Appendix A

Central Broward Transit – VISSIM Microsimulation Calibration Report

CENTRAL BROWARD EAST-WEST TRANSIT STUDY

VISSIM Microsimulation Calibration Report

February 2013

JACOBS

CENTRAL BROWARD
East
West
TRANSIT STUDY

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1.0 Introduction

This report documents the methodology followed to build and calibrate a detailed microsimulation model for the Central Broward East-West Transit project in Broward County, Florida using VISSIM 5.30. The purpose of the model is to serve as a testing tool for the operation of transit options and their impact in the surrounding traffic.

The extent of the project study area includes approximately 27 miles of roadway from the west at University Drive to the east at the Fort Lauderdale-Hollywood International Airport and into downtown Fort Lauderdale as shown in Figure 1 below.

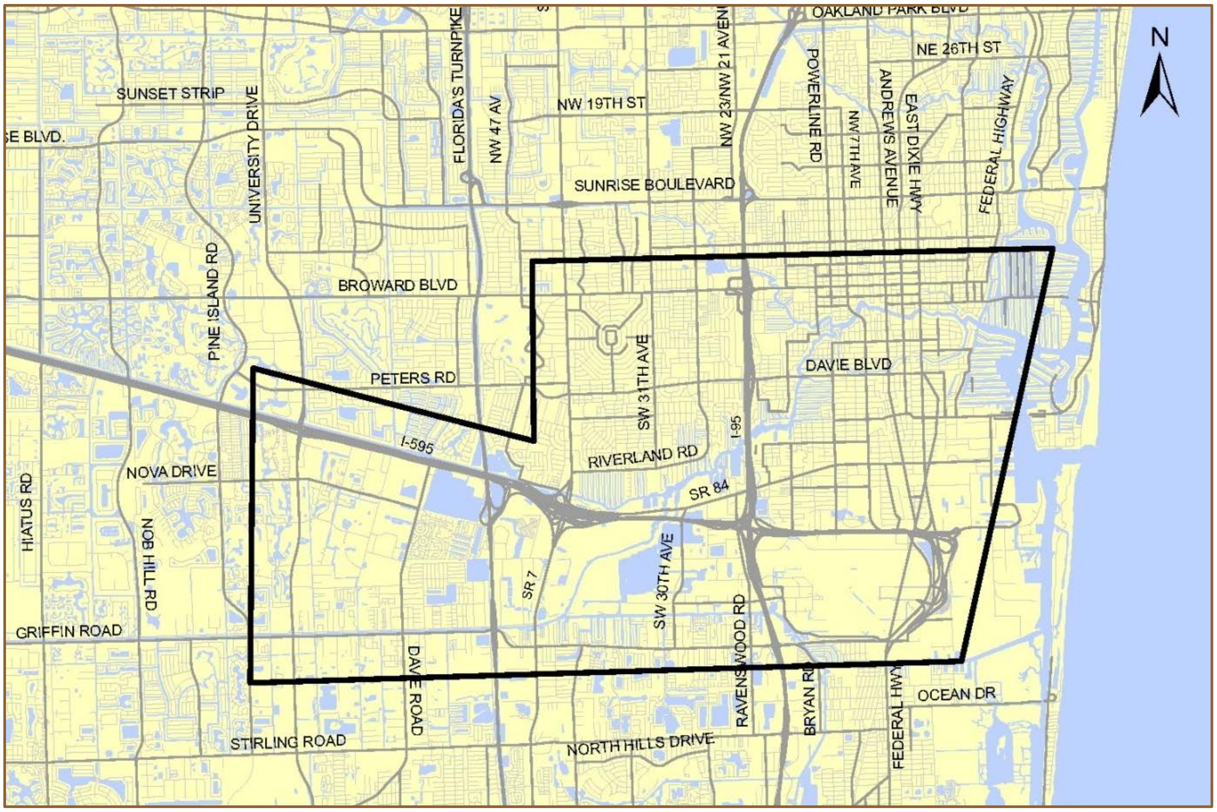


Figure 1: Central Broward East-West VISSIM Study Area

The limits of the corridor, in terms of arterials to be included, were determined during successive meetings with Florida Department of Transportation (FDOT) and other stakeholders. It was also established that the periods to be analyzed would be from 7:00 AM to 9:00 AM during the morning peak, and from 4:30 PM to 6:30 PM during the afternoon peak. Given the length of the transit route, the extended peak period was necessary to capture the transit service from the initial boarding stop to the final alighting stop.

The Central Broward East-West Corridor presents several challenges to microscopic simulation. Among others, it is heavily used for commute traffic, involves alternative transit options, and the immense scale of the network created unique difficulties. Within the model there are 74 intersections being analyzed, out of which 69 are signalized.

2.0 Model Development

Development of a microscopic simulation model requires a great deal of detail in the input data. The basic components of the model are:

- Network (number of lanes, type of facility)
- Controllers (signals and stop signs)
- Traffic (composition, desired speeds, fleet)

The network and controller characteristics constitute the supply side of the equation, whereas the traffic corresponds to the demand.

2.1 Network

The model network contains roadways east of the I-595/University Drive interchange. Since I-595 was under construction at the time of this modeling exercise, reliable data (i.e. traffic counts, travel time surveys, etc) representative of typical traffic conditions could not be collected. The typical section of I-595 within the study limits is being significantly modified as part of the I-595 Express Design, Build, Finance, Operate and Maintain (D/B/F/O/M) project to vastly improve traffic conditions along the I-595 corridor. The I-595 mainline improvements include the implementation of reversible toll lanes. Consequently, it was decided not to model I-595. Moreover, since there are no transit stops along I-595; the impact to traffic operations along I-595 as a result of the proposed transit service is expected to be negligible.

To code the network, aerial photographs from Google Earth® were scaled and displayed as a background image in the program, facilitating the tracing of the links and connectors of the model (Figure 2). Different topological features were considered for the description of the different elements of the Central Broward East-West Corridor as follows:

2.1.1 Arterials

- Number of lanes at each approach
- Existence and length of turn bays
- Position of traffic signals and traffic controllers
- Special conditions when necessary (de-facto turn bays, etc.)

Snapshots of all the arterial intersections included in the model along with their lane assignment and controller type are included in Appendix I.

