	9,298	6,702	1.39	1,745	921	1.89
10	6	7,140	6,434	1.11	2,356	1,328	1.77
11	8	6,678	3,557	1.88	317	209	1.52
12	0	0	0	0	0	0	0
13	18	29,541	28,033	1.05	418	335	1.25
14	6	14,352	12,663	1.13	384	586	0.66
15	26	31,458	31,567	1.00	1,207	754	1.60
16	14	23,152	24,605	0.94	608	335	1.81
17	18	45,215	53,701	0.84	1,733	1,208	1.43
18	12	28,914	38,643	0.75	1,378	1,644	0.84
19	16	42,830	45,934	0.93	894	388	2.30
20	37	56,692	60,574	0.94	1,048	1,015	1.03
21	16	65,993	64,705	1.02	3,502	2,365	1.48
22	16	15,863	17,846	0.89	354	416	0.85
23	15	35,884	43,535	0.82	19	31	0.61
24	6	14,376	11,986	1.20	239	214	1.12
25	8	30,109	35,494	0.85	1,955	1,789	1.09
26	12	25,258	33,560	0.75	1,159	1,077	1.08
31	20	54,347	49,166	1.11	585	1,142	0.51
32	16	68,198	72,667	0.94	2,685	3,617	0.74
33	8	14,880	14,760	1.01	261	468	0.56
34	8	20,485	22,972	0.89	490	892	0.55
35	12	28,653	19,171	1.49	749	398	1.88
36	16	28,995	24,061	1.21	795	2,044	0.39
37	26	56,098	50,154	1.12	1,793	2,530	0.71
38	16	24,791	23,975	1.03	538	1,127	0.48
39	12	20,954	17,660	1.19	453	409	1.11
41	0	0	0	0	0	0	0
42	2	7,865	7,236	1.09	244	194	1.26
43	2	4,686	4,161	1.13	206	168	1.23
44	4	11,980	13,635	0.88	427	355	1.20
45	4	11,227	14,836	0.76	538	598	0.90
46	6	13,374	22,916	0.58	553	893	0.62
47	4	14,980	15,496	0.97	1,504	1,357	1.11
51	4	9,358	7,146	1.31	182	97	1.88
52	4	10,532	8,141	1.29	384	269	1.43
53	2	2,307	1,884	1.22	49	75	0.65
54	2	1,646	786	2.09	0	0	0
55	2	4,135	3,299	1.25	495	286	1.73
56	4	3,701	1,639	2.26	169	45	3.76
57	4	2,011	1,979	1.02	213	267	0.80
58	2	6,568	3,742	1.76	217	52	4.17
61	2	2,259	1,745	1.29	0	0	0
62	4	4,736	5,473	0.87	213	220	0.97
63	6	5,333	4,535	1.18	466	243	1.92
64	4	4,963	5,630	0.88	44	24	1.83
65	2	2,448	4,509	0.54	73	99	0.74
66	2	2,617	2,487	1.05	0	0	0

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Table 128: 2015 Base Year Screenline Validation Summary – MD Period

