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VISSIM EXISTING CONDITIONS MODEL DEVELOPMENT AND CALIBRATION REPORT

I-16 at I-95 Interchange Reconstruction and I-16 Widening

Savannah, Georgia

PI Nos. 0012757 and 0012758

October 2016

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ACRONYMS AND ABBREVIATIONS

ADT	Average Daily Traffic
FHWA	Federal Highway Administration
ft/s^2	feet per second squared
GDOT	Georgia Department of Transportation
GPS	Global Positioning System
I-16	Interstate 16
I-95	Interstate 95
I-516	Interstate 516
IMR	Interchange Modification Report
kg	kilogram
KW	kilowatt
min/veh	minutes per vehicle
MOE	Measure of Effectiveness
mph	miles per hour
ODOT	Oregon Department of Transportation
PI	Project ID
RBC	Ring Barrier Controller
VMT	Vehicle Miles Traveled
vph	vehicle per hour

FREQUENTLY ASKED QUESTIONS

Question 1	What is the purpose of this report?
Answer	*The purpose of this report is to document the VISSIM existing conditions model development and calibration process for the I-16 and I-95 interchange Reconstruction and I-16 widening project PI numbers 0012757 and 0012758.*
Question 2	What guideline was used for calibration?
Answer	*This Calibration report closely follows the guidelines recommended in the "Traffic Analysis Toolbox Vol. III: Guidelines for Applying Traffic Microsimulation Modeling Software" published by FHWA in July 2004 and the "Interstate System Access Informational Guide" published by FHWA in August 2010.*
Question 3	What are the a.m. and p.m. peak periods for the study area?
Answer	*The a.m. peak period for the study area is 7:15 a.m. to 8:15 a.m., and the p.m. peak period is 4:45 p.m. to 5:45 p.m.*
Question 4	What modeling software packages and versions were used for calibration purposes?
Answer	*VISSIM Version 8.00-Service Pack 8 and SYNCHRO Version 8.0-Build 805.*
Question 5	What manuals or references were used for model calibration?
Answer	*The References section of this report lists the manuals, guides, and studies used for this project.*
Question 6	What types of field data were collected and when?
Answer	*Volumes, travel times, level of congestion, and other field data have been collected for this project. Sections 3 and 4 of this report describe the types of data collected for this project and the dates of collection.*
Question 7	How many runs were conducted for each peak period?
Answer	*Ten runs were conducted with varying random numbers for the a.m. and p.m. peak periods. Similar random numbers were used for both the a.m. and p.m. peak periods.*
Question 8	What changes were made to the global and local calibration parameters?
Answer	*Some of the car following and lane changing behaviors have been changed during the calibration. Section 7 details the global and local parameters that were changed.*
Question 9	What Measures of Effectiveness (MOEs) and targets were used for calibration purposes?

Answer	*Volumes, travel times, and other MOEs have been used for calibration. Section 8 lists the MOEs used for calibration and the calibration criteria for each MOE.*
Question 10	Was the calibration target for traffic volumes met?
Answer	*Yes, the target for traffic volumes was met for individual link flows and the sum of all link flows for the a.m. and p.m. peak period models. Additional information is provided in Section 8.*
Question 11	Was the calibration target for travel times met?
Answer	*Yes, the calibration target for travel times was met for the a.m. and p.m. peak period models. Additional information is provided in Section 8.*

1 INTRODUCTION

This document presents the existing conditions a.m. and p.m. peak period simulation model development and calibration results for the Interstate 16 (I-16) and Interstate 95 (I-95) interchange in Savannah, Georgia. Calibration is defined as the adjustment of computer-simulated model parameters to accurately reflect local driving behavior and traffic performance characteristics. This calibration report will be complemented later with an Interchange Modification Report based on Federal Highway Administration's (FHWA's) guidelines set in the Interstate System Access Informational Guide (FHWA 2010).

A calibrated model can analyze future alternatives to address operational and capacity needs for a project. The micro-simulation analysis for the I-16 and I-95 interchange project was conducted using VISSIM 8.00-Service Pack 8 simulation software (PTV Group). The study methodology used in the VISSIM simulation follows the FHWA's Traffic Analysis Toolbox Volume III (FHWA 2004) and is illustrated on Figure 1.

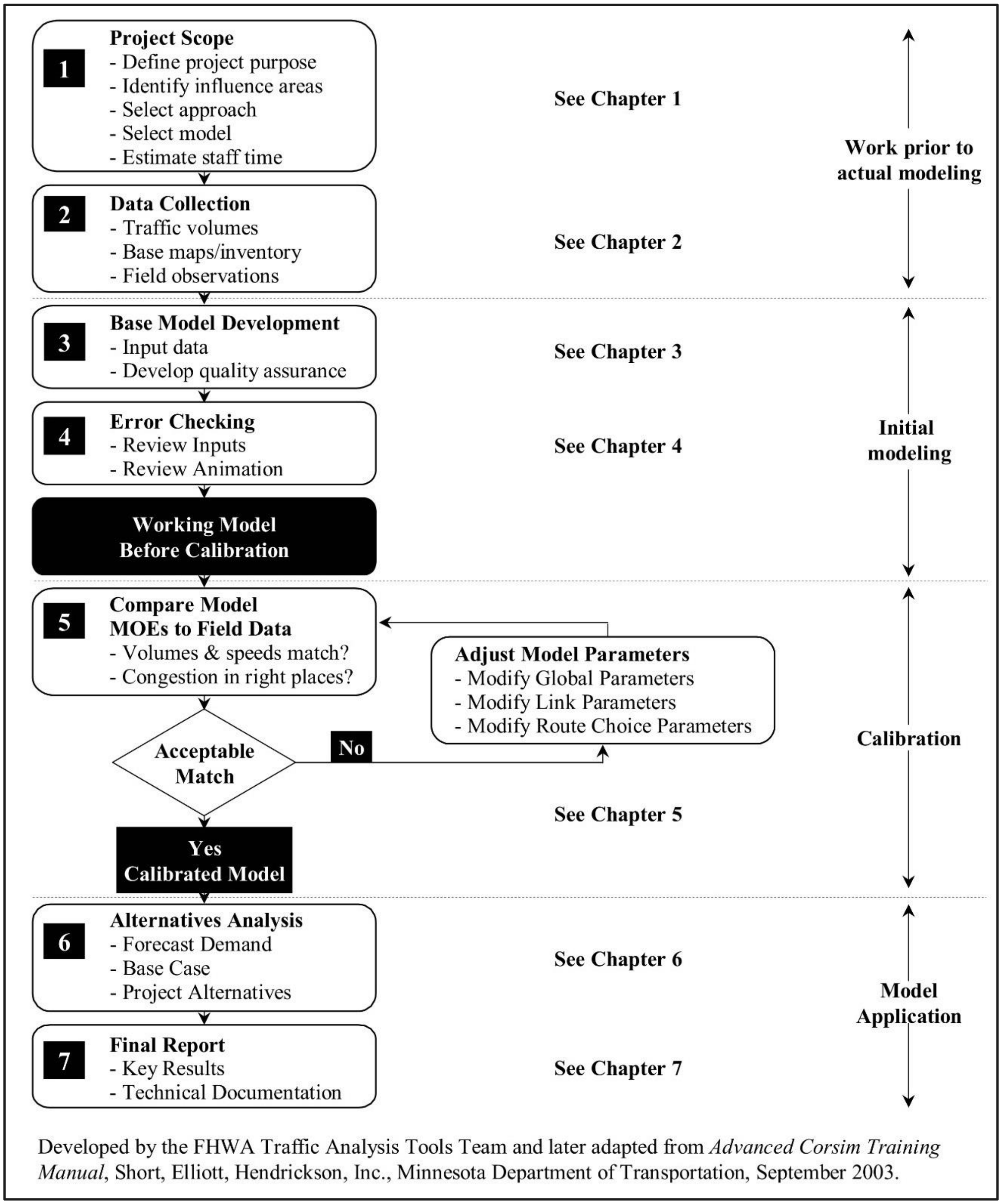


Figure 1: FHWA Simulation Studies Methodology

2 PROJECT PURPOSE

The purpose of the project is to determine the best way to improve travel time reliability, provide long-term mobility options, and improve operations around the I-16 and I-95 interchange and along I-16 corridor.

2.1 Project Location and Area of Influence

2.1.1 Project Location

The project is located in the City of Savannah, in Chatham County, Georgia. The project begins west of the I-95 interchange and ends at the I-516 interchange. The traffic analysis will aid in development of the Interchange Modification Report (IMR) and therefore must meet both federal and state guidelines. According to FHWA's Interstate System Access Informational Guide published in August 2010 (Page 15, Section 3.3.3), the network should include an area of influence (study area) around the proposed interchange (project location). At least the first adjacent interchange on either side of the project limits must be included in the volume projections.

Georgia Department of Transportation (GDOT) also suggests that the study area network cover the vicinity of the project limits (GDOT Design Policy Manual, June 2016, Page 13-17, Section 13.3.1). Therefore, the extended simulation network includes the intersections adjacent to interchanges to provide a better representation of traffic entering and exiting the project study area.

2.1.2 Area of Influence

The area of influence has been determined in conformance to the FHWA guideline in the Interstate System Access Informational Guide published in August 2010 (Page 15, Section 3.3.3). The simulation network included six interchanges along I-16 (four service interchanges and two system-to-system interchanges). The simulation network also included four interchanges along I-95 (two service interchanges and one system-to-system interchange) and I-516 (two service interchanges and one system-to-system interchange). The following interchanges were included in the study:

<u>I-16 Interchanges:</u>

- Pooler Parkway – Service Interchange
- I-95 – System-to-System Interchange
- SR 307 (Dean Forest Road) – Service Interchange
- Chatham Parkway – Service Interchange
- I-516 – System-to-System Interchange
- SR 204 (37th Street) – Service Interchange

<u>I-95 Interchanges:</u>

- US 80 (Louisville Road) – Service Interchange
- I-16 – System-to-System Interchange

- SR 204 (Abercorn Street) – Service Interchange

<u>I-516 Interchanges:</u>

- West Gwinnett Street – Service Interchange
- I-16 – System-to-System Interchange
- Tremont Road – Service Interchange

For the arterials, the simulation network included the ramp terminal intersections and one intersection adjacent to the ramp terminal intersections. Figure 2 shows the area of influence for this project.

LEGEND

Intersections

Area of Influence

Figure 2
Area of Influence

VISSIM Existing Conditions Model Development and Calibration Report

3 DATA COLLECTION

This task involved the collection and preparation of all data necessary for the micro-simulation analysis. Micro-simulation models require extensive input data, including but not limited to:

- Roadway Geometry Data
- Existing Demand Data (e.g., tube counts, turning movement counts)
- Control Data (e.g., signal timings, stop/yield signs, regulatory/advisory speed limits)
- Calibration Data (e.g., capacities, travel times, queues).

3.1 Roadway Geometry Data

Aerial imagery was used to visually construct the network. The necessary roadway geometry information, including number of lanes; length of acceleration/deceleration lanes; extent and amount of curvature along mainline I-16, I-95, and I-516; and similar elements, was recorded from the aerial imagery and field-verified for use in the VISSIM model. The roadway geometry data were modified based on the field verifications.

3.2 Existing Demand Data

A significant amount of traffic data has been collected for the I-16, I-95, and I-516 corridors. Traffic counts were collected from December 2015 to January 2016. These counts were used to develop the year 2015 volumes. Traffic count data were also requested from the GDOT Office of Planning and the GDOT Office of Transportation Data.

Tube counts were collected for 24 hours at all entrance and exit ramps within the study area. Additionally, 24-hour vehicle classification counts were collected along critical sections on I-16, I-95, and I-516. Four-hour (7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.) turning movement counts were collected at the intersections in the study area.

Further details on volume diagram development, such as the locations of the data collection points and the type of data collected for the study area, are included in the “Volume Projection Approach and Existing Year Volumes for I-16 at I-95 Interchange Reconstruction and I-16 Widening Project PI Nos. 0012757 and 0012758, Chatham County, Georgia” memorandum included in Appendix A of this report. This memorandum was approved by GDOT on March 5, 2016.

3.3 Control Data

Traffic signal timing data for the a.m. and p.m. peak hours were obtained from GDOT and Chatham County, Georgia. Field visits were conducted for selected intersections during the a.m. and p.m. peak hours to verify the signal timing and phasing information provided.

3.4 Calibration Data

Data necessary for calibration of the micro-simulation analysis were collected and prepared, including:

- Traffic volumes
- Travel times
- Bottlenecks and queue locations.