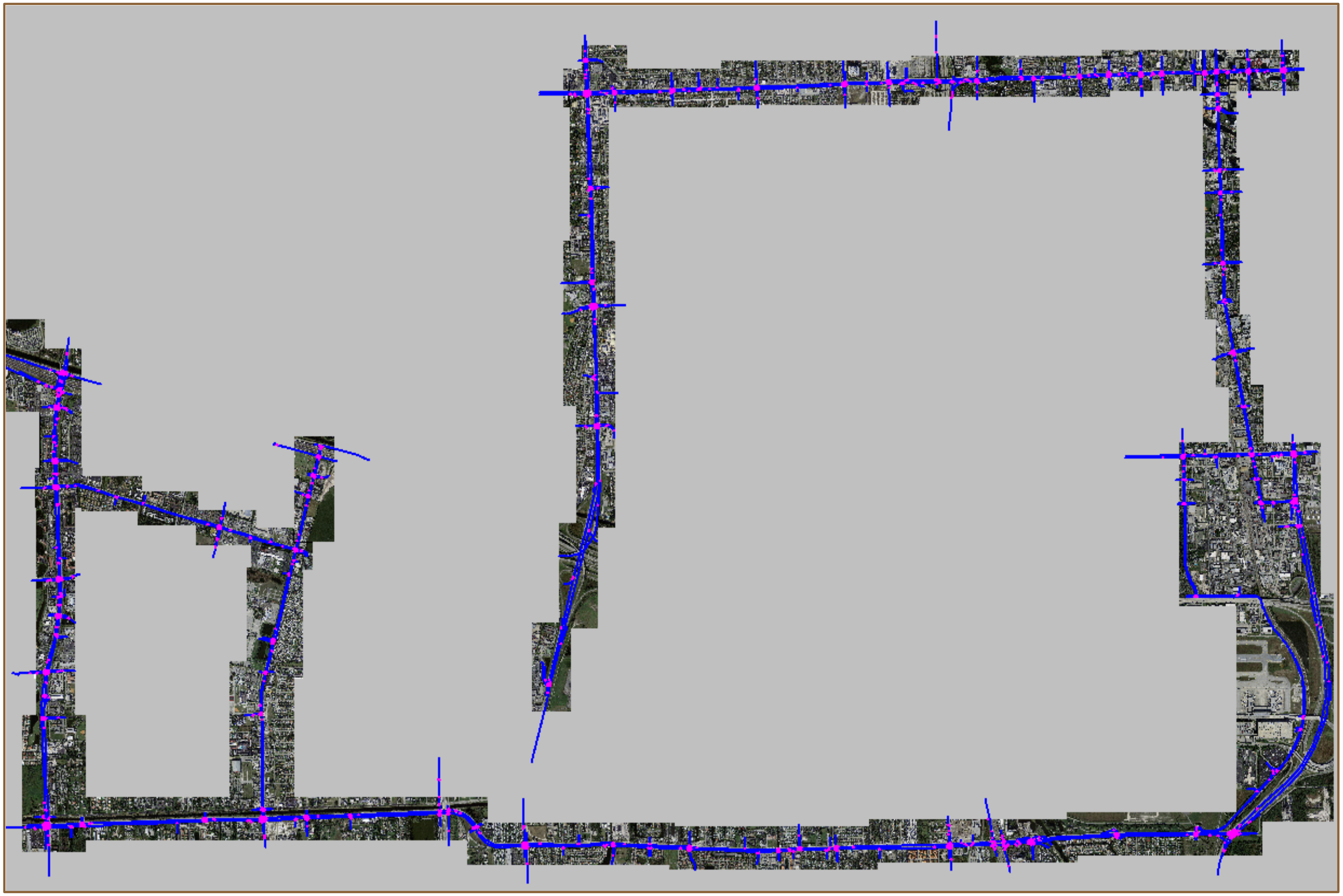


Figure 2: Network Coding Aerial

2.1.2 Speeds

In VISSIM, stochastic distributions of desired speeds are defined for each vehicle type within each traffic composition. This parameter has a significant influence on roadway capacity and achievable travel speeds. What it means is that, if not hindered by other vehicles, a vehicle will travel at its desired speed with a small stochastic variation.

The definition of desired speed for this network began with the review of the posted speeds at the different roadway segments that compose the model, as described in Table 1:

Roadway	Posted Speed (MPH)
SR 84	40,50
University Blvd	45
Nova Dr	35
SW 30th St	30
SW 39th St	30
Davie Rd	40
Griffin Rd	45
SR 7	45
Turnpike Off Ramps	30,45
Riverland Rd	25,35
Davie Blvd	30,35
Broward Blvd	35,40,45
NW/SW 31st Ave	35
NW/SW 27th Ave	45
I-95 Off Ramps	40,45
NW/SW 9th Ave	35
NW/SW 7th Ave	35
NW/SW 3rd Ave	35
US 1	35,40,50
Andrews Ave	35
Los Olas Blvd	30
SW/SE 17th St	30
SW 4th Ave	35
SW 40th Ave	30
Ravenswood Rd/ Anglers Ave	35
Old Griffin Rd	35
Perimeter Rd	35

Table 1: Posted Speed Limits

Based on the previous speed limits, the following Speed Distributions were generated, as shown in Table 2.

SD No.	Min	Max	15%	85%
1	20	35	25	30
2	25	40	30	35
3	30	45	35	40
4	35	50	40	45
5	35	55	40	50
6	40	60	45	55

Table 2: Speed Distributions

VISSIM requires the coding of Desired Speed Decision points, which are placed at locations where permanent speed changes should become effective. When a vehicle crosses over these decision points, it acquires a new speed from the relevant speed distribution. Desired Speed Decision points are usually coded to match the location of speed signs in the field. The location of the Desired Speed Decision points within the model is included in Appendix II.

To model short sections of slow speed characteristics (curves or turns), Reduced Speed Areas are recommended over the use of Desired Speed Decisions. When encountering a Reduced Speed Area, each vehicle is assigned a new desired speed from within the speed distribution assigned. After leaving the reduced speed area, the vehicle returns to its previous desired speed.

The Reduced Speed Areas coded in the model correspond to turns (left and right) and locations that because of their geometry will impose a mandatory reduction on the speed of vehicles, independently of their originally desired speed. Reduced speed areas vary depending on the vehicle type and roadway geometry. In the case of this model, Reduced Speed Areas are also used to simulate vehicle slow down when approaching active school zones. The locations with Reduced Speed Areas are included in Appendix III.