Screenline	Number of Links	Estimated Volume	Count	V/C Ratio	Truck Volume	Truck Count	Truck V/C Ratio
1	4	1,096	2,818	0.39	2,041	291	7.01
2	6	38,351	31,603	1.21	5,642	4,487	1.26
3	6	97,491	81,945	1.19	5,575	2,645	2.11
4	4	3,743	2,065	1.81	684	348	1.97
5	4	30,946	29,168	1.06	969	530	1.83
6	4	24,435	24,599	0.99	298	437	0.68
7	6	58,232	42,331	1.38	808	1,081	0.75
8	6	12,506	9,877	1.27	156	408	0.38
9	8	27,890	20,874	1.34	4,568	2,923	1.56
10	6	19,264	20,495	0.94	5,677	4,174	1.36
11	8	23,634	10,822	2.18	808	621	1.30
12	0	0	0	0	0	0	0
13	18	64,810	68,484	0.95	1,066	922	1.16
14	6	32,713	24,736	1.32	1,093	1,482	0.74
15	26	69,800	75,762	0.92	3,278	2,628	1.25
16	14	48,982	61,304	0.80	1,527	845	1.81
17	18	98,667	117,179	0.84	4,902	3,635	1.35
18	12	66,190	73,100	0.91	3,912	5,046	0.78
19	16	93,835	106,379	0.88	2,654	1,374	1.93
20	37	132,544	144,151	0.92	2,868	2,693	1.06
21	16	159,710	151,541	1.05	9,491	7,719	1.23
22	16	31,046	33,993	0.91	964	757	1.27
23	15	74,397	71,024	1.05	33	127	0.26
24	6	34,202	29,162	1.17	725	667	1.09
25	8	73,351	70,916	1.03	4,989	5,044	0.99
26	12	61,047	67,675	0.90	3,598	3,333	1.08
31	20	110,108	123,733	0.89	1,341	2,559	0.52
32	16	144,815	155,679	0.93	7,199	6,584	1.09
33	8	28,211	36,559	0.77	587	1,482	0.40
34	8	44,390	50,261	0.88	1,592	2,011	0.79
35	12	64,393	73,081	0.88	1,839	1,131	1.63
36	16	59,738	69,494	0.86	1,953	6,425	0.30
37	26	122,118	127,524	0.96	4,830	6,647	0.73
38	16	48,969	62,477	0.78	1,200	2,823	0.43
39	12	38,387	48,302	0.79	1,128	1,114	1.01
41	0	0	0	0	0	0	0
42	2	20,129	25,206	0.80	589	478	1.23
43	2	10,301	13,682	0.75	434	493	0.88
44	4	26,124	36,336	0.72	1,248	959	1.30
45	4	29,618	31,951	0.93	1,690	1,788	0.95
46	6	37,745	44,085	0.86	2,076	2,453	0.85
47	4	45,552	37,097	1.23	4,148	4,405	0.94
51	4	24,923	21,559	1.16	426	286	1.49
52	4	26,098	25,091	1.04	824	820	1.00
53	2	8,056	5,894	1.37	136	253	0.54
54	2	6,070	1,922	3.16	0	0	0
55	2	11,617	7,750	1.50	1,137	811	1.40
56	4	11,227	4,681	2.40	439	133	3.30
57	4	5,488	4,977	1.10	459	790	0.58
58	2	14,493	15,512	0.93	468	127	3.69
61	2	6,786	5,228	1.30	0	0	0
62	4	9,192	17,450	0.53	503	616	0.82
63	6	10,718	12,425	0.86	1,017	709	1.43
64	4	9,043	14,894	0.61	90	75	1.20
65	2	3,542	16,097	0.22	164	220	0.75
66	2	6,030	5,515	1.09	0	0	0

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Table 129: 2015 Base Year Screenline Validation Summary – PM Period

Screenline	Number of Links	Estimated Volume	Count	V/C Ratio	Truck Volume	Truck Count	Truck V/C Ratio
1	4	647	1,741	0.37	593	75	7.91
2	6	23,146	18,425	1.26	2,410	1,590	1.52
3	6	56,560	50,187	1.13	1,261	709	1.78
4	4	2,256	1,759	1.28	250	204	1.23
5	4	15,649	17,338	0.90	170	151	1.13
6	4	15,166	14,920	1.02	89	133	0.67
7	6	27,042	24,840	1.09	253	349	0.72
8	6	5,315	6,194	0.86	50	115	0.43
9	8	12,195	8,865	1.38	1,602	994	1.61
10	6	8,897	9,513	0.94	2,130	1,417	1.50
11	8	9,214	5,387	1.71	246	170	1.45
12	0	0	0	0	0	0	0
13	18	42,558	38,125	1.12	355	353	1.01
14	6	20,529	16,830	1.22	312	532	0.59
15	26	44,365	43,890	1.01	1,163	932	1.25
16	14	33,872	34,348	0.99	514	294	1.75
17	18	65,810	68,068	0.97	1,409	953	1.48
18	12	38,890	46,348	0.84	1,298	1,620	0.80
19	16	60,549	64,478	0.94	709	393	1.80
20	37	88,380	88,211	1.00	855	1,029	0.83
21	16	94,172	85,247	1.10	2,891	2,580	1.12
22	16	21,837	23,484	0.93	282	285	0.99
23	15	58,235	57,578	1.01	16	38	0.42
24	6	21,305	17,446	1.22	198	305	0.65
25	8	43,206	44,954	0.96	1,755	1,587	1.11
26	12	37,820	44,095	0.86	1,139	1,213	0.94
31	20	75,287	69,441	1.08	495	1,307	0.38
32	16	97,441	93,789	1.04	2,152	2,902	0.74
33	8	22,463	21,128	1.06	217	697	0.31
34	8	28,691	32,070	0.89	398	1,058	0.38
35	12	42,571	36,970	1.15	632	286	2.21
36	16	42,888	39,316	1.09	656	3,550	0.18
37	26	81,730	71,154	1.15	1,479	3,660	0.40
38	16	36,366	35,824	1.02	454	1,472	0.31
39	12	28,488	25,130	1.13	381	672	0.57
41	0	0	0	0	0	0	0
42	2	11,294	11,815	0.96	199	137	1.45
43	2	6,943	6,725	1.03	166	136	1.22
44	4	17,208	20,762	0.83	342	259	1.32
45	4	15,536	20,705	0.75	419	467	0.90
46	6	19,546	29,083	0.67	430	724	0.59
47	4	20,549	20,712	0.99	1,394	1,421	0.98
51	4	13,123	11,669	1.12	145	64	2.27
52	4	15,439	12,577	1.23	308	242	1.27
53	2	3,257	3,048	1.07	36	75	0.48
54	2	2,359	975	2.42	0	0	0
55	2	5,351	4,440	1.21	389	209	1.86
56	4	5,090	2,663	1.91	133	48	2.77
57	4	2,570	2,865	0.90	185	230	0.80
58	2	9,549	6,506	1.47	177	31	5.71
61	2	3,024	2,691	1.12	0	0	0
62	4	7,042	8,268	0.85	175	190	0.92
63	6	7,145	6,801	1.05	394	212	1.86
64	4	7,007	7,418	0.94	36	24	1.50
65	2	3,314	7,546	0.44	60	43	1.40
66	2	3,791	2,977	1.27	0	0	0