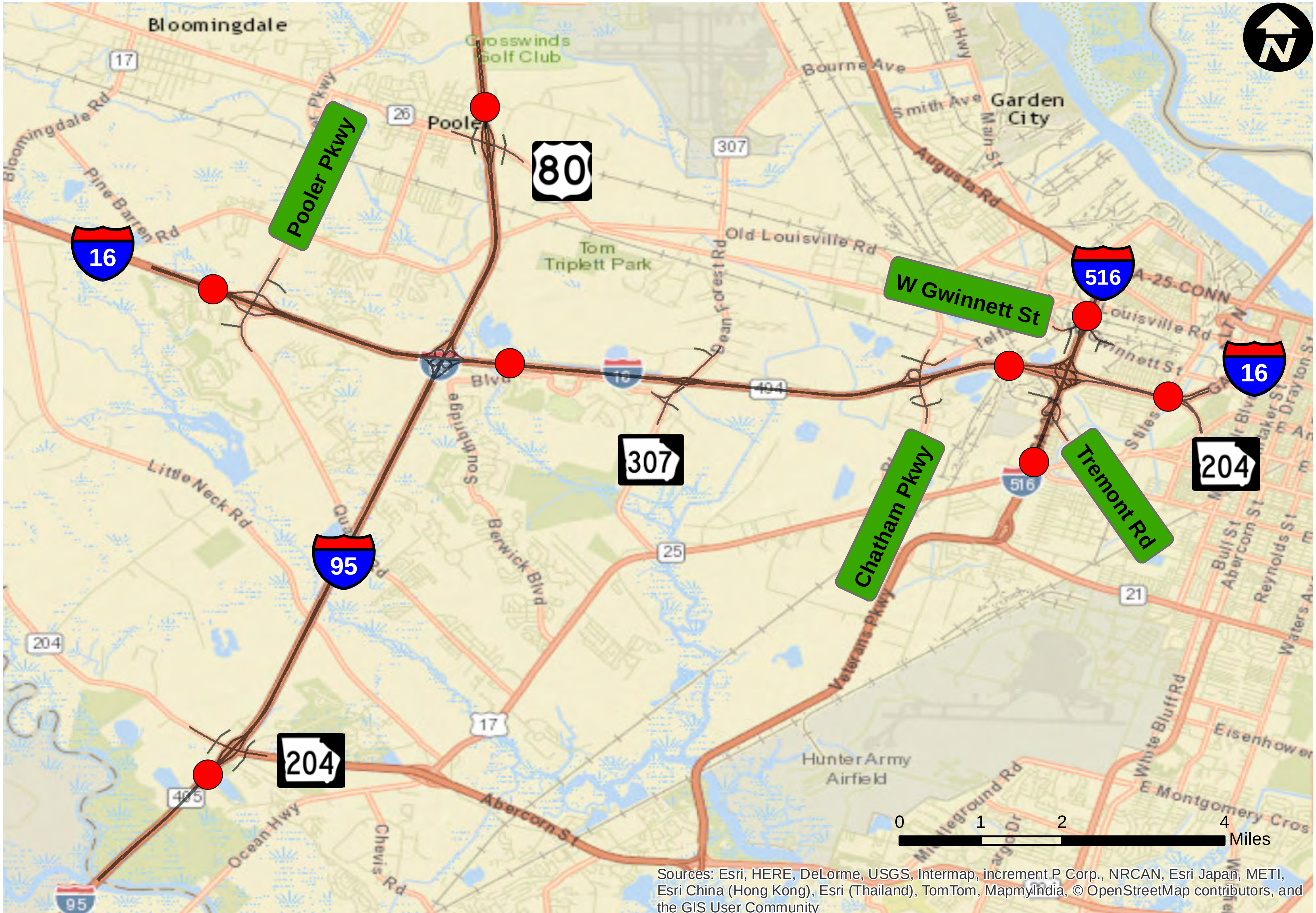
3.4.1 Traffic Volumes

A set of base year (Year 2015) traffic volume diagrams for the project was prepared and submitted to GDOT. The volume diagrams were approved by GDOT on March 5, 2016. These existing year traffic volumes were used in the VISSIM modeling, and 5-hour simulations were performed using 15-minute volume intervals. The 15-minute distribution percentages were calculated from 48-hour counts at selected mainline locations.

3.4.2 Travel Times

To identify and quantify congestion along the I-16 corridor, travel time data were collected for normal weekdays. The travel times between multiple ends of the project were purchased from StreetLight Data, Inc (StreetLight). This data set was used to calibrate travel times in the VISSIM models. In addition, February 2016 a.m. and p.m. peak hour travel time runs were performed using probe vehicles. Multiple runs in each direction were conducted to capture the large variation in travel time in the study area.

The majority of the travel time data was collected using INRIX® based data purchased from StreetLight. Additionally, StreetLight supplements INRIX data with anonymized global positioning system (GPS) data to calculate travel time with high accuracy. Useful statistics, such as overall frequency of trips and average travel time during the a.m. and p.m. peak hours, were calculated. Figure 3 presents the points used to calculate the travel times.



LEGEND

Travel Time Data Collection Point

Study Area

Figure 3
Travel Time Data Collection Points

VISSIM Existing Conditions Model Development and Calibration Report

To better evaluate the typical locations of bottlenecks and queues in the study area, additional travel time data was collected using video recordings. To do this, a camera was mounted on the windshield, similar to a GPS, and included the date and time stamp (actual time in hours, minutes, and seconds) of the recording. The start and end time stamps were summarized to determine the travel time between locations traveled, which is the difference between the end time and the start time. A screenshot of a video recording is shown on Figure 4, with the date and time stamp visible on the lower left corner of the image.

Figure 4: Travel Time Calculation Using Camera

The average values of travel times recorded using the GPS and video camera were used for the VISSIM model travel time calibration. A summary of field travel times is provided in Table 1.

Table 1. Travel Time Summary

Direction	Approximate Locations		Distance (mi)	Average Observed Travel Time (MM:SS)	
	From	To		AM	PM
I-16 EB	Pooler	SR204 Split	10.3	13:13	10:59
	Pooler	W Gwinnett	10.6	17:55	14:01
	Pooler	Ogeechee	11.4	14:06	13:39
I-16 WB	SR204 Split	Pooler	10.3	9:51	11:34
	SR204 Split	Abercorn	13.1	15:58	17:11
	SR204 Split	Louisville	11.2	11:19	14:24
I-95 NB	Abercorn	Louisville	9.5	8:16	8:02
	Abercorn	SR204 Split	13.1	14:55	12:25
	Abercorn	W Gwinnett	13.5	16:31	15:00
I-95 SB	Louisville	Abercorn	9.5	8:02	8:16
	Louisville	SR204 Split	11.2	14:26	12:00
	Louisville	Ogeechee	12.0	16:07	12:39
I-516 NB	Ogeechee	Pooler	11.4	12:49	15:41
	Ogeechee	Louisville	12.0	14:11	18:13
	Ogeechee	W Gwinnett	2.5	2:41	2:47
I-516 SB	W Gwinnett	Pooler	10.6	11:49	12:25
	W Gwinnett	Abercorn	13.5	20:06	18:47
	W Gwinnett	Ogeechee	2.5	2:47	2:41

3.4.3 Visual Bottleneck and Queue Locations

During travel time data collection activities, visual bottlenecks and speed drop zones were identified, and the backs of queues along mainlines and ramps within the study area were documented. Bottleneck locations and the extents of queues were used in the VISSIM model calibration.

4 EXISTING CONDITIONS

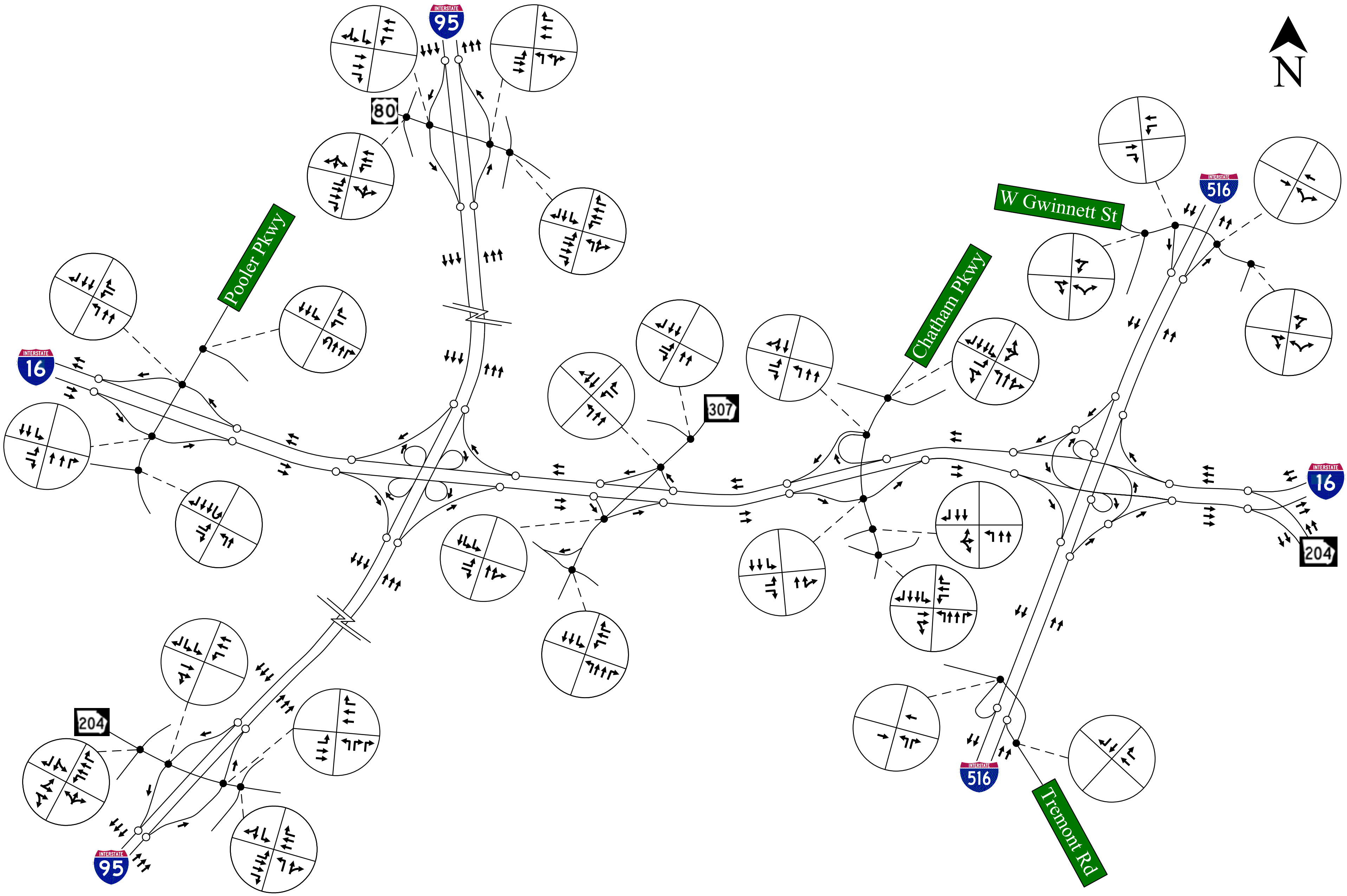
I-16 is a heavily congested two-lane (in each direction) corridor between the Pooler Parkway and SR 204 37th Street interchanges. I-95 is a three-lane (in each direction) corridor between US 80 Louisville Road and SR 204 Abercorn Street. Finally, I-516 is a two-lane (in each direction) corridor between US 80 Louisville Road and SR 204 Abercorn Street. Lane configuration for the interstate mainlines and intersections are illustrated on Figure 5.

4.1 A.M. and P.M. Peak Hours

To determine the volume-based peak hour in the study area, daily volumes at 20 locations along the mainline segments were analyzed. Table 2 illustrates the volume-based peak hours for each location based on the collected average daily traffic (ADT) counts within the project area. The data presented in Table 2 show that, in the morning, the peak volume occurs generally between 7:15 a.m. and 8:15, and in the evening, the peak volume occurs generally between 4:45 p.m. to 5:45 p.m.

Table 2: Peak Hours along Mainline Sections

Corridor	Location	Direction	AM Peak	PM Peak
I-16	West of Pooler Pkwy	EB	6:30AM-7:30AM	4:00PM-5:00PM
		WB	7:45AM-8:45AM	4:30PM-5:30PM
	I-95 to Dean Forest Rd	EB	7:00AM-8:00AM	5:00PM-6:00PM
		WB	7:45AM-8:45AM	4:30PM-5:30PM
	Dean Forest Rd to Chatham Pkwy	EB	7:00AM-8:00AM	4:45PM-5:45PM
		WB	7:30AM-8:30AM	4:30PM-5:30PM
	Chatham Pkwy to I-516	EB	7:00AM-8:00AM	4:45PM-5:45PM
		WB	7:30AM-8:30AM	3:15PM-4:15PM
	W 37th St to W Gwinnett St	EB	7:30AM-8:30AM	4:45PM-5:45PM
		WB	7:15AM-8:15AM	4:45PM-5:45PM
SR 204 37th St	I-16 to Ogeechee Rd	NB	7:30AM-8:30AM	4:45PM-5:45PM
		SB	7:15AM-8:15AM	4:45PM-5:45PM
I-516	Ogeechee Rd to Tremont Rd	NB	7:15AM-8:15AM	3:45PM-4:45PM
		SB	7:00AM-8:00AM	4:45PM-5:45PM
	W Gwinnett St to Augusta Ave	NB	7:00AM-8:00AM	4:45PM-5:45PM
		SB	7:00AM-8:00AM	4:30PM-5:30PM
I-95	I-16 to Louisville Rd	NB	7:15AM-8:15AM	3:15PM-4:15PM
		SB	7:15AM-8:15AM	4:45PM-5:45PM
	I-16 to Abercorn St	NB	7:15AM-8:15AM	3:00PM-4:00PM
		SB	7:30AM-8:30AM	4:45PM-5:45PM



LEGEND

→ = Lane

Figure 5
Existing Lane Geometry

VISSIM Existing Conditions
Model Development and
Calibration Report

4.2 A.M. Peak Conditions

The a.m. peak period for the study area is from 7:15 a.m. to 8:15 a.m. with heavy eastbound I-16 traffic starting at Pooler Parkway interchange to the Dean Forest Road interchange. There are two major bottlenecks along this section of I-16. The first is around the I-95 northbound ramp and I-95 southbound loop merge with I-16 eastbound, where the three through lanes under the bridge merge to two lanes. This congestion also results in queues along I-95 southbound trying to exit towards I-16 eastbound.