2.2 Controllers

VISSIM models signalized intersections by either a built-in fixed-time control or an optional external Signal State Generator (SSG). Among the external SSG options, VISSIM signals can be controlled through a NEMA Standard Signal Control (SC) Emulator, which emulates common signal controllers used in USA ([1]); or by a Ring Barrier Controller, which is replacing NEMA Standard Signal Control (SC) Emulator as the new standard in North American releases of VISSIM. During a simulation VISSIM passes the status of it detectors and signal heads to the Ring Barrier Controller (RBC) and the controller returns the state of the signal heads for the next time period ([2]). Ring Barrier Controllers were used in this model.

2.2.1 Traffic Signals

In VISSIM, each signal head is associated with a Signal Group (SG). All signal heads in the same group display the same signal status at all times. The model includes a total of 69 signalized intersections.

Traffic signals were modeled using the Ring Barrier Controller Emulator, which allowed the simulation of fully actuated as well as coordinated and semi-actuated coordinated signal controls. The settings on this controller type are saved to an external data file with the extension *.rbc. The intersection’s signal timing plans were acquired from Broward County Traffic Engineering and can be found in Appendix IV.

The simulation of signals also requires the inclusion of detectors, which are associated with a specific phase of the controller. Furthermore, because of the architecture of VISSIM (absence of "nodes" or locations where vehicles on different links or connectors effectively "recognize" each other), Priority Rules and Conflict Areas must be defined at each intersection for it to operate acceptably.

Conflict Areas are a fairly recent feature in VISSIM that was created to alleviate the excessive work involved with the coding of priority rules. A Conflict Area can be defined wherever two links/connectors in the network overlap and allow the specification as to which of the conflicting links has right of way.

2.2.2 STOP Signs

Intersection approaches controlled by STOP signs are modeled in VISSIM as a combination of priority rule and STOP sign. A STOP sign forces vehicles to stop for at least one time step regardless of the presence of conflicting traffic while the priority rules deals with conflicting traffic, looking for minimum gap time and headway. ([1]).

In this model time distributions for length of time step required at STOP signs were established based on vehicle type and location.

2.3 Traffic

For the demand side of the system (traffic) Vehicle Inputs were used in conjunction with Routing Decisions to control both the volume and flow of traffic throughout the network. The traffic volumes used for the Vehicle Inputs throughout the model were determined using the turning movement counts collected in the field.

2.3.1 Traffic Sources

Turning Moving Counts:

Turning movement counts were collected at arterial intersections during AM and PM peak periods. The collected data consists of turning movement counts (TMCs) in 15-minute intervals. Table 3 includes the list of the 74 intersections and Figure 3 shows the location of the collected counts. The turning movement counts were collected on Tuesdays, Wednesdays or Thursdays during the weeks of:

- March 9-11, 2010
- March 16-18, 2010
- March 23-25, 2010
- April 6-8, 2010
- April 13-15, 2010
- April 27-29, 2010
- March 22-24, 2011