APPENDIX G – HIGHWAY ASSIGNMENT VALIDATION

Table 130: 2015 Base Year Screenline Validation Summary – EV Period

Screenline	Number of Links	Estimated Volume	Count	V/C Ratio	Truck Volume	Truck Count	Truck V/C Ratio
1	4	675	1,502	0.45	1,297	136	9.54
2	6	22,334	19,281	1.16	3,348	3,089	1.08
3	6	59,069	56,654	1.04	3,172	1,501	2.11
4	4	2,332	1,606	1.45	416	182	2.29
5	4	20,262	18,372	1.10	462	176	2.63
6	4	15,355	16,164	0.95	128	205	0.62
7	6	34,690	31,194	1.11	509	716	0.71
8	6	6,925	7,108	0.97	79	168	0.47
9	8	17,438	11,711	1.49	2,979	2,473	1.20
10	6	11,904	12,161	0.98	3,596	3,478	1.03
11	8	13,659	4,434	3.08	501	217	2.31
12	0	0	0	0	0	0	0
13	18	44,422	36,860	1.21	479	333	1.44
14	6	19,819	18,270	1.08	550	768	0.72
15	26	41,293	49,777	0.83	2,036	2,074	0.98
16	14	32,372	34,541	0.94	702	388	1.81
17	18	64,528	82,047	0.79	2,532	1,966	1.29
18	12	41,345	53,414	0.77	2,342	3,478	0.67
19	16	59,433	71,112	0.84	1,477	922	1.60
20	37	88,417	104,872	0.84	1,410	1,223	1.15
21	16	103,935	106,006	0.98	5,793	4,827	1.20
22	16	18,178	22,980	0.79	553	407	1.36
23	15	43,332	42,057	1.03	16	20	0.80
24	6	24,185	18,507	1.31	334	264	1.27
25	8	43,163	50,334	0.86	3,110	3,694	0.84
26	12	36,936	44,168	0.84	2,219	2,672	0.83
31	20	69,392	70,610	0.98	611	1,354	0.45
32	16	91,776	92,367	0.99	3,853	3,266	1.18
33	8	15,648	20,051	0.78	273	638	0.43
34	8	27,874	27,698	1.01	755	781	0.97
35	12	40,956	33,780	1.21	851	185	4.60
36	16	38,076	35,629	1.07	940	3,553	0.26
37	26	77,665	71,567	1.09	2,332	3,279	0.71
38	16	31,300	38,027	0.82	544	1,955	0.28
39	12	24,497	26,207	0.93	511	604	0.85
41	0	0	0	0	0	0	0
42	2	12,691	10,742	1.18	273	183	1.49
43	2	6,089	4,931	1.23	246	190	1.29
44	4	15,906	19,265	0.83	661	344	1.92
45	4	18,466	19,508	0.95	1,011	570	1.77
46	6	23,852	27,417	0.87	1,240	853	1.45
47	4	28,711	25,195	1.14	2,720	3,518	0.77
51	4	14,588	10,628	1.37	205	97	2.11
52	4	15,880	10,691	1.49	435	349	1.25
53	2	4,421	2,175	2.03	74	63	1.17
54	2	3,673	1,017	3.61	0	0	0
55	2	7,910	4,511	1.75	736	436	1.69
56	4	7,839	2,316	3.38	279	46	6.07
57	4	2,640	3,180	0.83	261	469	0.56
58	2	9,272	5,241	1.77	239	66	3.62
61	2	4,328	2,336	1.85	0	0	0
62	4	5,484	5,810	0.94	281	189	1.49
63	6	6,279	5,640	1.11	541	314	1.72
64	4	5,347	5,357	1.00	45	16	2.81
65	2	2,080	5,848	0.36	90	119	0.76
66	2	3,728	2,521	1.48	0	0	0