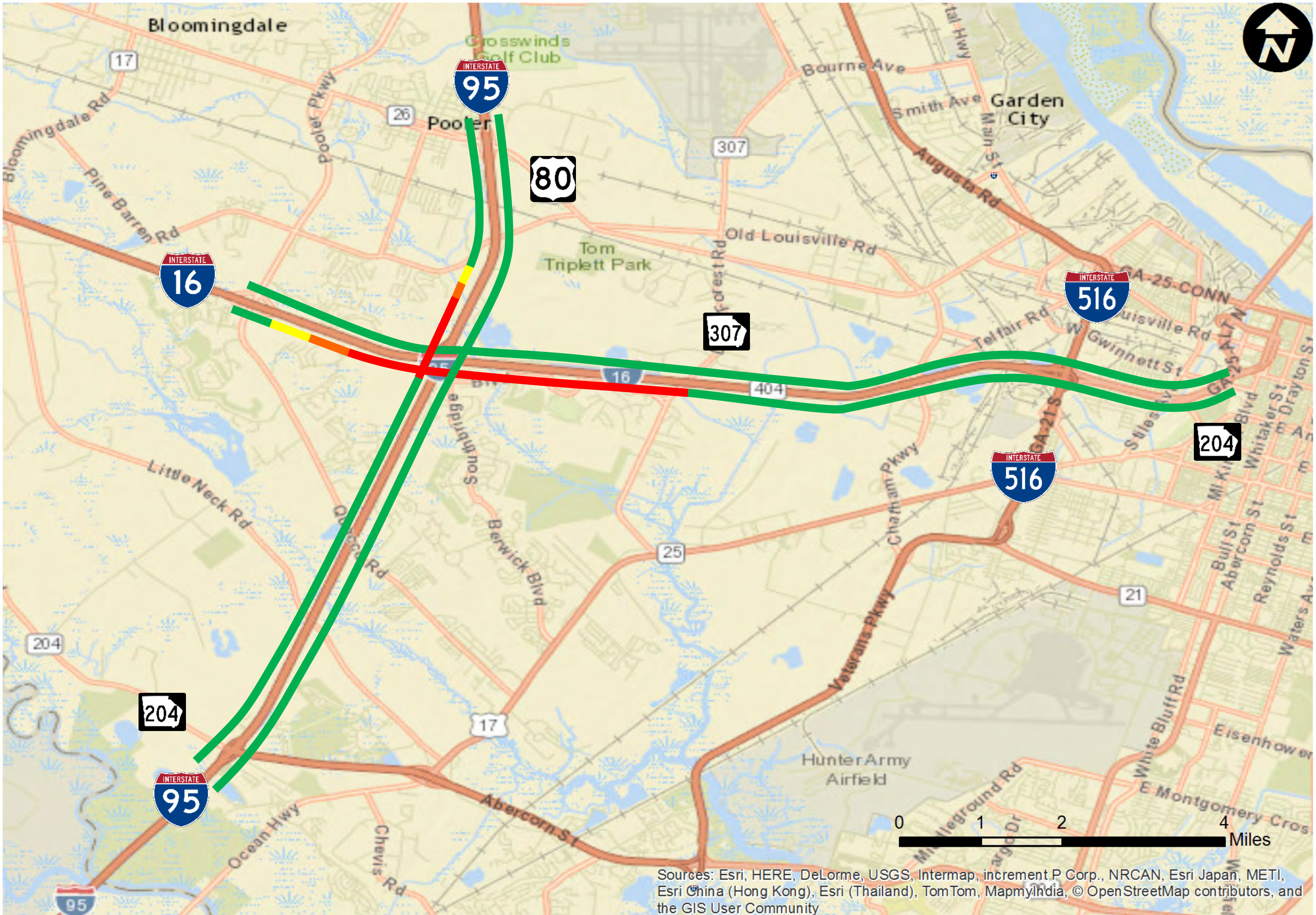
The second bottleneck is the weaving section between the I-95 and Dean Forest Road interchanges. It was observed that the Dean Forest Road eastbound off ramp frequently spills back to I-16 eastbound mainline, increasing the already congested section. Figure 6 is an existing conditions map that highlights the bottleneck locations during the a.m. peak hour.

4.3 P.M. Peak Conditions

The p.m. peak period for the study area is from 4:45 p.m. to 5:45 p.m. with heavy traffic along I-16 westbound.

During the p.m. peak conditions, two bottlenecks occur on I-16 westbound. The first bottleneck in the I-16 westbound direction occurs between I-516 southbound on ramp to I-16 westbound and Chatham Parkway westbound off ramp interchanges due to merging, weaving, and lack of capacity issues along I-16 westbound. The resulting congestion spills back to I-16 westbound before the I-516 interchange.

The second bottleneck is on I-16 westbound between Chatham Parkway on ramp and Dean Forest Road off ramp. This bottleneck is also results of merging, weaving, and lack of capacity on I-16 between Chatham Parkway and Dean Forest Road interchanges. Figure 7 is an existing conditions map highlighting the bottleneck locations in the study area during the p.m. peak hour.



Legend

Normal Condition	Moderate Congestion
Low Congestion	High Congestion

Figure 6
Existing Condition
Bottlenecks – A.M.

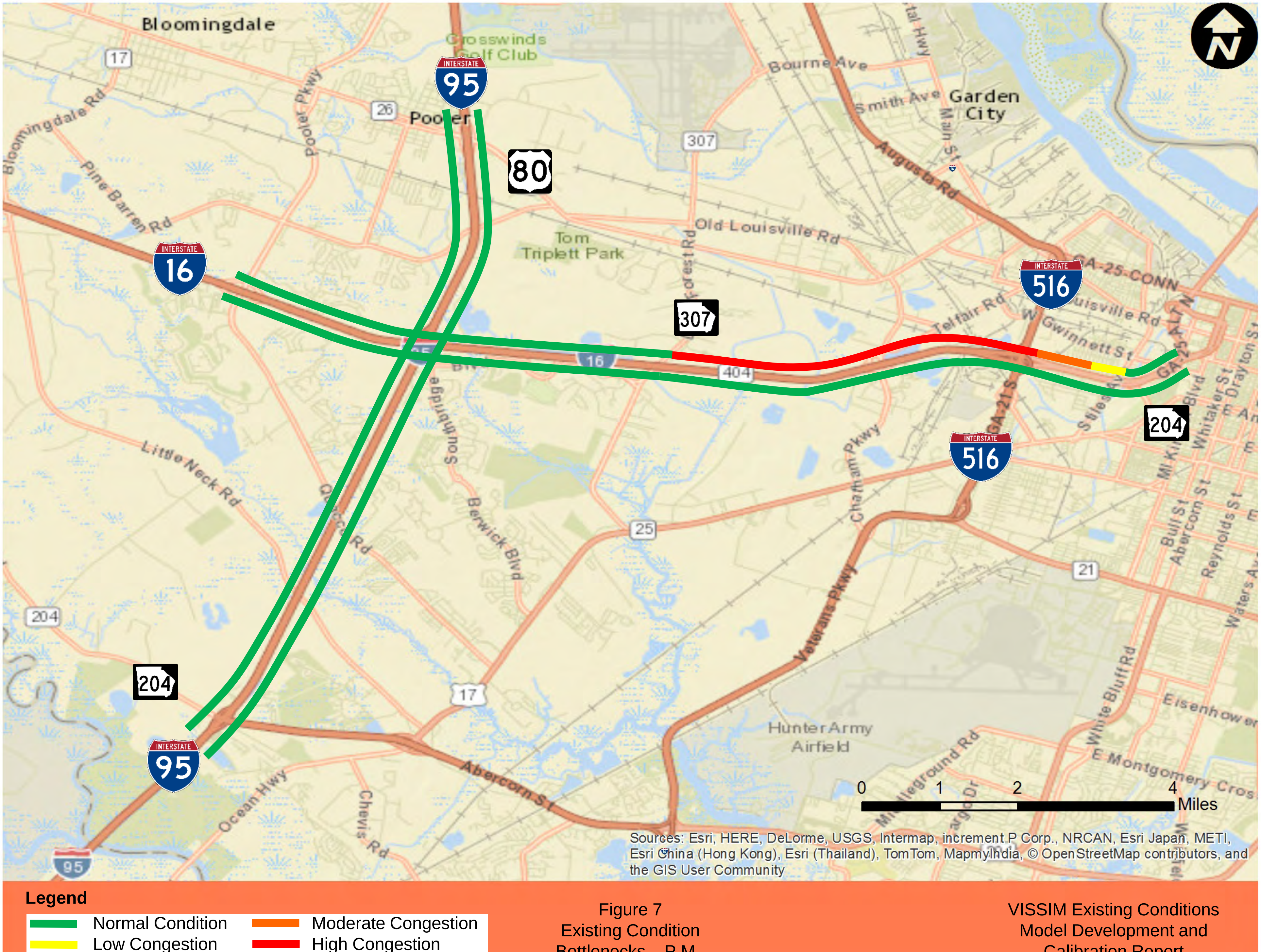


Figure 7
Existing Condition
Bottlenecks – P.M.

VISSIM Existing Conditions Model Development and Calibration Report

5 BASE MODEL DEVELOPMENT

The VISSIM simulation model for this study included the I-16, I-95, and I-516 mainline travel lanes; ramp merge/diverge areas; ramp terminal intersections; and adjacent signalized intersections. The interchanges/intersections included in the analysis are listed in Table 3.

Table 3: Simulation Study Area Interchanges/Intersections

Freeway/ Limited-Access Facility	Interchange	Intersections/Ramps
I-16	Pooler Parkway	Memorial Boulevard
		I-16 Westbound Ramp
		I-16 Eastbound Ramp
		Blue Moon Crossing
	SR 307 Dean Forest Road	Pine Meadow Drive
		I-16 Westbound Ramp
		I-16 Eastbound Ramp
		Southbridge Boulevard
	Chatham Parkway	Telfair Road
		I-16 Westbound Ramp
		I-16 Eastbound Ramp
		Park of Commerce Way
		Park of Commerce Boulevard
	SR 204 W 37th Street	-
I-95	US 80 Louisville Road	Parsons Avenue/Governor Treutlen Drive
		I-95 Southbound Ramp
		I-95 Northbound Ramp
		Bourne Avenue/Continental Boulevard
	SR 204 Abercorn Street	Gateway Boulevard West
		I-95 Southbound Ramp
		I-95 Northbound Ramp
		Al Henderson Boulevard/Gateway Boulevard South
I-516	W Gwinnett Street	Lynes Avenue
		I-516 Southbound Ramp
		I-516 Northbound Ramp

Freeway/ Limited-Access Facility	Interchange	Intersections/Ramps
		Interchange Drive
	Tremont Road	I-516 Southbound Ramp
		I-516 Northbound Ramp

5.1 Roadway Geometry

The VISSIM network for the existing conditions analysis was developed using Year 2015 aerial imagery from Google Maps. Google Street View was used along with field visits to verify the roadway geometric information from the aerial imagery. A preliminary roadway network composed of links, connectors, and storage bays for turn movements was created. Links are one-directional segments of freeways or surface streets. Links represent the length of the segment and usually contain data on the geometric characteristics of the road or highway between connectors. Ideally, a link represents a roadway segment with uniform geometry and traffic operation conditions. Connectors are usually placed to connect two links.

Field visits were conducted when necessary to validate the roadway geometry coding and record the operational aspects, such as right-turn-on-red, signal phasing (protected/permitted operations), and other features, that are essential for network calibration. The VISSIM network was updated with the information collected from field visits to reflect existing traffic operations. Figure 8 shows the extent of the VISSIM network for the project study area. To facilitate network coding and to assist in the calibration process, several link types and driving behavior sets were used, which include freeway basic segments, freeway merge/diverge segments, major merge/diverge segments, freeway weaving segments, ramps, and arterial segments. Each link type was coded with a different color to assist reviewers in error checking as shown on Figure 9.