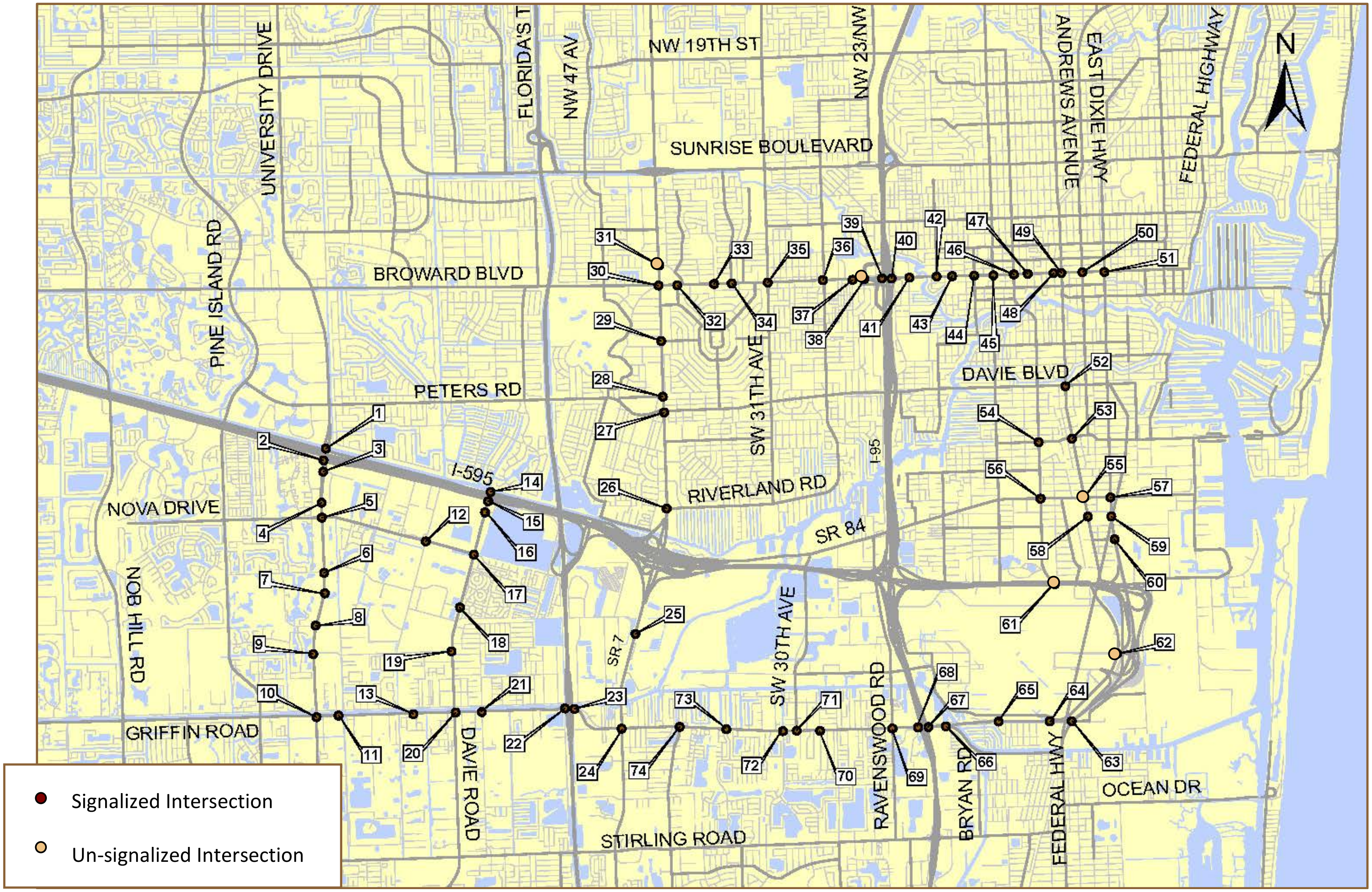


Figure 3: Turning Movement Count Locations

Turning Movement Count Locations		
1)University Drive & SR 84 WB	26) SR 7 & Riverland Road	51) Broward Boulevard & US 1
2) University Drive & SR 84 EB	27) SR 7 & Davie Boulevard	52) Andrews Avenue & Davie Boulevard
3) University Drive & Kolsky Boulevard	28) SR 7 & Peters Road	53) Andrews Avenue & SW 17th Street
4) University Drive & SW 23rd Street	29) SR 7 & SW 6th Street	54) SW 17th Street & SW 4th Avenue
5) University Drive & Nova Drive	30) SR 7 & Broward Boulevard	55) Andrews Avenue & SR 84
6) University Drive & SW 30th Street	31) SR 7 & NW 3rd Street	56) SR 84 & SW 4th Avenue
7) University Drive & Nova University	32) Broward Boulevard & SW 38th Avenue	57) SR 84 & US 1
8) University Drive & SW 36th Street	33) Broward Boulevard & Kentucky Avenue	58) Andrews Avenue & SE 28th Street
9) University Drive & SW 39th Street	34) Broward Boulevard & NW 34th Avenue	59) US 1 & SE 28th Street
10) University Drive & Griffin Road	35) Broward Boulevard & NW 31st Avenue	60) US 1 & SE 30th Street
11) Griffin Road & 8400 Block	36) Broward Boulevard & NW 27th Avenue	61) SW 4th Avenue & SW 34th Street
12) Nova Drive & College Avenue	37) Broward Boulevard & NW 24th Avenue	62) Perimeter Road & Airport Terminal
13) Griffin Road & 6800 Block	38) Broward Boulevard & Tri-Rail Driveways	63) Griffin Road & US 1
14) Davie Road & SR 84 WB	39) Broward Boulevard & I-95 SB	64) Griffin Road & Perimeter Road
15) Davie Road & SR 84 EB	40) Broward Boulevard & I-95 NB	65) Griffin Road & NW 10th Street
16) Davie Road & Reese Road	41) Broward Boulevard & NW 18th Avenue	66) Griffin Road & Design Center
17) Davie Road & Nova Drive	42) Broward Boulevard & NW 15th Avenue	67) Griffin Road & I-95 NB
18) Davie Road & BCC Entrance	43) Broward Boulevard & SW 14th Avenue	68) Griffin Road & I-95 SB
19) Davie Road & SW 39th Street	44) Broward Boulevard & NW 11th Avenue	69) Griffin Road & Ravenswood Road
20) Griffin Road & Davie Road	45) Broward Boulevard & NW 9th Avenue	70) Griffin Road & SW 28th Avenue
21) Griffin Road & 61st Avenue	46) Broward Boulevard & NW 7th Avenue	71) Griffin Road & SW 30th Avenue
22) Griffin Road & Turnpike SB	47) Broward Boulevard & NW 5th Avenue	72) Griffin Road & SW 31st Avenue
23) Griffin Road & Turnpike NB	48) Broward Boulevard & NW 1st Avenue	73) Griffin Road & SW 35th Avenue
24) Griffin Road & SR 7	49) Broward Boulevard & Andrews Avenue	74) Griffin Road & SW 40th Avenue
25) SR 7 & Oakes Road	50) Broward Boulevard & NE 3rd Street	

Table 3: Turning Movement Count Locations

- January 3-5, 2012
- January 10-12, 2012
- January 17-20, 2012
- February 7-9, 2012.

These traffic counts are included in Appendix V.

2.3.2 Traffic Composition

In VISSIM, vehicles are categorized by vehicles types, which share common vehicle performance attributes. These attributes include model, minimum and maximum acceleration, minimum and maximum deceleration, weight, power, and length. With the exception of model and length, all other attributes are defined with user-defined probabilistic distributions.

Two main vehicle types were used for the purpose of this model calibration: cars and trucks. The vehicle specifications for cars are identical to those of the default Car type in VISSIM. Trucks (identified as HGV in VISSIM) account for two percent of the total traffic demand and also have vehicle specifications identical to those of the default HGV type in VISSIM.

2.3.3 Traffic Input

VISSIM supports two different forms of input for the traffic demands: static (in which fixed vehicle inputs are assigned to entry links and routed throughout the network by means of static routing) and dynamic (in which the driver-vehicle unit must choose a route at the start of the trip at the origin parking lot).

This model uses static assignment, which is useful when turning volumes are known and the model seeks to replicate existing conditions. Based on traffic data collected during peak hours, Vehicle Inputs are placed at each of the model's entry links. These Vehicle Inputs locations are used to generate vehicles, which are routed appropriately for the next approaching intersection using Routing Decisions.

The Routing Decisions assign vehicle routes using percentages VISSIM calculates based on the turning movement counts collected. Once they complete one routing and clear the intersection, the vehicles then cross another Routing Decision, which assigns the route for the next approaching intersection. This process is repeated until the vehicle leaves the network.

The morning peak period runs from 7:00 AM to 9:00 AM. To start gathering information, the network should be filled with vehicles to prevent biasing the outcomes; therefore, an additional period was included to account for the initial half hour prior to the actual simulation period (from 6:30 AM to 7:00 AM). In the same way, for the afternoon peak (4:30 PM to 6:30 PM), an additional period was included, for another half hour (from 4:00 PM to 4:30 PM).