APPENDIX G – HIGHWAY ASSIGNMENT VALIDATION

Table 131: 2015 Base Year Screenline Validation Summary – Daily

Screenline	Number of Links	Estimated Volume	Count	V/C Ratio	Truck Volume	Truck Count	Truck V/C Ratio
1	12	151,961	156,100	0.97	4,692	596	7.87
2	6	101,122	83,700	1.21	14,093	10,692	1.32
3	12	343,635	308,501	1.11	11,653	5,718	2.04
4	18	176,543	184,100	0.96	1,657	893	1.86
5	8	101,075	113,700	0.89	1,820	1,063	1.71
6	10	114,885	125,400	0.92	622	957	0.65
7	8	193,943	163,001	1.19	1,895	2,563	0.74
8	8	77,240	71,400	1.08	349	815	0.43
9	10	67,343	50,051	1.35	10,892	7,311	1.49
10	10	57,492	59,301	0.97	13,759	10,397	1.32
11	12	61,892	26,850	2.31	1,871	1,220	1.53
12	6	35,004	38,900	0.90	0	0	0
13	19	188,513	177,399	1.06	2,318	1,942	1.19
14	11	148,330	115,001	1.29	2,339	3,369	0.69
15	30	216,483	213,999	1.01	7,682	6,388	1.20
16	22	205,923	224,100	0.92	3,349	1,859	1.80
17	20	277,090	324,998	0.85	10,577	7,766	1.36
18	14	180,956	220,301	0.82	8,930	11,788	0.76
19	22	333,348	368,300	0.91	5,730	3,080	1.86
20	37	366,032	397,808	0.92	6,183	5,960	1.04
21	16	423,811	407,501	1.04	21,678	17,491	1.24
22	20	232,838	241,700	0.96	2,154	1,861	1.16
23	24	347,726	348,100	1.00	83	215	0.39
24	12	311,695	303,599	1.03	1,496	1,449	1.03
25	10	202,963	213,699	0.95	11,811	12,117	0.97
26	16	273,739	292,502	0.94	8,116	8,296	0.98
31	23	321,395	327,250	0.98	3,028	6,365	0.48
32	20	433,150	444,100	0.98	15,885	16,367	0.97
33	10	150,831	156,499	0.96	1,337	3,282	0.41
34	10	135,275	150,499	0.90	3,233	4,740	0.68
35	14	197,390	179,501	1.10	4,071	1,999	2.04
36	18	176,447	175,100	1.01	4,346	15,570	0.28
37	36	406,791	394,499	1.03	10,436	16,114	0.65
38	16	141,425	160,300	0.88	2,736	7,379	0.37
39	14	118,769	125,699	0.94	2,475	2,797	0.88
41	2	53,527	53,500	1.00	0	0	0
42	2	51,979	54,999	0.95	1,305	991	1.32
43	4	33,175	36,000	0.92	1,051	987	1.06
44	8	90,829	122,001	0.74	2,678	1,918	1.40
45	6	80,746	88,499	0.91	3,657	3,425	1.07
46	8	108,595	133,500	0.81	4,300	4,925	0.87
47	8	145,775	133,900	1.09	9,767	10,702	0.91
51	16	108,725	106,400	1.02	959	544	1.76
52	14	124,779	111,500	1.12	1,952	1,679	1.16
53	8	28,409	24,000	1.18	295	467	0.63
54	14	38,136	37,900	1.01	0	0	0
55	6	34,363	25,000	1.37	2,757	1,742	1.58
56	8	32,684	16,400	1.99	1,021	272	3.75
57	14	25,423	21,300	1.19	1,117	1,756	0.64
58	8	91,843	84,200	1.09	1,101	275	4.00
61	4	25,510	17,500	1.46	0	0	0
62	6	36,431	41,000	0.89	1,171	1,217	0.96
63	10	32,529	34,700	0.94	2,417	1,477	1.64
64	8	29,430	39,600	0.74	214	139	1.54
65	6	24,271	45,701	0.53	388	482	0.80
66	2	16,167	13,500	1.20	0	0	0