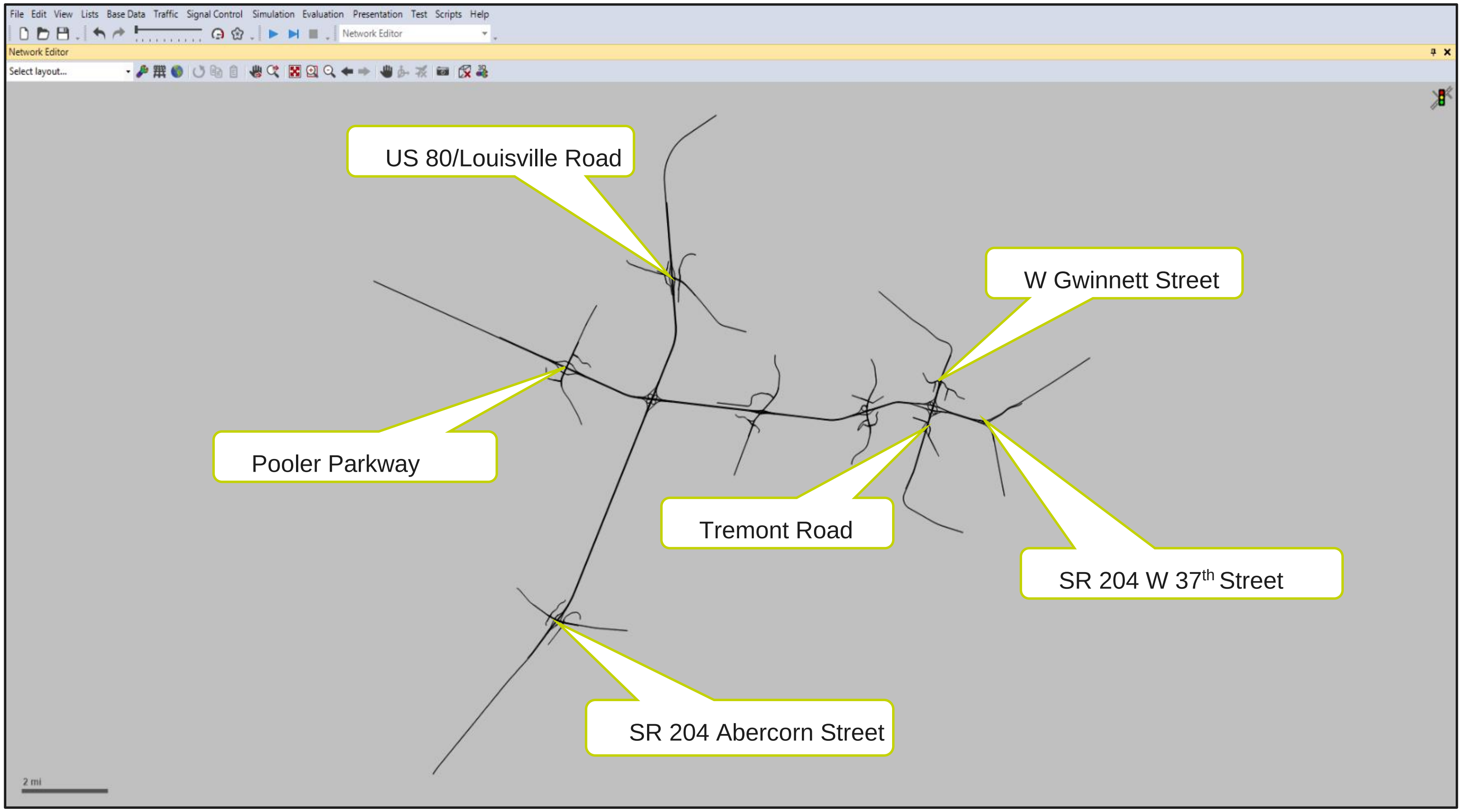


Figure 8: VISSIM Network Extent

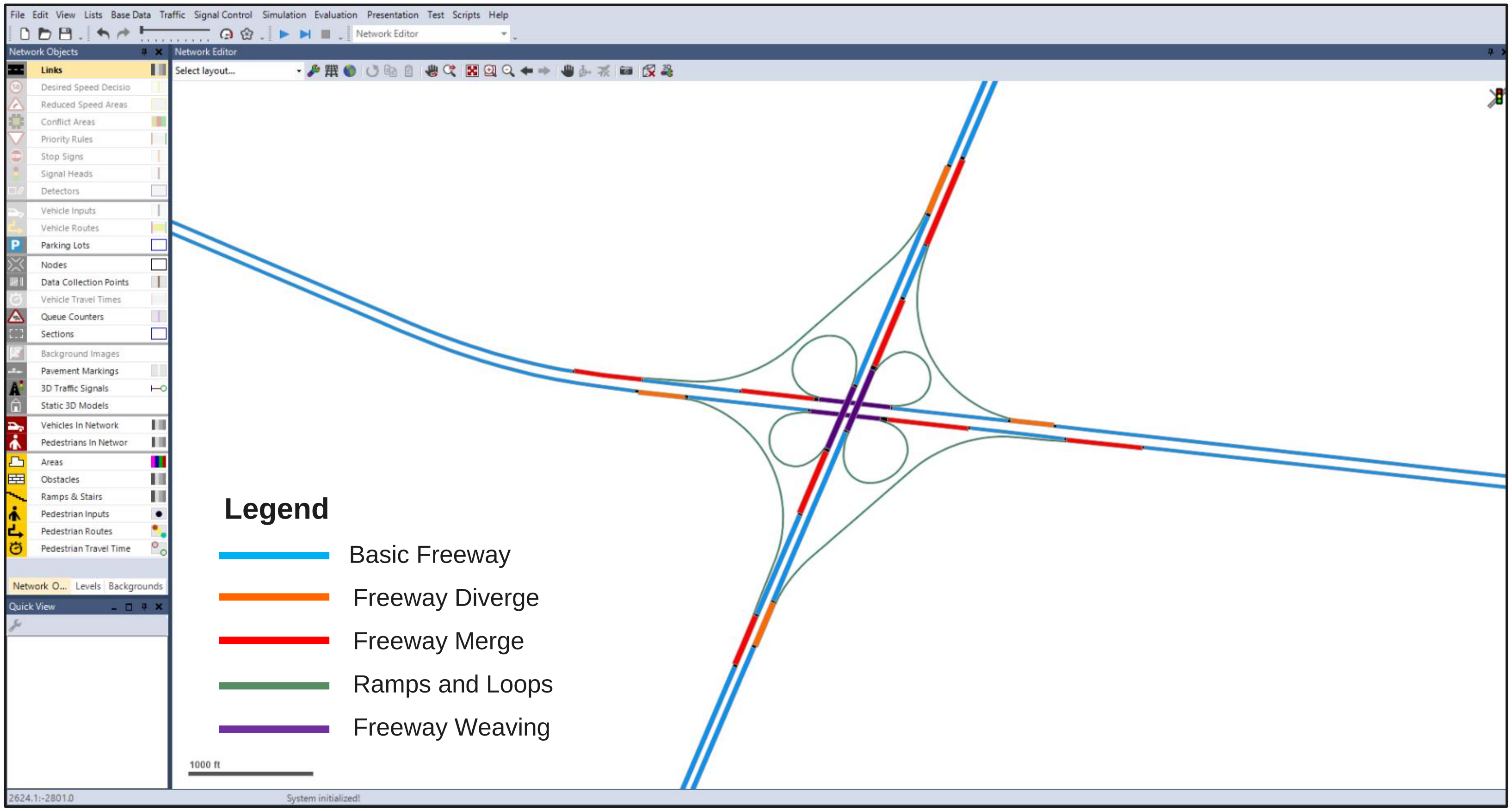


Figure 9: Link Types in VISSIM

5.2 Speed Distributions

To control the speeds of vehicles in VISSIM, the modeler can apply Desired Speed Decisions or Reduced Speed Areas on a network link. Desired speed decision points in VISSIM change the speed of vehicles that cross it, and should be used when the free-flow speeds of an area change significantly due to the posted speed limit, geometric change, topography, or other factors. Reduced speed areas are temporary zones with a reduced speed limit and should be used to code small sections where vehicles have a significant change in speed (e.g., ramps, turning movements).

The Desired Speed Decisions and Reduced Speed Areas were coded in VISSIM based on the type of roadway segment/facility. Regulatory and advisory speed limit data were collected from field observations. The desired speed decisions for the study area were based on the posted speed limits and field observations using GPS. During field data collection activities, a wide range of speeds were observed from 50 miles per hour (mph) to 75 mph on the I-16 mainlines in the study area. For arterials, the upper and lower limits for the speed distribution were selected as a linear distribution, with 85 percent of vehicles driving at or below the posted speed limit.

Table 4 provides the free-flow desired speed distributions used for the VISSIM models, and Figure 10 shows the speed profile for I-16 as an example.

Table 4: Free Flow Desired Speed Decisions

Road Name	Vehicle Types	Posted Speed Limit (mph)	Minimum (mph)	Maximum (mph)
I-16	Cars/Trucks	55	50	70
I-16	Cars/Trucks	65	55	75
I-95	Cars/Trucks	70	60	80
I-516	Cars/Trucks	55	50	70

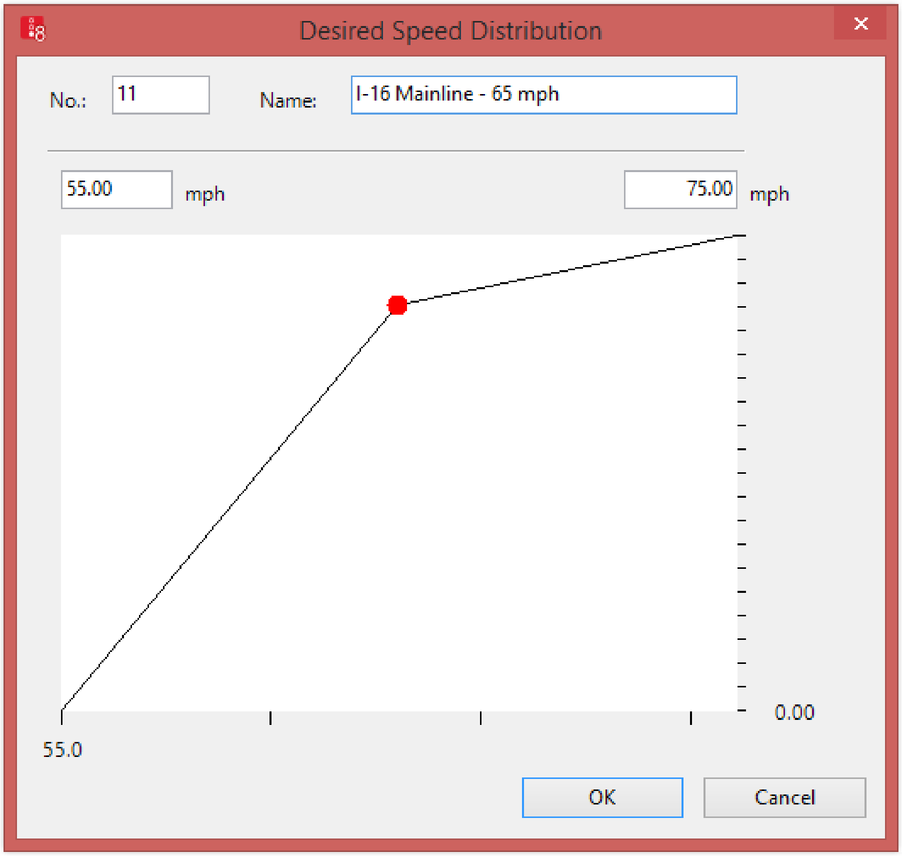


Figure 10: I-16 Speed Profile (65 mph Speed Limit)

Table 5 shows the parameters for right-turn and left-turn reduced speeds used in the VISSIM models.

Table 5: Reduced Speeds for Left and Right Turns

Location	Vehicle Types	Minimum (mph)	Maximum (mph)
Right Turns	Cars/Trucks	9	13
Left Turns	Cars/Trucks	13	17

5.3 Vehicular Composition

Vehicular traffic in VISSIM is composed of different vehicle types, including Cars (Vehicle Type Car - 100) and Single-Unit and Combination-Unit Trucks (Vehicle Type – HGV - Type 200).

Truck percentages for the peak-period analyses were determined from the approved volume diagrams. The peak hour truck percentages from the approved volume diagrams for I-16, I-95, and I-516 are summarized in Table 6.

Table 6: VISSIM Vehicle Composition

Roadway	Percentage of Cars	Percentage of Single-Unit Trucks	Percentage of Combination Unit Trucks	Percentage of HGV
I-16 EB	87.7	2.4	9.9	12.3
I-16 WB	95.5	2.2	2.3	5.5
I-95 NB	84.0	2.1	13.9	16.0
I-95 SB	86.3	2.5	11.2	13.7
I-516 NB	96.9	2.4	0.7	3.1
I-516 SB	93.8	1.9	4.3	6.2

The default vehicle models in VISSIM are European vehicles and do not represent the vehicle type composition that is typical for North America. PTV, the software developer for VISSIM, has developed a "NorthAmericaDefault.inp" file with vehicle models that provide an accurate representation of vehicles types found in North America. The default VISSIM software values for the maximum and desired acceleration range (in feet per second squared [ft/sec^2]), maximum and desired deceleration range (in ft/sec^2), weight (in kilograms [kg]) and power (in kilowatts [KW]) were used for the three vehicles types (Cars and HGV).

5.4 Control Devices

Traffic near signalized intersections within the VISSIM network is controlled through the use of signal heads and detectors. Signal timing and phasing data for the signal heads coded in VISSIM for all signalized intersections were collected. Field visits were conducted to validate selected signal timing and phasing information. During these field visits, other signal operation features, such as protected/permitted left-turn movements, right-turn-on-red locations, right-turn overlap phasing, and exclusive pedestrian phasing, were identified. A total of 14 signalized intersections and 12 unsignalized intersections were included in the existing conditions a.m. and p.m. peak hour VISSIM models. The intersection of Chatham Parkway and Telfair Road is unsignalized. However, it is manually controlled by police during school arrival/departure hours. These intersections and ramps are listed in Table 7.

Table 7: Intersection Traffic Control Information

Arterial Roadway	Intersection	Control Type
Pooler Parkway	Memorial Boulevard	Unsignalized
	I-16 Westbound Ramp	Traffic Signal
	I-16 Eastbound Ramp	Traffic Signal
	Blue Moon Crossing	Unsignalized
SR 307 Dean Forest Road	Pine Meadow Drive	Unsignalized
	I-16 Westbound Ramp	Traffic Signal
SR 307 Dean Forest Road	I-16 Eastbound Ramp	Traffic Signal

Arterial Roadway	Intersection	Control Type
	Southbridge Boulevard	Traffic Signal
Chatham Parkway	Telfair Road	Unsignalized but manually controlled by police during school hours
	I-16 Westbound Ramp	Traffic Signal
	I-16 Eastbound Ramp	Traffic Signal
	Park of Commerce Way	Unsignalized
	Park of Commerce Boulevard	Traffic Signal
US 80 Louisville Road	Parsons Ave./Governor Treutlen Drive	Traffic Signal
	I-95 Southbound Ramp	Traffic Signal
	I-95 Northbound Ramp	Traffic Signal
	Bourne Ave./Continental Boulevard	Traffic Signal
SR 204 Abercorn Street	Gateway Boulevard West	Unsignalized
	I-95 Southbound Ramp	Traffic Signal
	I-95 Northbound Ramp	Traffic Signal
	Al Henderson Blvd/Gateway Blvd S	Traffic Signal
W Gwinnett Street	Lynes Avenue	Unsignalized
	I-516 Southbound Ramp	Unsignalized
	I-516 Northbound Ramp	Unsignalized
	Interchange Drive	Unsignalized
Tremont Road	I-516 Southbound Ramp	Unsignalized
	I-516 Northbound Ramp	Unsignalized

Ring Barrier Controller (RBC) files were developed using SYNCHRO 8 software for the a.m. and p.m. peak periods. Right-turn-on-red and conflict areas were also coded for signalized intersections. Conflict areas and/or priority rules were also coded to model yielding conditions within the VISSIM network where traffic on a minor street has to yield the right-of-way for major street traffic (e.g., channelized right turns and permissive left turns).