3.0 Calibration Process

The calibration of the model was performed in the following steps:

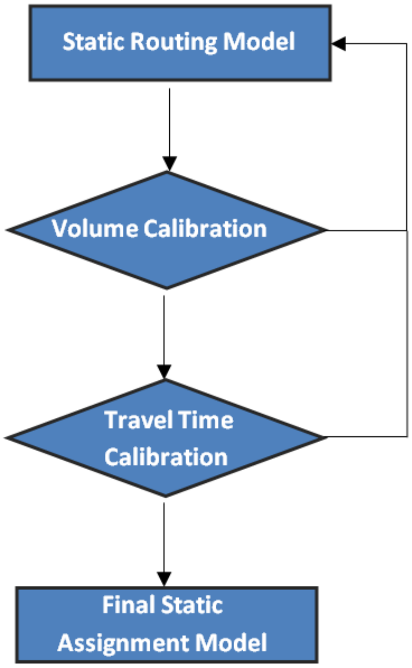


Figure 4: Calibration Process Flowchart

In the calibration process, model parameters affecting driving behavior such as car following, lane changing, headway, and driver distraction are tuned in order to replicate the values of both traffic volumes and travel times measured in the field.

3.1 Capacity Calibration

VISSIM uses two variations of the Weidemann model for car following behavior: Weidemann 99, suitable for freeway traffic and Weidemann 74, used for urban streets. The Weidemann 74 variation was utilized for the majority of the model with the exception of the highway off ramps throughout the model which were coding using the Weidemann 99 variation.

3.1.1 Arterials or Urban Streets

Arterials and surface streets were modeled using the Weidemann 74 model, as prescribed in the VISSIM manual (*[1]*). Within this model, parameters related to car following, lane changing, headway, and driver distraction were calibrated in order to achieve a performance of the arterials as closely as observed to the field as possible. The arterials within the network are coded using urban parameters.

The final selection of the Weidemann 74 model parameters are shown in Table 4a. This set represents, out of all the combinations tried during the process, the one that best met the calibration goals.

	Urban
Average standstill distance (ft)	6.56
Additive part of desired safety distance (ft)	3.00
Multiplicative part of desired safety distance (ft)	4.00

Table 4a: Car Following Parameters

3.1.2 Highway Off Ramps

Highway off-ramps were modeled using the Weidemann 99 model, as prescribed in the VISSIM manual (*[1]*). Within this model, parameters related to headway time, following threshold, and standstill acceleration were calibrated in order to achieve a performance as closely as observed to the field as possible.

The final selection of the Weidemann 99 model and temporary lack of attention parameters are shown in Table 4b. This set represents, out of all the combinations tried during the process, the one that best met the calibration goals.

	Off Ramps
Standstill Distance (ft)	4.92
Headway Time (s)	0.50
‘Following’ Variation (ft)	13.12
Threshold for Entering ‘Following’	-8.00
Negative ‘Following’ Threshold	-0.35
Positive ‘Following’ Threshold	0.20
Speed dependency of Oscillation	11.00
Standstill Acceleration (ft/s2)	13.02

Table 4b: Car Following Parameters

3.2 Driving Performance Calibration

3.2.1 Lane Changing Behavior (Global)

VISSIM, just like most microsimulation software packages, accounts for two types of lane changes: necessary and discretionary. The former relates to the changes a vehicle must perform in order to reach its destination (routing). The latter has to do with the trailing vehicle desiring to move over another lane because of lack of sufficient distance with the leading vehicle and/or the desire to travel at higher speeds. In either case an appropriate gap must exist in the destination lane for a given vehicle to make the move.

Rather than calibrating the aggressiveness of the vehicle-driver units, it is the aggressiveness of the 'lane changing' itself that can be defined in VISSIM, and specifically for necessary lane changes. These parameters correspond to the Free Lane Selection model (or general behavior), as opposed to the Right (or Left) Side Rule model. Table 5 shows the selected parameters for all link types.

		Urban	Off Ramps
Maximum Deceleration	Own	-13.12	-13.12
	Trailing	-9.84	-9.84
-1ft/sec^2 per distance	Own	300.00	300.00
	Trailing	200.00	200.00
Accepted Deceleration	Own	-3.28	-3.28
	Trailing	-3.28	-3.28
Waiting time before diffusion		60.00	60.00
Min. Headway (front/rear)		1.64	1.64
Safety distance reduction factor		1.00	0.90
Maximum deceleration for cooperative braking		-29.49	-29.49

Table 5: Lane Change Parameters

3.2.2 Lane Changing Behavior (Link Level)

In addition to the global parameters described in the previous section, there are two parameters at link (or rather connector) level that also impact lane changing behavior. They are: look back distance and emergency stop distance.

Look back distance governs the distance upstream of a bifurcation at which vehicles begin reacting to it and maneuvering towards their desired lane. The default value (656.2 feet) was unrealistically low for highway ramp approaches and other areas with high volume turn off. The look back distance was therefore increased up to 2,500 feet, depending on the location, for these high volume turns.

The emergency stop distance represents the distance upstream of a bifurcation at which vehicles will stop if they have not been able to perform the necessary lane change. The default value (16.4 feet) was used in this model.

Related to the emergency stop distance is the “Waiting time before diffusion” parameter. When a vehicle comes to a stop at this distance because it could not change lanes to continue on its route, it will wait the inputted amount of time indicated by this parameter for a gap before being removed from the simulation. The default value of 60 seconds was maintained for this model.

4.0 Output

Several outputs were generated to calibrate the model and to produce the volumes and travel times.

VISSIM provides a large number of options for output, all of which can be tailored to the needs of the user (*[1]*). For the purpose of this project, two main output files were used, as follows:

4.1 Node Evaluation

This output provides the collection of data within nodes that when placed surrounding an intersection can be used to gather information on vehicles entering and leaving the intersection. These files have a *.kna extension.

In the model, nodes were coded at the 74 intersections being analyzed. These served the purpose of collecting information on the volume of vehicles entering at each approach as well as the turning movement volumes at those intersections. Information was also collected on the delay vehicles experienced at those intersections.

As stated before, VISSIM output files need to be configured by the user (the configuration file has the extension *.knk). In this case, the output file reported the following compiled data:

- Node
- From Link
- To Link
- Movement
- Number of Vehicles (all vehicle types)
- Average Queue Length
- Maximum Queue Length
- Delay Time (all vehicle types)

Additionally, the user must specify the start and end time of the data collection as well as the interval at which this data is collected. Data was collected every hour (3,600 seconds). In order to avoid biasing the results due to an initially empty network, in both periods (AM and PM), data collection started at 30 minutes (1,800 seconds) after the initiation of the simulation (seeding period).