5.5 Traffic Volume Input

A 5.5-hour peak period VISSIM model, which depicts buildup and dissipation of congestion within the study area, was created for the a.m. and p.m. peak hours. The 5.5 hours of simulation consist of 30 minutes of seeding time to load the network with traffic to reach equilibrium between the number of vehicles entering and exiting the network, an hour prior to the peak hour, the peak hour, and 3 hours after the peak hour to recover from congestion. The peak hour in terms of volume was the second hour of the simulation. The simulation durations developed in VISSIM are as follows:

- Seeding Time: 0 to 1,800 simulation seconds
- Pre-Peak Hour: 1,800 to 5,400 simulation seconds
- Peak Hour: 5,400 to 9,000 simulation seconds
- Post-Peak Hour 1: 9,000 to 12,600 simulation seconds
- Post-Peak Hour 2: 12,600 to 16,200 simulation seconds
- Post-Peak Hour 3: 16,200 to 19,800 simulation seconds.

The input volumes in VISSIM models were developed using the peak hour volumes and off-peak volume distribution percentages from the approved volume development memorandum included in the Appendix A of this report and are presented in Tables 8 and 9. Volumes were entered into VISSIM as 15-minute flow rates for all the entry links. Flow rates replicating peak hour volumes were entered during the seeding time intervals to load the network with vehicular traffic. The main purpose of seeding time was to fill the network with enough volume to reach equilibrium. The 1,800 seconds of seeding time were not included in the evaluations conducted, nor was any congestion identified that was spilling into the first hour of simulation.

Table 8: A.M. Peak Hour 15-Minute Distribution Percentages

From	To	15-minute Distribution	Hourly Distribution
5:45 AM	6:00 AM	10.33%	-
6:00 AM	6:15 AM	11.30%	
6:15 AM	6:30 AM	14.65%	76%
6:30 AM	6:45 AM	18.85%	
6:45 AM	7:00 AM	20.30%	
7:00 AM	7:15 AM	22.31%	
7:15 AM	7:30 AM	25.06%	100%
7:30 AM	7:45 AM	25.38%	
7:45 AM	8:00 AM	25.67%	
8:00 AM	8:15 AM	23.89%	
8:15 AM	8:30 AM	22.54%	79%
8:30 AM	8:45 AM	20.66%	
8:45 AM	9:00 AM	19.45%	
9:00 AM	9:15 AM	16.81%	
9:15 AM	9:30 AM	16.98%	65%
9:30 AM	9:45 AM	17.26%	
9:45 AM	10:00 AM	16.05%	
10:00 AM	10:15 AM	15.21%	

From	To	15-minute Distribution	Hourly Distribution
10:15 AM	10:30 AM	15.99%	65%
10:30 AM	10:45 AM	16.61%	
10:45 AM	11:00 AM	16.14%	
11:00 AM	11:15 AM	15.99%	

Table 9: P.M. Peak Hour 15-Minute Distribution Percentage

From	To	15-minute Distribution	Hourly Distribution
3:15 PM	3:30 PM	21.31%	-
3:30 PM	3:45 PM	21.58%	
3:45 PM	4:00 PM	22.26%	91%
4:00 PM	4:15 PM	22.31%	
4:15 PM	4:30 PM	22.33%	
4:30 PM	4:45 PM	23.60%	
4:45 PM	5:00 PM	24.62%	100%
5:00 PM	5:15 PM	25.00%	
5:15 PM	5:30 PM	25.77%	
5:30 PM	5:45 PM	24.62%	
5:45 PM	6:00 PM	22.59%	80%
6:00 PM	6:15 PM	21.49%	
6:15 PM	6:30 PM	19.48%	
6:30 PM	6:45 PM	16.26%	
6:45 PM	7:00 PM	13.68%	50%
7:00 PM	7:15 PM	12.83%	
7:15 PM	7:30 PM	12.23%	
7:30 PM	7:45 PM	10.78%	
7:45 PM	8:00 PM	10.27%	37%
8:00 PM	8:15 PM	9.40%	
8:15 PM	8:30 PM	9.18%	
8:30 PM	8:45 PM	8.63%	

5.6 Traffic Routing

The routing of traffic in VISSIM from the entry links can be assigned in two ways: Static Routing (pre-determined paths for traffic to a destination) and Dynamic Routing (pre-defined conditions for traffic to decide the route for a destination)

Dynamic routing of traffic is useful when multiple routes are available for vehicular traffic from one origin to a desired destination within the study area. However, for this study, there is only one route in the VISSIM network for vehicular traffic to use to reach a desired destination. Therefore, static routing was used for directing traffic from one entry link to a desired destination exit link for the a.m. and p.m. peak period VISSIM models.

Routing decisions were coded in VISSIM using the static routing feature for the a.m. and p.m. peak period models. The routing decision feature uses the entry link traffic volumes and estimates relative percentage splits based on off-ramp and intersection turning movement volumes and provides longer paths and respective volumes from each entry link to different exit points within the network.

6 ERROR CHECKING

The VISSIM model input parameters were reviewed after the initial coding of the a.m. and p.m. peak period models. The error checking process was performed by the model developers as well as an independent reviewer who was not associated with the model development.

6.1 Review Inputs

All network input values were checked by both the model development team and the independent reviewer. The comments received from the independent review, and any errors observed in coding by the model development team were fixed and/or addressed. The quality control sheets are included in Appendix B for reference.

6.2 Review Animation

After reviewing the model and addressing coding or input errors, the a.m. and p.m. peak period VISSIM models were run to observe the simulation. The models were initially run for the entire peak period duration of 5 hours to identify any errors that would hinder the progress of the simulation.

The models were then rerun, and the animation of the simulations were reviewed closely to observe vehicular routes. Any errors observed in the vehicular routes were corrected. The animation was watched to observe traffic signal operations near signalized intersections, conflict areas near stop signs, and priority rules for yielding right-of-way. The models were corrected if any of the observed features were not working properly. Corrections were applied to both the a.m. and p.m. peak hour models for consistency. After the input parameters and the VISSIM animation were reviewed thoroughly, the a.m. and p.m. peak period models were considered to be ready for calibration.

7 NETWORK CALIBRATION

VISSIM model simulation calibration is the process used to achieve adequate validity of the model by establishing suitable parameter values so that the model replicates local traffic conditions as closely as possible. Calibration is achieved by iteratively changing model parameters to replicate the traffic patterns, congestion, bottlenecks, and driver behavior observed within the study area. The existing conditions calibrated model parameters are then used for comparisons of alternatives for future traffic conditions.

This study used the calibration criteria from FHWA's Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software report (Page 64, Section 5.6) as a guide. Table 10 provides the established VISSIM model calibration criteria used for this project. All reasonable efforts were made to calibrate the a.m. and p.m. peak period VISSIM models to the proposed calibration criteria and targets. Additionally, individual link flows were checked to determine whether they are within 15 percent of field flows for more than 85 percent of the cases.

Table 10: Calibration Criteria Based on FHWA's Traffic Analysis Toolbox

Criteria and Measures	Calibration Acceptance Targets
Hourly Flows, Model Versus Observed	
Individual Link Flows – Within 15%	> 85% of cases
Within 100 vph, for Flow < 700 vph	> 85% of cases
Within 15%, for 700 vph < Flow < 2,700 vph	> 85% of cases
Within 400 vph, for Flow > 2,700 vph	> 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
Travel Times, Model Versus Observed	
Journey Times, Network	> 85% of cases
Within 15%	
Visual Audits	
Individual Link Speeds	To analyst's satisfaction
Visually Acceptable Speed-Flow Relationship	
Bottlenecks	To analyst's satisfaction
Visually Acceptable Queuing	

* The GEH statistic is obtained as follows:

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Where E = model estimated volume and V = field count

7.1 VISSIM Calibration Parameters

There are three calibration parameters in VISSIM, based on operational characteristics, to replicate field conditions: car following behavior, lane change behavior, and lane changing distances parameters. These three operational parameters are generally modified in VISSIM to replicate the capacity observed along mainline segments, merges, diverges, and weaving sections of freeways. These parameters play a large role in the capacity calibration of a model. To change these parameters effectively to calibrate existing conditions, different “Driver Behavior Types” were coded in the a.m. and p.m. peak period models.

7.1.1 Driver Behavior Types

Arterials:

The “Urban (motorized)” driver behavior was created for arterial roadways during the network construction phase of the a.m. and p.m. peak period models to assist in the calibration process. The default VISSIM-provided Wiedemann 74 (car following model) parameters and lane changing parameters were used for all arterial driver behavior types and were reflective of field-observed driver behaviors. The default parameters were not changed on these driver behavior types.

Freeways:

The modeling process started with the creation of the five generic driver behaviors that are observed on a freeway:

1. Basic Freeway Segments
2. Major Merge/Diverge Segments
3. Normal Merge/Diverge Segments
4. Weave Segments
5. On-/Off-Ramps (ramps and loops).

Car Following and Lane Change Parameters:

There are 10 Wiedemann 99 (freeway car following model) parameters (CC0 to CC9) for each driver behavior type that can be used for calibration of VISSIM models. Some of the car following and lane change parameters were modified based on suggested values provided by Oregon Department of Transportation (ODOT) in the Protocol for VISSIM Simulation report (Mai et al. 2011) and other previous research and studies, such as Integrated Microscopic and Macroscopic Calibration for Psycho-Physical Car Following Models (Menneni et al. 2009), Calibration of VISSIM for a Congested Freeway (Gomes et al. 2004), and Calibrating Freeway Simulation Models in VISSIM (Woody 2006). The suggested ranges for the CC parameters from the ODOT Protocol for VISSIM Simulation report are provided in Table 11.

Table 11: CC Parameter Suggested Range – ODOT

		Default	Unit	Suggested Range	
				Basic Segment	Merging/ Weaving
CC0	Standstill Distance	4.92	ft	4.5 – 5.5	> 4.92
CC1	Headway Time	0.9	s	0.85 – 1.05	0.90 1.50
CC2	‘Following’ Variation	13.12	ft	6.56 – 22.97	13.12 – 39.37
CC3	Threshold for Entering ‘Following’	-8		Use default	

		Default	Unit	Suggested Range	
				Basic Segment	Merging/ Weaving
CC4	Negative ‘Following’ Threshold	-0.35		Use default	
CC5	Positive ‘Following’ Threshold	0.35		Use default	
CC6	Speed Dependency of Oscillation	11.44		Use default	
CC7	Oscillation Acceleration	0.82	ft/s^2	Use default	
CC8	Standstill Acceleration	11.48	ft/s^2	Use default	
CC9	Acceleration at 55 mph	4.92	ft/s^2	Use default	

Source: ODOT

The ODOT report suggests changing the Standstill Distance (CC0), Headway Time (CC1), and ‘Following’ Variation (CC2) parameters to attain calibration criteria compliance. However, these are only suggestions, and other values can be modified if needed.

The models were initially run with the default values for all driving behaviors, and calibration criteria were checked for compliance. An iterative process was then conducted to identify the modeling parameters that produced compliance with all of the calibration criteria.

The lane change parameters were also adjusted in the model to replicate existing field traffic operations. The following parameters were found to have some impact on driver behavior during a sensitivity analysis:

1. Necessary Lane Change Parameters
   a. Maximum Deceleration
   b. -1 ft/sec^2 per Distance
2. Safety Distance Reduction Factor
3. Cooperative Lane Change.

The suggested ranges for the lane change parameters from the ODOT Protocol for VISSIM Simulation report are provided in Table 12. The car following and lane change calibration parameters used for this project are provided in Tables 13 and 14, respectively. The CC0, CC1, CC2, and CC7 parameters were changed for this project. The calibration effort did not require a change in other CC values. The final calibration parameters for the various driver behavior types were incorporated into both the a.m. and p.m. peak period models for consistency.

The final calibration parameters for the various driver behavior types were incorporated into both the a.m. and p.m. peak period models for consistency. The “Wait time before diffusion (sec)” default value of 60 seconds was not changed.

Table 12: Lane Change Parameter Suggested Range – ODOT

Defaults				
General Behavior Necessary Lane Change (route)	**Free Lane Selection Own**	**Unit**	**Trailing Vehicle**	**Unit**
Maximum deceleration:	-13.12	ft/s^2	-9.84	ft/s^2
-1ft/s^2 per distance:	200	ft	200	ft
Accepted deceleration:	-3.28	ft/s^2	-1.64	ft/s^2
Waiting time before diffusion:			60	s
Min. headway (front/rear):			1.64	ft
To slower lane if collision time above:			0	s
Safety distance reduction factor:			0.6	
Maximum deceleration for cooperative braking:			-9.84	ft/s^2
Overtake reduced speed areas:			☐*	
Suggested Ranges				
General Behavior Necessary Lane Change (route)	**Free Lane Selection Own**	**Unit**	**Trailing Vehicle**	**Unit**
Maximum deceleration:	-15 to -12	ft/s^2	-12 to -8	ft/s^2
-1ft/s^2 per distance:	150 to 250	ft	150 to 250	ft
Accepted deceleration:	-2.5 to -4	ft/s^2	-1.5 to -2.5	ft/s^2
Waiting time before diffusion:			60	ft
Min. headway (front/rear):			1.5 to 2	s
To slower lane if collision time above:			0 to 0.5	
Safety distance reduction factor:			0.25 to 1.00	ft/s^2
Maximum deceleration for cooperative braking:			-8 to -15	
Overtake reduced speed areas:			☐*	

*Leave box unchecked.

Source: ODOT

Table 13: Car-Following Calibration Parameters

Wiedemann 99 Model Parameters	Default	Basic Freeway	Ramps/ Loops	Freeway Weave	Freeway Major Merge	Freeway Merge Dropped Lanes
CC0 (Standstill Distance) (ft)	4.92	4.92	4.92	4.92	4.92	4.92
CC1 (Headway Time) (sec)	0.90	0.90	0.90	0.90	0.90	0.90
CC2 ('Following' Variation) (ft)	13.12	13.12	13.12	13.12	13.12	13.12
CC3 (Threshold for Entering Following)	-8.00	-8.00	-8.00	-11.00	-11.00	-11.00
CC4 (Negative 'Following' Threshold)	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35
CC5 (Positive 'Following' Threshold)	0.35	0.35	0.35	0.35	0.35	0.35
CC6 (Speed Dependency of Oscillation)	11.44	11.44	11.44	11.44	11.44	11.44
CC7 (Oscillation Acceleration) (ft/sec^2)	0.82	0.82	0.82	0.82	0.82	0.82
CC8 (Standstill Acceleration) (ft/sec^2)	11.48	11.48	11.48	11.48	11.48	11.48
CC9 (Acceleration at 50 mph) (ft/sec^2)	4.92	4.92	4.92	4.92	4.92	4.92

Note: The entries highlighted in blue have been updated from the default value.

Table 14: VISSIM Lane Change Calibration Parameters

Lane Change Parameters	Default	Basic Freeway	Ramps/ Loops	Freeway Weave	Freeway Major Merge	Freeway Merge Dropped Lanes
Max. Deceleration (own) (ft/sec^2)	-13.12	-13.12	-13.12	-13.12	-13.12	-13.12
Max. Deceleration (trailing) (ft/sec^2)	-9.84	-9.84	-9.84	-20.00	-20.00	-9.84
-1 fps^2 per Dist. (own) (ft)	200	200	200	200	200	200
-1 fps^2 per Dist. (trailing) (ft)	200	200	200	200	200	200
Accepted Deceleration (own) (ft/sec^2)	-3.28	-3.28	-3.28	-3.28	-3.28	-3.28
Accepted Deceleration (trailing) (ft/sec^2)	-1.64	-1.64	-1.64	-1.64	-1.64	-1.64
Wait Time Before Diffusion (sec)	60	60	60	60	60	60
Min. Headway (front / rear)	1.64	1.64	1.64	1.64	1.64	1.64
To Slower Lane - Collision Time Above (sec)	0.00	0.00	0.00	0.00	0.00	0.00
Safety Distance Reduction Factor	0.60	0.40	0.60	0.20	0.15	0.15
Max. Deceleration for Cooperative Braking (ft/sec^2)	-9.84	-9.84	-9.84	-9.84	-9.84	-9.84
Overtake Reduced Speed Areas	Off	Off	Off	Off	Off	Off
Advanced Merging	On	On	On	On	On	On
Consider subsequent static routing decisions	On	On	On	On	On	On
Cooperative Lane Change	Off	Off	Off	Off	On	On
Lateral Correction of Rear-end Position	Off	Off	Off	Off	Off	Off

Note: The entries highlighted in blue have been updated from the default value.

<u>Lane Change Distance:</u>

Lane change distance is defined as the distance upstream of the merge/diverge area, such as off-ramps and lane drops, where vehicles will start attempting to change lanes to position themselves for the conditions ahead. The lane change distance in VISSIM can significantly affect freeway operations. The default lane change distance on a connector is 656.2 feet; however, this distance is too short to perform the appropriate lane changes. This default value needs to be adjusted to match real-world driver reaction points, as commuters often react well before the anticipated conditions ahead of them. Therefore, the default value in VISSIM was changed from 656.2 feet per lane to up to 2,640 feet per lane when necessary.

7.2 Measures of Effectiveness for Calibration

The VISSIM models provide various Measures of Effectiveness (MOEs) to describe the operational performance of a modeled scenario. Several MOEs are available for the comparison of field data to modeled data such as vehicular volumes, travel times, speeds, delays, queue lengths, and other conditions. The outputs from the VISSIM model must be user-defined prior to running the simulation. The critical outputs for the calibration of traffic operations include mainline volumes, travel times, and speeds. The network-wide outputs are more beneficial for comparing different scenarios or alternatives. The various data collection elements that need to be defined by the modeler to obtain the MOEs of interest are:

- Link Evaluations – volume, density, and speed information for all roadways in the VISSIM network
- Travel Time Sections – number of vehicles, travel times, and speeds for freeway mainline sections
- Network-wide Data – Total travel time, average delay times, average model speeds, vehicle-miles traveled (VMT), latent delay, and latent volume for the entire VISSIM model.

7.3 VISSIM Model Number of Runs

Due to the stochastic nature of VISSIM microscopic simulation, the results obtained from different individual random seeds can vary significantly. It is necessary to run VISSIM models multiple times with different random seeds to attain an accurate reflection of the performance of the models. The VISSIM software has a built-in multi-run capability and an output processor that records and summarizes performance measures from each run. The multi-run feature in VISSIM runs the model multiple times by changing the random seed number for each run. The output processor collects user-defined MOE data for the network over multiple runs and organizes the data into a single database file.

The maximum number of runs required for a simulation depends on two primary variables:

- The variance in the mean of one or more MOEs selected
- The tolerable error as selected by the analyst (5 to 10 percent).

The formula used to determine the required number of simulation runs for the existing conditions a.m. and p.m. peak period VISSIM models is presented below.

$$n = \frac{1.96^2 \times \sigma^2}{E^2}$$

Where:

n is the required sample size (e.g., number of simulation runs)
1.96 is the Z-value for the Standard Normal Curve for 95% confidence
σ^2 is the sample variance computed from the simulation results
E is the tolerable error for the sample mean (in same units as the mean)

The above formula is a general statistical formula used to determine sample size for any sets of data. Based on the normal distribution, 1.96 is the Z-value for 95 percent confidence interval. The multi-run process requires an initial data set to be generated. An initial sample of ten simulation runs was performed for the a.m. and p.m. peak period models. In most cases, these ten runs will generate a sample size large enough to produce a true statistical average of the results, but this was verified by the above equation. Five MOEs as shown in Table 15 were chosen as the key MOEs to verify if the initial ten runs were producing “statistically significant” outputs. A 95 percent confidence interval and an allowable error of 7.5 percent (average value of allowable range 5-10 percent) were assumed. Table 15 shows the calculated required number of runs for the a.m. and p.m. peak period models in order to produce “statistically significant” results for the chosen MOEs. As a result, ten simulation runs with varying random seeds were selected for the a.m. and p.m. peak period models. These ten seeds numbers are 42, 47, 52, 57, 62, 67, 72, 77, 82, and 87.

Table 15: Required Number of Runs Calculation

Parameter	AM			PM		
	Standard Deviation	Mean	Min. No. of Runs	Standard Deviation	Mean	Min. No. of Runs
Average speed (mph)	1.7	46.3	1	1.0	49.4	1
Vehicle miles traveled (mi)	1,186	698,448	1	1,100	768,487	1
Vehicle hours traveled (h)	553	15,090	1	308	15,572	1
Number of vehicles left the network	39.0	96,753	1	49.0	105,882	1
Number of vehicles in the network	53.6	3,044	1	66.1	3,532	1

8 CALIBRATION RESULTS

The calibration was conducted as a combination of visual examination and evaluation of statistical model outputs. The existing conditions model calibration primarily focused on replicating the traffic volume data, travel time/operating speeds data, and existing bottleneck/congestion locations in the study area based on field observations. This section provides a detailed comparison of model outputs and existing data within the context of the calibration criteria.

8.1 Hourly Flows (Modeled Versus Observed)

Link evaluation files were processed to summarize the highest volume hours for the a.m. and p.m. peak periods. I-16, I-95, and I-516 mainlines and ramp links were considered for calibration of the a.m. and p.m. models.

8.1.1 Individual Link Flows

Depending on the observed volumes on the roadway segments, a link falls under one of the three categories defined by FHWA's Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software report (Dowling et al. 2004):

- Low volume links (flow less than 700 vph)
- Medium volume links (flow between 700 vph and 2,700 vph)
- High volume links (flow greater than 2,700 vph).

The calibration criteria vary depending on these three volume categories, as summarized in Table 10 in Section 7 of this report. Based on these criteria, the volumes of all freeway and arterial links within the VISSIM network were compared to the existing traffic volumes for each of the three categories within the peak hours. Also, all of the individual links were checked to determine if they are within 15 percent of the field-observed volume values.

The first calibration check performed on the modeled volumes was to verify that the modeled traffic volumes are within 15 percent of the field-observed traffic counts for at least 85 percent of the links within the VISSIM models. Table 16 provides a summary of the total number of links analyzed and the number of links that comply with the criteria identified. This table shows that 98 percent of all links in the a.m. and 98 percent of all links in the p.m. peak hours are within the allowable 15 percent range.

Table 16: Individual Link Flows – All Links (within 15 Percent)

Peak Period	Simulation Hour	Total No. of Links (Observed)	Links Within Criteria (Modeled)	Criteria	Percentage Compliant	Criteria Met
A.M.	Peak	141	138	85%	98%	YES
P.M.	Peak	141	138	85%	98%	YES

Second, low volume links (links with flow < 700 vph) were checked to verify that the modeled traffic volumes are within 100 vph of the field-observed traffic counts for 85 percent of these link types within the VISSIM models as specified in FHWA's Traffic Analysis Tool Box. Table 17 provides a summary of the total number of links that fall under this category during each peak period and the number of links that comply with the criteria identified. This table shows that all links (100 percent) that fall under this volume category, both in the a.m. and p.m. peak hours are within the allowable 100 vph range.

Table 17: Individual Link Flows – Low Volume Links (within 100 vph)

Peak Period	Simulation Hour	Total No. of Links (Observed)	Links Within Criteria (Modeled)	Criteria	Percentage Compliant	Criteria Met
A.M.	Peak	34	34	85%	100%	YES
P.M.	Peak	30	30	85%	100%	YES

Medium volume links (links with flow > 700 vph and < 2,700 vph) were checked to verify that the modeled traffic volumes are within 15 percent of the field-observed traffic counts for 85 percent of these link types within the VISSIM models as specified in FHWA's Traffic Analysis Tool Box. Table 18 provides a summary of the total number of links that fall under this category during each peak period and the number of links that comply with the criteria identified. This table shows that 100 percent of all links in the a.m. and 100 percent of all links in the p.m. peak hours are within the allowable 15 percent range.

Table 18: Individual Link Flows – Medium Volume Links (within 15 Percent)

Peak Period	Simulation Hour	Total No. of Links (Observed)	Links Within Criteria (Modeled)	Criteria	Percentage Compliant	Criteria Met
A.M.	Peak	89	89	85%	100%	YES
P.M.	Peak	70	70	85%	100%	YES

High volume links (links with flow > 2,700 vph) were checked to verify that the modeled traffic volumes are within 400 vph of the field-observed traffic counts for 85 percent of these link types within the VISSIM models as specified in FHWA's Traffic Analysis Tool Box. Table 19 provides a summary of the total number of links that fall under this category during each peak period and the number of links that comply with the criteria identified. This table shows that 100 percent of all links in the a.m. and 100 percent of all links in the p.m. peak hours are within the allowable 400 vph range.

Table 19: Individual Link Flows – High Volume Links (within 400 vph)

Peak Period	Simulation Hour	Total No. of Links (Observed)	Links within Criteria (Modeled)	Criteria	Percentage Compliant	Criteria Met
A.M.	Peak	18	18	85%	100%	YES
P.M.	Peak	41	41	85%	100%	YES

8.1.2 GEH Statistic

The GEH statistic is an empirical formula used in traffic engineering to compare two sets of traffic volumes. The GEH statistic aids in avoiding pitfalls that occur when using simple percentages to compare two sets of volumes. A GEH value of less than 5.0 is considered a good fit between the hourly input volumes and the modeled volumes. Both the a.m. and p.m. peak period models had GEH compliant percentages of 85 percent or better across the network. Table 20 summarizes the GEH statistic summary for a.m. and p.m. peak periods. This table shows that 93 percent of all links in the a.m. and 91 percent of all links in the p.m. peak hours are within the allowable GEH<5 range.

Table 20: GEH Statistic Summary

Peak Period	Simulation Hour	Total No. of Links	Links within Criteria (GEH<5)	Criteria	Percentage Compliant	Criteria Met
A.M.	Peak	141	131	85%	93%	YES
P.M.	Peak	141	128	85%	91%	YES

Tables 21 and 22 present detailed link volume calibration information for the a.m. and p.m. peak hours. The analysis of the modeled versus observed volumes presented above indicates that the individual link flows for the a.m. and p.m. peak hours meet the volume criteria set for this project.