The results were then compared in the successive runs with the respective field data in order to develop link-flow calibration spreadsheets.

4.2 Travel Time

During a given run, VISSIM can evaluate average travel times if Travel Time sections have been defined in the network and the option “Travel Times” is selected as part of the evaluation files.

Travel Time sections (start and destination) were also coded in the model, consistently with the beginning and end of the field travel time runs performed as part of the data collection effort (see section 5.2.1). VISSIM determines the average travel time (including waiting or dwell times) as the time a vehicle crosses the first cross-section (start) to crossing the second cross-section (destination). The generated output files have *.rsz extension.

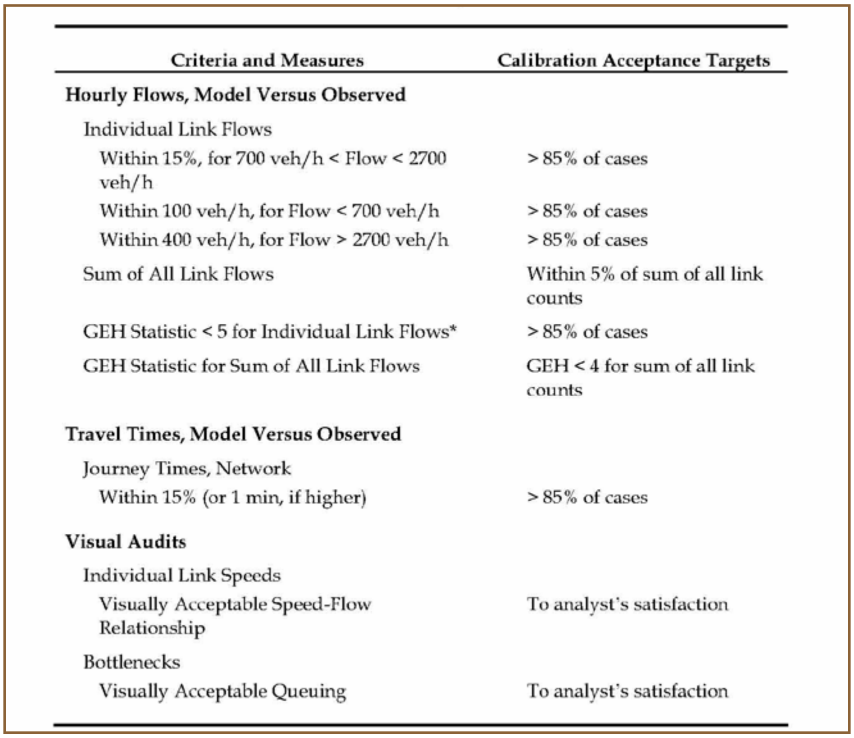
Travel times were also collected every hour (3,600 seconds) from 30 minutes (1,800 seconds within the simulation as seeding time) until the end of the run (after a two-hour peak period). As with the other performance measures, the results yielded by VISSIM were successively compared with field collected data during the calibration process.

5.0 Calibration Results

To ensure satisfactory calibration of the model is achieved, standards were used to establish targets regarding traffic flows and travel times.

5.1 Calibration Thresholds

The calibration effort used as targets those included in the literature of reference (*[3]*). Namely:



Criteria and Measures	Calibration Acceptance Targets
Hourly Flows, Model Versus Observed	
Individual Link Flows	
Within 15%, for 700 veh/h < Flow < 2700 veh/h	> 85% of cases
Within 100 veh/h, for Flow < 700 veh/h	> 85% of cases
Within 400 veh/h, for Flow > 2700 veh/h	> 85% of cases
Sum of All Link Flows	Within 5% of sum of all link counts
GEH Statistic < 5 for Individual Link Flows*	> 85% of cases
GEH Statistic for Sum of All Link Flows	GEH < 4 for sum of all link counts
Travel Times, Model Versus Observed	
Journey Times, Network	
Within 15% (or 1 min, if higher)	> 85% of cases
Visual Audits	
Individual Link Speeds	
Visually Acceptable Speed-Flow Relationship	To analyst's satisfaction
Bottlenecks	
Visually Acceptable Queuing	To analyst's satisfaction

Figure 5: Calibration Targets

Most of the criteria included in Figure 5 are self explanatory, with the possible exception of GEH Statistic. This measure is a formula used in traffic modeling to compare two sets of traffic volumes (Observed and Modeled). Its mathematical formulation is similar to the Chi-Squared test, but it is not a true statistical test but rather an empirical formula. The formulation for the GEH Statistic is as follows:

$$GEH = \sqrt{\frac{(M - O)^2}{0.5 \times (M + O)}}$$

Where M represents the modeled flows and O the observed ones.

his statistic is typically used to offset the discrepancies that occur when using only simple percentages, as traffic volumes vary over a wide range. In other words, if using only percentages, small absolute discrepancies have no impact on large volumes but a large percent impact in smaller numbers, and vice versa. It has been shown that for traffic volumes smaller than 10,000 a five percent variation yields smaller numbers than a GEH of five. Beyond 10,000, five percent differences keep growing linearly whereas GEH=5 follows a decaying curve.

5.2 Calibration Results

In addition to the flow control of the calibration, travel times were used as the performance measure of choice, in accordance with the criteria set in Figure 5.

5.2.1 Travel Time Performance Measure

The average travel times calculated from field data were utilized in the calibration process to compare actual travel times experienced to travel times observed in the model.

Actual travel times for the study corridor were compiled from a series of travel time runs driven along eastbound and westbound Broward Boulevard, as well as the northbound and southbound directions of University Drive, SR 7, and Andrews Avenue during both peak periods on January 19, 2010 and January 20, 2010. Each run was conducted repeatedly throughout each of the two two-hour peak periods; resulting in four runs during the AM and PM peak periods along SR 7, Broward Boulevard, and Andrews Avenue, and six runs during the AM and PM peak periods along University Drive.

The network was subdivided into eight (8) travel time segments defined by the major roadways within the model (Figures 6a and 6b). The time (in seconds) taken to travel each segment was recorded for each travel run.

The data collected over this two-day period was used to develop average travel times, which were referenced during the calibration process of the model. The travel time field data along with the average travel times have been included in Appendix VI.