Table 21: Existing Conditions – Volume Comparison – A.M. Peak Period

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph		
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
I-16 Eastbound	1001	Upstream of Pooler Pkwy off-ramp: 2-lane freeway	5400-9000	1,955	1,862	-93	-5%	YES	-	-	-5%	YES	-	-	2.1
	1002	Between Pooler Pkwy off-ramp and Gate Pkwy on-ramp: 2-lane freeway	5400-9000	1,625	1,531	-94	-6%	YES	-	-	-6%	YES	-	-	2.4
	1003	Upstream of Pooler Pkwy on-ramp: 3-lane merge	5400-9000	2,519	2,423	-96	-4%	YES	-	-	-4%	YES	-	-	1.9
	1004	Between Pooler Pkwy on-ramp to I-95 SB off-ramp: 2-lane freeway	5400-9000	2,519	2,353	-166	-7%	YES	-	-	-7%	YES	-	-	3.4
	1005	Upstream of I-95 SB off-ramp: 3 lane diverge	5400-9000	2,519	2,203	-316	-13%	YES	-	-	-13%	YES	-	-	6.5
	1006	Upstream of Pooler Pkwy off-ramp to I-95 NB off-ramp: 2-lane freeway	5400-9000	2,284	1,978	-306	-13%	YES	-	-	-13%	YES	-	-	6.6
	1007	Upstream of I-9 5 NB off-ramp: 3 lane diverge	5400-9000	3,210	2,951	-259	-8%	YES	-	-	-	-	-259	YES	4.7
	1008	Downstream of I-95 NB off-ramp: 3-lane freeway	5400-9000	2,697	2,651	-46	-2%	YES	-	-	-2%	YES	-	-	0.9
	1009	Upstream of I-95 NB off-ramp: 2-lane freeway	5400-9000	2,697	2,631	-66	-2%	YES	-	-	-2%	YES	-	-	1.3
	1010	Downstream of I-95 NB on-ramp: 3-lane merge	5400-9000	3,714	3,667	-47	-1%	YES	-	-	-	-	-47	YES	0.8
	1011	Upstream of Dean forest Rd off-ramp: 2-lane freeway	5400-9000	3,714	3,595	-119	-3%	YES	-	-	-	-	-119	YES	2.0
	1012	Between Dean Forest Rd off-ramp and on-ramp: 2-lane freeway	5400-9000	3,219	3,066	-153	-5%	YES	-	-	-	-	-153	YES	2.7
	1013	Downstream of Dean Forest Rd on-ramp: 3-lane merge	5400-9000	4,065	3,846	-219	-5%	YES	-	-	-	-	-219	YES	3.5
	1014	Upstream of Chatham Pkwy off-ramp: 2-lane freeway	5400-9000	4,065	3,858	-207	-5%	YES	-	-	-	-	-207	YES	3.3
	1015	Upstream of Chatham Pkwy off-ramp: 3-lane diverge	5400-9000	4,065	3,760	-305	-8%	YES	-	-	-	-	-305	YES	4.9
	1016	Between Chatham Pkwy off-ramp and Chatham Pkwy on-ramp: 2-lane freeway	5400-9000	3,274	3,124	-150	-5%	YES	-	-	-	-	-150	YES	2.7
	1017	Downstream of Chatham Pkwy on-ramp: 3-lane merge	5400-9000	3,855	3,660	-195	-5%	YES	-	-	-	-	-195	YES	3.2
	1018	Upstream of I-516 SB off-ramp: 2-lane freeway	5400-9000	3,855	3,702	-153	-4%	YES	-	-	-	-	-153	YES	2.5
	1019	Upstream of I-516 SB off-ramp: 3-lane diverge	5400-9000	3,855	3,618	-237	-6%	YES	-	-	-	-	-237	YES	3.9
	1020	Downstream of I-516 SB off-ramp: 2-lane freeway	5400-9000	2,600	2,402	-198	-8%	YES	-	-	-8%	YES	-	-	4.0
	1021	Upstream of I-516 on-ramp: 2-diverge	5400-9000	2,600	2,365	-235	-9%	YES	-	-	-9%	YES	-	-	4.7
	1022	Upstream of I-516 NB off-ramp: 4-weave	5400-9000	3,038	2,802	-236	-8%	YES	-	-	-	-	-236	YES	4.4
	1023	Downstream of I-516 NB off-ramp: 3-lane freeway	5400-9000	2,571	2,428	-143	-6%	YES	-	-	-6%	YES	-	-	2.9
	1024	Downstream of I-516 on-ramp: 4-lane merge	5400-9000	3,451	3,270	-181	-5%	YES	-	-	-	-	-181	YES	3.1
	1025	Downstream of I-516 on-ramp: 3-lane freeway	5400-9000	3,451	3,287	-164	-5%	YES	-	-	-	-	-164	YES	2.8
	1026	Downstream of SR 204 off-ramp: 3-lane freeway	5400-9000	2,613	2,368	-245	-9%	YES	-	-	-9%	YES	-	-	4.9
I-16 Eastbound Ramps	1501	Pooler Pkwy off-ramp: 1-lane	5400-9000	330	329	-1	0%	YES	-1	YES	-	-	-	-	0.0
	1505	Pooler Pkwy on-ramp: 1-lane	5400-9000	894	919	25	3%	YES	-	-	3%	YES	-	-	0.8
	1506	I-95 off-ramp going SB: 1-lane	5400-9000	235	213	-22	-9%	YES	-22	YES	-	-	-	-	1.5
	1507	I-95 off-ramp going NB: 1-lane	5400-9000	304	271	-33	-11%	YES	-33	YES	-	-	-	-	2.0
	1508	I-95 on-ramp from SB: 1-lane	5400-9000	926	1,024	98	11%	YES	-	-	11%	YES	-	-	3.2
	1509	I-95 on-ramp from NB: 1-lane	5400-9000	1,017	1,091	74	7%	YES	-	-	7%	YES	-	-	2.3

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph		
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
	1510	Dean forest off-ramp: 1-lane	5400-9000	495	408	-87	-18%	NO	-87	YES	-	-	-	-	4.1
	1514	Dean forest on-ramp: 1-lane	5400-9000	811	791	-20	-2%	YES	-	-	-2%	YES	-	-	0.7
	1515	Chatham Pkwy off-ramp: 1-lane	5400-9000	857	735	-122	-14%	YES	-	-	-14%	YES	-	-	4.3
	1518	Chatham Pkwy on-ramp: 1-lane	5400-9000	581	568	-13	-2%	YES	-13	YES	-	-	-	-	0.6
	1519	I-516 off-ramp going SB: 1-lane	5400-9000	1,255	1,280	25	2%	YES	-	-	2%	YES	-	-	0.7
	1520	I-516 off-ramp going NB: 1-lane	5400-9000	467	414	-53	-11%	YES	-53	YES	-	-	-	-	2.5
	1521	I-516 on-ramp from NB: 1-lane	5400-9000	438	428	-10	-2%	YES	-10	YES	-	-	-	-	0.5
	1522	I-516 on-ramp from SB: 1-lane	5400-9000	1,362	1,467	105	8%	YES	-	-	8%	YES	-	-	2.8
	1523	I-516 on-ramp from SB: 1-lane	5400-9000	880	856	-24	-3%	YES	-	-	-3%	YES	-	-	0.8
	1524	SR 204 off-ramp: 2-lane	5400-9000	1,050	919	-131	-12%	YES	-	-	-12%	YES	-	-	4.2
	2001	Upstream of SR 204 on-ramp: 2-lane freeway	5400-9000	1,658	1,495	-163	-10%	YES	-	-	-10%	YES	-	-	4.1
	2002	Downstream of SR 204 on-ramp: 4-lane merge	5400-9000	2,259	2,067	-192	-8%	YES	-	-	-8%	YES	-	-	4.1
	2003	Upstream of I-516 off-ramp: 3-lane freeway	5400-9000	2,259	2,080	-179	-8%	YES	-	-	-8%	YES	-	-	3.9
	2004	Downstream of I-516 off-ramp: 2-lane freeway	5400-9000	1,983	1,751	-232	-12%	YES	-	-	-12%	YES	-	-	5.4
	2005	Upstream of I-516 SB off-ramp: 4-weave	5400-9000	2,610	2,339	-271	-10%	YES	-	-	-10%	YES	-	-	5.4
	2006	Downstream of I-516 SB off-ramp: 3-lane freeway	5400-9000	2,287	2,042	-245	-11%	YES	-	-	-11%	YES	-	-	5.3
	2007	Upstream of I-516 SB on-ramp: 2-lane freeway	5400-9000	2,287	2,051	-236	-10%	YES	-	-	-10%	YES	-	-	5.1
	2008	Downstream of I-516 off-ramp: 3-lane weave	5400-9000	2,311	2,186	-125	-5%	YES	-	-	-5%	YES	-	-	2.6
	2009	Downstream of I-516 off-ramp: 2-lane freeway	5400-9000	2,311	2,273	-38	-2%	YES	-	-	-2%	YES	-	-	0.8
	2010	Between Chatham Pkwy off-ramp and on-ramp: 2-lane freeway	5400-9000	1,685	1,644	-41	-2%	YES	-	-	-2%	YES	-	-	1.0
	2011	Downstream of Chatham Pkwy on-ramp: 3-lane merge	5400-9000	1,948	1,952	4	0%	YES	-	-	0%	YES	-	-	0.1
	2012	Upstream of Dean Forest Rd off-ramp: 3-lane freeway	5400-9000	1,948	2,003	55	3%	YES	-	-	3%	YES	-	-	1.2
I-16 Westbound	2013	Upstream of Dean Forest Rd off-ramp: 3-lane diverge	5400-9000	1,948	1,968	20	1%	YES	-	-	1%	YES	-	-	0.5
	2014	Between Dean Forest Rd off-ramp and on-ramp: 2-lane freeway	5400-9000	1,369	1,421	52	4%	YES	-	-	4%	YES	-	-	1.4
	2015	Downstream of Dean Forest Rd on-ramp: 2-lane freeway	5400-9000	1,658	1,714	56	3%	YES	-	-	3%	YES	-	-	1.4
	2016	Upstream of Dean Forest Rd off-ramp: 2-lane freeway	5400-9000	1,658	1,739	81	5%	YES	-	-	5%	YES	-	-	2.0
	2017	Upstream of I-95 NB off-ramp: 3-lane diverge	5400-9000	1,658	1,710	52	3%	YES	-	-	3%	YES	-	-	1.3
	2018	Upstream of I-95 NB on-ramp: 2-lane freeway	5400-9000	1,033	1,085	52	5%	YES	-	-	5%	YES	-	-	1.6
	2019	Downstream of I-95 NB on-ramp: 3-lane weave	5400-9000	1,265	1,315	50	4%	YES	-	-	4%	YES	-	-	1.4
	2020	Downstream of I-95 SB off-ramp: 3-lane merge	5400-9000	881	845	-36	-4%	YES	-	-	-4%	YES	-	-	1.2
	2021	Upstream of I-95 SB on-ramp: 2-lane freeway	5400-9000	881	847	-34	-4%	YES	-	-	-4%	YES	-	-	1.2
	2022	Downstream of I-95 SB on -ramp: 3-lane merge	5400-9000	1,065	1,050	-15	-1%	YES	-	-	-1%	YES	-	-	0.5
	2023	Upstream of Pooler Pkwy off-ramp: 2-lane freeway	5400-9000	1,065	1,061	-4	0%	YES	-	-	0%	YES	-	-	0.1
	2024	Between Pooler Pkwy off-ramp and on-ramp: 2-lane freeway	5400-9000	726	728	2	0%	YES	-	-	0%	YES	-	-	0.1
	2025	Upstream of Pooler Pkwy on-ramp: 3-lane merge	5400-9000	994	995	1	0%	YES	-	-	0%	YES	-	-	0.0