It should be noted that at the time of the travel time data collection, there was construction along Andrews Avenue which closed a lane in each direction; therefore, travel times for this segment were excluded from the travel time calibration.

The average field collected travel times for each peak period were compared to the respective travel times obtained from the VISSIM travel time output files. According to the thresholds included in previous Figure 5, the model travel times must be within 15% (or one minute, if higher) of the observed (field collected) travel time for more than 85% of the cases.

For each peak period, a “case” represents the average travel time for the AM or PM peak period along one segment.

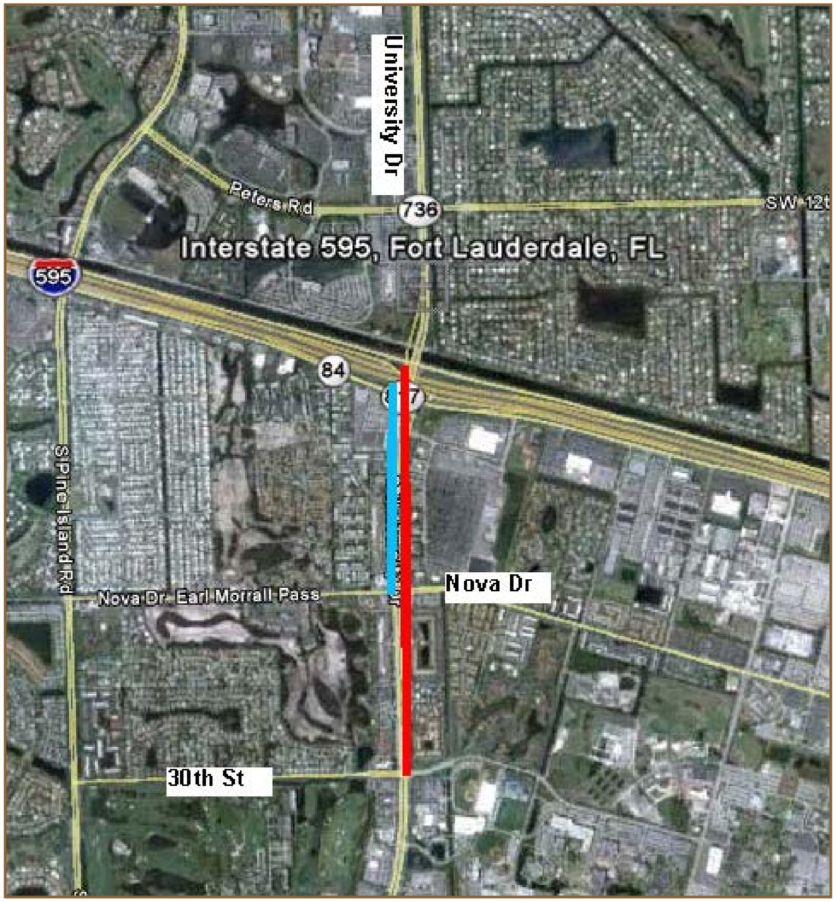


Figure 6a: Travel Time Segments - West

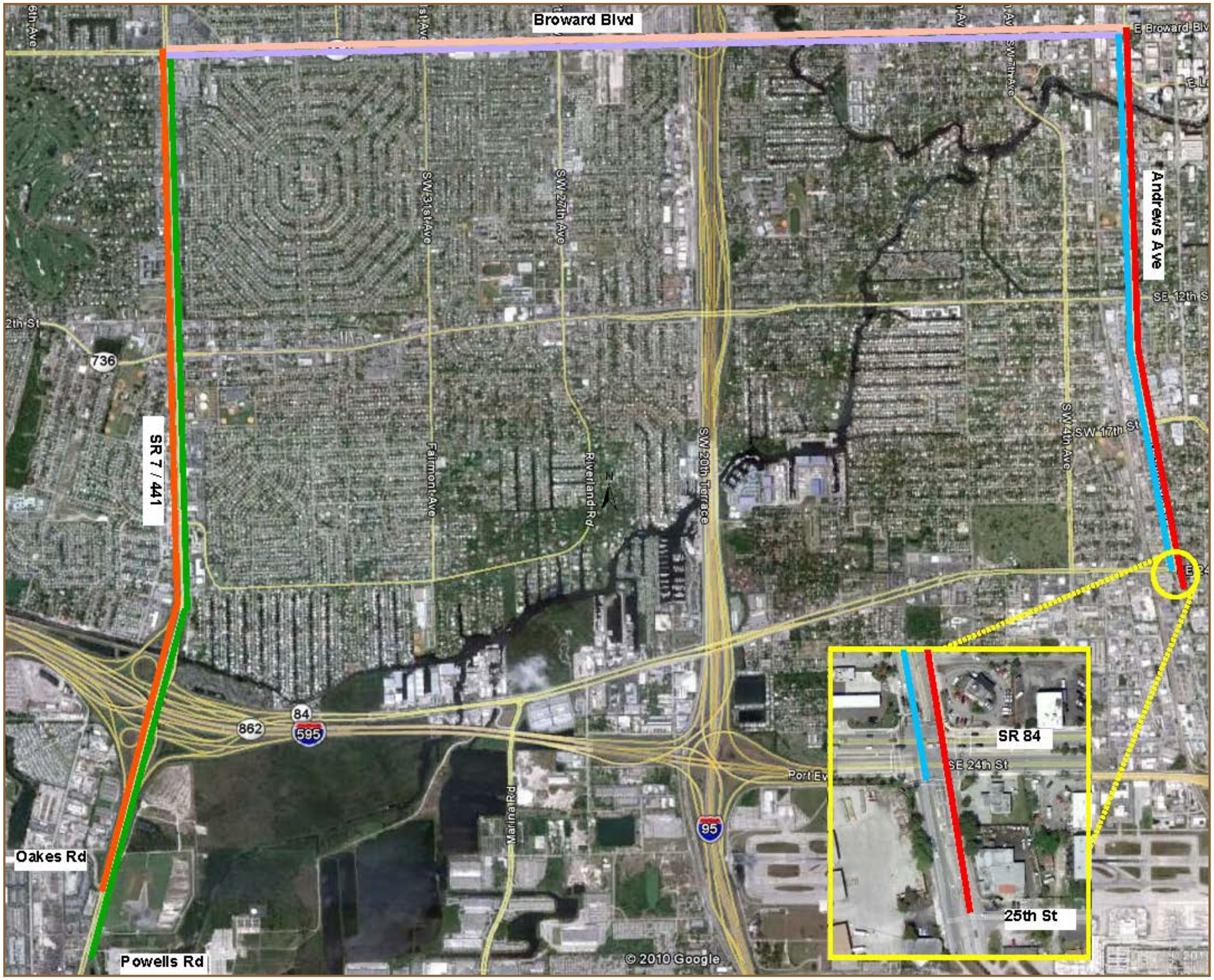


Figure 6b: Travel Time Segments - East

5.2.2 AM and PM Peak Calibration Results

The peak periods presented different characteristics in directionality. Therefore, they were calibrated separately. The results included herein correspond to ten (10) runs with different random seeds, which have been averaged.

Link Flows Calibration

The following tables show the summary of the calibration results in terms of global GEH values and link flows for both the AM and PM peak period models. The complete GEH and link flow tables by link for the AM and PM models are included in Appendices VII and VIII, respectively.

As shown in Figure 5, a network is assumed to be reasonably calibrated if:

- 85% of the network links flows have a GEH less than or equal to 5
- Sum of all link flows is within 5% of sum of all link counts.
- Link flows must satisfy modeled versus observed flow thresholds for 85% of the individual links.

AM Peak Period

Percentage of Links by GEH (Criteria GEH ≤ 5):

GEH	≤5
7:00-8:00	100%
8:00-9:00	100%

Sum Link Flows ±5%:

Sum Link Flows ±5%	
7:00-8:00	-1%
8:00-9:00	0%

Percentage of Links Meeting Flow Thresholds:

Individual Link Flows			
Time	Flow<700 vph (± 100)	700<Flow<2700 vph (± 15%)	Flow<2700 vph (±400)
7:00-8:00	100%	100%	100%
8:00-9:00	100%	100%	100%

PM Peak Period

Percentage of Links by GEH (Criteria GEH ≤ 5):

GEH	≤5
4:30-5:30	100%
5:30-6:30	100%

Sum Link Flows ±5%:

Sum Link Flows ±5%	
4:30-5:30	1%
5:30-6:30	1%

Percentage of Links Meeting Flow Thresholds:

Individual Link Flows			
Time	Flow<700 vph (± 100)	700<Flow<2700 vph (± 15%)	Flow<2700 vph (±400)
4:30-5:30	100%	100%	100%
5:30-6:30	100%	100%	100%

Travel Time Calibration

According to Figure 5, a model is reasonably calibrated when the modeled travel times are within 15% (or one minute if higher) of the average field collected travel time for 85% of the cases. The travel time results indicate that the Existing AM model generated travel times meet the calibration criteria for 100% of the cases. Likewise, 100% of the travel time cases for the Existing PM model also satisfy the travel time calibration criteria. Hence, the model is considered reasonably calibrated from a travel time standpoint. The travel time calibration tables for the AM and PM peak periods have been included in Appendices VII and VIII, respectively.

Percentage of Travel Times within 15% (or one minute):

Travel Times	
7:00-9:00 AM	100%
4:30-6:30 PM	100%

6.0 Conclusions

As previously mentioned, the Central Broward East-West corridor presents several challenges to microscopic simulation. Among others, it is heavily used for commute traffic, involves alternative transit options, and the immense scale of the network created unique difficulties. During the development of the Existing (Base) Model, the following challenges were encountered:

- The extent of the model itself (in size of the network and length of the simulation) required extensive running time, which slowed progress.
- I-595 was under construction at the time of model development; therefore reliable data could not be collected for use in the model calibration. Moreover, the changes being implemented on the I-595 mainline as part of the I-595 Express Design, Build, Finance, Operate and Maintain (D/B/F/O/M) project are expected to improve traffic conditions along I-595 with the implementation of reversible express toll lanes and other ramp, mainline and frontage road improvements. Consequently, it was decided not to model I-595. Moreover, since there are no transit stops along I-595; the impact to traffic operations on I-595 as a result of the proposed transit service will be negligible.
- Turning moving counts were not collected for the intersections of 2nd Street, Las Olas Boulevard, 6th Street, and 7th Street along Andrews Avenue. Therefore assumptions were made in order to balance volumes in this area.
- The short distance between several intersections within the model did not allow adequate time for drivers to follow routing decisions, causing unrealistic congestion as they attempted to change lanes. For these situations, routings had to be placed further downstream than the adjacent intersection.
- Turning movement counts at the I-95 ramps on Broward Boulevard were taken on the same day as the 2011 Mercedes-Benz Corporate Run. This created PM traffic volumes for the eastbound direction that were unusually high. To prevent excessive congestion the volumes were scaled down to match those taken previously at the intersection of Broward Boulevard and 24th Avenue.
- After the model had been created and calibrated using NEMA Standard Signal Control (SC) Emulator, it was requested to convert to all signal controllers to RBC standards. The conversion and recalibration of the model required an extensive amount of time.
- A FEC rail line crosses Broward Boulevard between NW 1st Avenue and NW 5th Avenue and Griffin Road west of US 1. Delay for the train crossing had to be simulated using a fixed time signal controller on a 20 minute (1,200 second) cycle length as this was the maximum allowed in VISSIM. To simulate the train crossing according to the FEC train schedule there should be approximately a 25 minute gap between trains in the AM and a 40 minute gap in the PM. These were reproduced accordingly in the simulation.
- A CSX/Tri-Rail line crosses Griffin Road just west of I-95. According to the CSX train schedule, there are no CSX trains traversing the study area during the AM and PM peak periods. However, Tri-Rail commuter train does provide service to the Fort Lauderdale Airport station located in the southwest quadrant of the Griffin Road/I-95 interchange during the peak periods. The northbound and southbound Tri-Rail train headways and departure times were coded in the model according to the South Florida Regional Transportation Authority (SFRTA) Tri-Rail schedule.

- While conducting travel time runs in the field, sections of Andrews Avenue were under heavy construction causing the observed travel times collected to be higher than those experienced within the model. Therefore, these travel time segments could not be used in the model calibration.

Nevertheless, the previously listed challenges were overcome to produce a soundly calibrated model. The calibrated AM and PM peak period models satisfy the volume and travel time calibration thresholds and appear to reasonably reproduce real-world traffic conditions.