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph		
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
	2026	Upstream of Pooler Pkwy on-ramp: 2-lane freeway	5400-9000	994	1,004	10	1%	YES	-	-	1%	YES	-	-	0.3
I-16 Westbound Ramps	2501	SR 204 on-ramp: 2-lane	5400-9000	601	594	-7	-1%	YES	-7	YES	-	-	-	-	0.3
	2502	I-516 off-ramp going NB:1-lane	5400-9000	276	314	38	14%	YES	38	YES	-	-	-	-	2.2
	2503	I-516 off-ramp going SB: 1-lane	5400-9000	323	328	5	2%	YES	5	YES	-	-	-	-	0.3
	2504	I-516 on-ramp from NB:1-lane	5400-9000	627	619	-8	-1%	YES	-8	YES	-	-	-	-	0.3
	2505	I-516 on-ramp from SB:1-lane	5400-9000	598	643	45	8%	YES	45	YES	-	-	-	-	1.8
	2506	I-516 on-ramp from SB:1-lane	5400-9000	195	216	21	11%	YES	21	YES	-	-	-	-	1.5
	2507	Chatham Pkwy lane off-ramp: 1-lane	5400-9000	626	624	-2	0%	YES	-2	YES	-	-	-	-	0.1
	2510	Chatham Pkwy lane on-ramp: 1-lane	5400-9000	348	351	3	1%	YES	3	YES	-	-	-	-	0.1
	2511	Dean forest lane off-ramp: 1-lane	5400-9000	579	566	-13	-2%	YES	-13	YES	-	-	-	-	0.5
	2514	Dean forest lane on-ramp: 1-lane	5400-9000	317	319	2	1%	YES	2	YES	-	-	-	-	0.1
	2515	I-95 lane off-ramp going NB: 1-lane	5400-9000	625	644	19	3%	YES	19	YES	-	-	-	-	0.8
	2516	I-95 lane off-ramp going SB: 1-lane	5400-9000	384	469	85	22%	NO	85	YES	-	-	-	-	4.1
	2517	I-95 lane on-ramp from NB: 2-lane	5400-9000	222	238	16	7%	YES	16	YES	-	-	-	-	1.1
	2518	I-95 lane on-ramp from SB: 1-lane	5400-9000	184	208	24	13%	YES	24	YES	-	-	-	-	1.7
	2519	Pooler Pkwy lane off-ramp: 1-lane	5400-9000	339	332	-7	-2%	YES	-7	YES	-	-	-	-	0.4
	2523	Pooler Pkwy lane on-ramp: 1-lane	5400-9000	268	276	8	3%	YES	8	YES	-	-	-	-	0.5
I-95 Northbound	3001	Upstream of Abercorn Expy off-ramp:3-lane freeway	5400-9000	2,610	2,711	101	4%	YES	-	-	4%	YES	-	-	2.0
	3002	Upstream of Abercorn Expy off-ramp:4-lane diverge	5400-9000	2,610	2,649	39	1%	YES	-	-	1%	YES	-	-	0.8
	3003	Between Abercorn Expy off-ramp and on-ramp: 3-lane freeway	5400-9000	2,094	2,187	93	4%	YES	-	-	4%	YES	-	-	2.0
	3004	Downstream of Abercorn Expy on-ramp:4-lane merge	5400-9000	2,717	2,760	43	2%	YES	-	-	-	-	43	YES	0.8
	3005	Upstream of I-16 EB off-ramp:3-lane freeway	5400-9000	2,717	2,796	79	3%	YES	-	-	-	-	79	YES	1.5
	3006	Upstream of I-16 EB off-ramp:4-lane diverge	5400-9000	2,717	2,730	13	0%	YES	-	-	-	-	13	YES	0.2
	3007	Upstream of I-16 on-ramp from EB: 3-lane freeway	5400-9000	1,700	1,670	-30	-2%	YES	-	-	-2%	YES	-	-	0.7
	3008	Between I-16 on-ramp from EB and I-16 WB off-ramp:4-lane weave	5400-9000	2,239	1,925	-314	-14%	YES	-	-	-14%	YES	-	-	6.9
	3009	Downstream of I-16 WB off-ramp: 3-lane merge	5400-9000	1,642	1,691	49	3%	YES	-	-	3%	YES	-	-	1.2
	3010	Upstream of I-16 WB on-ramp:3-lane freeway	5400-9000	1,642	1,685	43	3%	YES	-	-	3%	YES	-	-	1.1
	3011	Downstream of I-16 WB on-ramp: 4-lane merge	5400-9000	2,267	2,328	61	3%	YES	-	-	3%	YES	-	-	1.3
	3012	Downstream of I-16 WB on-ramp: 3-lane freeway	5400-9000	2,267	2,348	81	4%	YES	-	-	4%	YES	-	-	1.7
	3013	Between Louisville off-ramp and on ramp: 3-lane freeway	5400-9000	1,796	1,881	85	5%	YES	-	-	5%	YES	-	-	2.0
	3014	Downstream of Louisville on-ramp: 4-lane merge	5400-9000	2,477	2,524	47	2%	YES	-	-	2%	YES	-	-	0.9
	3015	Downstream of Louisville on-ramp: 3-lane freeway	5400-9000	2,477	2,559	82	3%	YES	-	-	3%	YES	-	-	1.6
I-95 Northbound Ramps (Excludes I-16 Ramps)	3501	Abercorn Expy off-ramp: 1-lane	5400-9000	516	508	-8	-1%	YES	-8	YES	-	-	-	-	0.3
	3504	Abercorn Expy on-ramp: 1-lane	5400-9000	623	600	-23	-4%	YES	-23	YES	-	-	-	-	0.9
	3505	Louisville Rd off-ramp: 1-lane	5400-9000	471	458	-13	-3%	YES	-13	YES	-	-	-	-	0.6

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph		
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
	3508	Louisville Rd on-ramp: 1-lane	5400-9000	681	673	-8	-1%	YES	-8	YES	-	-	-	-	0.3
I-95 Southbound	4001	Upstream of Louisville Rd off-ramp: 3-lane freeway	5400-9000	2,573	2,867	294	11%	YES	-	-	11%	YES	-	-	5.6
	4002	Upstream of Louisville Rd off-ramp: 4-lane diverge	5400-9000	2,573	2,646	73	3%	YES	-	-	3%	YES	-	-	1.4
	4003	Between Louisville off-ramp and on ramp: 3-lane freeway	5400-9000	1,791	1,958	167	9%	YES	-	-	9%	YES	-	-	3.9
	4004	Downstream of Louisville on-ramp: 4-lane merge	5400-9000	2,107	2,351	244	12%	YES	-	-	12%	YES	-	-	5.2
	4005	Downstream of Louisville on-ramp: 3-lane freeway	5400-9000	2,107	2,362	255	12%	YES	-	-	12%	YES	-	-	5.4
	4006	Upstream of I-16 WB off-ramp:4-lane diverge	5400-9000	2,107	2,291	184	9%	YES	-	-	9%	YES	-	-	3.9
	4007	Upstream of I-16 WB on-ramp:3-lane freeway	5400-9000	1,923	2,077	154	8%	YES	-	-	8%	YES	-	-	3.4
	4008	Between I-16 on-ramp from WB and I-16 EB off-ramp:4-lane weave	5400-9000	2,439	2,490	51	2%	YES	-	-	2%	YES	-	-	1.0
	4009	Downstream of I-16 WB off ramp: 4 lane merge	5400-9000	1,513	1,453	-60	-4%	YES	-	-	-4%	YES	-	-	1.6
	4010	Upstream of I-16 EB on-ramp:3-lane freeway	5400-9000	1,513	1,451	-62	-4%	YES	-	-	-4%	YES	-	-	1.6
	4011	Downstream of I-16 EB on-ramp:4-lane merge	5400-9000	1,748	1,654	-94	-5%	YES	-	-	-5%	YES	-	-	2.3
	4012	Upstream of Abercorn Expy off-ramp:3-lane freeway	5400-9000	1,748	1,674	-74	-4%	YES	-	-	-4%	YES	-	-	1.8
	4013	Upstream of Abercorn Expy off-ramp:4-lane diverge	5400-9000	1,748	1,646	-102	-6%	YES	-	-	-6%	YES	-	-	2.5
	4014	Between Abercorn Expy off-ramp and on-ramp: 3-lane freeway	5400-9000	1,305	1,238	-67	-5%	YES	-	-	-5%	YES	-	-	1.9
	4015	Downstream of Abercorn Expy on-ramp:4-lane merge	5400-9000	1,875	1,782	-93	-5%	YES	-	-	-5%	YES	-	-	2.2
	4016	Downstream of Abercorn Expy on-ramp:4-lane freeway	5400-9000	1,875	1,803	-72	-4%	YES	-	-	-4%	YES	-	-	1.7
I-95 Southbound Ramps (Excludes I-16 Ramps)	4501	Louisville Rd off-ramp: 1-lane	5400-9000	837	716	-121	-14%	YES	-	-	-14%	YES	-	-	4.3
	4504	Louisville Rd on-ramp: 1-lane	5400-9000	416	411	-5	-1%	YES	-5	YES	-	-	-	-	0.2
	4505	Ft. Argyle off-ramp: 1-lane	5400-9000	443	428	-15	-3%	YES	-15	YES	-	-	-	-	0.7
	4508	Ft. Argyle on-ramp: 1-lane	5400-9000	570	560	-10	-2%	YES	-10	YES	-	-	-	-	0.4
I-516 Northbound and Ramps (Excludes I-16 Ramps)	5001	Upstream of Tremont Rd on-ramp: 2-lane freeway	5400-9000	2,291	2,466	175	8%	YES	-	-	8%	YES	-	-	3.6
	5002	Downstream of Tremont Rd on-ramp: 3-lane weave	5400-9000	2,570	2,675	105	4%	YES	-	-	4%	YES	-	-	2.1
	5003	Downstream of off-ramp to I-16 EB and WB: 2-lane freeway	5400-9000	1,208	1,199	-9	-1%	YES	-	-	-1%	YES	-	-	0.3
	5004	Downstream of on-ramp from I-16 EB:3-lane merge	5400-9000	1,675	1,602	-73	-4%	YES	-	-	-4%	YES	-	-	1.8
	5005	Upstream of on-ramp from I-16 WB:2-lane freeway	5400-9000	1,675	1,613	-62	-4%	YES	-	-	-4%	YES	-	-	1.5
	5006	Between I-16 WB on-ramp and W Gwinnett St off-ramp: 3-lane weave	5400-9000	1,951	1,909	-42	-2%	YES	-	-	-2%	YES	-	-	1.0
	5007	Downstream of W Gwinnett St off-ramp: 2-lane	5400-9000	1,627	1,619	-8	-1%	YES	-	-	-1%	YES	-	-	0.2
	5501	Tremont Rd on-ramp: 1-lane	5400-9000	239	225	-14	-6%	YES	-14	YES	-	-	-	-	0.9
	5502	W Gwinnett St off-ramp: 1-lane	5400-9000	324	314	-10	-3%	YES	-10	YES	-	-	-	-	0.6
I-516 Southbound and Ramps (Excludes I-16 Ramps)	6001	Upstream of W Gwinnett St off-ramp: 2-lane	5400-9000	1,608	1,667	59	4%	YES	-	-	4%	YES	-	-	1.4
	6002	Between W Gwinnett St on-ramp and I-16 EB off-ramp: 3-lane weave	5400-9000	1,818	1,805	-13	-1%	YES	-	-	-1%	YES	-	-	0.3
	6003	Downstream of off-ramp to I-16 WB and EB: 2-lane freeway	5400-9000	1,220	1,179	-41	-3%	YES	-	-	-3%	YES	-	-	1.2
	6004	Downstream of on-ramp from I-16 WB: 3-lane merge	5400-9000	1,543	1,493	-50	-3%	YES	-	-	-3%	YES	-	-	1.3
	6005	Upstream of on-ramp from I-16 EB: 2-lane freeway	5400-9000	1,543	1,494	-49	-3%	YES	-	-	-3%	YES	-	-	1.2

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic	
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph			
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met		
	6006	Upstream of Tremont Rd off-ramp: 3-lane weave	5400-9000	2,798	2,786	-12	0%	YES	-	-	-	-	-12	YES	0.2	
	6007	Downstream of Tremont Rd on-ramp: 2-lane freeway	5400-9000	2,624	2,623	-1	0%	YES	-	-	0%	YES	-	-	0.0	
	6501	W Gwinnett St on-ramp: 1-lane	5400-9000	210	157	-53	-25%	NO	-53	YES	-	-	-	-	3.9	
	6502	Tremont Rd off-ramp: 1-lane	5400-9000	174	162	-12	-7%	YES	-12	YES	-	-	-	-	0.9	
Total				**237,757**	**232,742**	**-5,015**										
Sum of all Link Flows					**-2.1%**											
Sum of all Link Flows (Flows > 85% and GEH Statistic < 5)					**YES**											
Total Count							141	138	34	34	89	89	18	18	141	131
Individual Links							**98%**		**100%**		**100%**		**100%**		**93%**	
Individual Links (Flows met for >85% Cases and GEH Statistic < 5 for 85% of Cases)							**YES**		**YES**		**YES**		**YES**		**YES**	

Table 22: Existing Conditions – Volume Comparison – P.M. Peak Period

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph		
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
I-16 Eastbound	1001	Upstream of Pooler Pkwy off-ramp: 2-lane freeway	5400-9000	1,061	1,191	130	12%	YES	-	-	12%	YES	-	-	3.9
	1002	Between Pooler Pkwy off-ramp and Gate Pkwy on-ramp: 2-lane freeway	5400-9000	814	859	45	6%	YES	-	-	6%	YES	-	-	1.6
	1003	Upstream of Pooler Pkwy on-ramp: 3-lane merge	5400-9000	1,210	1,274	64	5%	YES	-	-	5%	YES	-	-	1.8
	1004	Between Pooler Pkwy on-ramp to I-95 SB off-ramp: 2-lane freeway	5400-9000	1,210	1,282	72	6%	YES	-	-	6%	YES	-	-	2.0
	1005	Upstream of I-95 SB off-ramp: 3 lane diverge	5400-9000	1,210	1,262	52	4%	YES	-	-	4%	YES	-	-	1.5
	1006	Upstream of Pooler Pkwy off-ramp to I-95 NB off-ramp: 2-lane freeway	5400-9000	879	968	89	10%	YES	-	-	10%	YES	-	-	2.9
	1007	Upstream of I-9 5 NB off-ramp: 3 lane diverge	5400-9000	1,638	1,699	61	4%	YES	-	-	4%	YES	-	-	1.5
	1008	Downstream of I-95 NB off-ramp: 3-lane freeway	5400-9000	1,404	1,540	136	10%	YES	-	-	10%	YES	-	-	3.5
	1009	Upstream of I-95 NB off-ramp: 2-lane freeway	5400-9000	1,404	1,546	142	10%	YES	-	-	10%	YES	-	-	3.7
	1010	Downstream of I-95 NB on-ramp: 3-lane merge	5400-9000	1,947	2,172	225	12%	YES	-	-	12%	YES	-	-	5.0
	1011	Upstream of Dean forest Rd off-ramp: 2-lane freeway	5400-9000	1,947	2,186	239	12%	YES	-	-	12%	YES	-	-	5.3
	1012	Between Dean Forest Rd off-ramp and on-ramp: 2-lane freeway	5400-9000	1,614	1,729	115	7%	YES	-	-	7%	YES	-	-	2.8
	1013	Downstream of Dean Forest Rd on-ramp: 3-lane merge	5400-9000	1,993	2,159	166	8%	YES	-	-	8%	YES	-	-	3.7
	1014	Upstream of Chatham Pkwy off-ramp: 2-lane freeway	5400-9000	1,993	2,163	170	9%	YES	-	-	9%	YES	-	-	3.7
	1015	Upstream of Chatham Pkwy off-ramp: 3-lane diverge	5400-9000	1,993	2,102	109	5%	YES	-	-	5%	YES	-	-	2.4
	1016	Between Chatham Pkwy off-ramp and Chatham Pkwy on-ramp: 2-lane freeway	5400-9000	1,789	1,790	1	0%	YES	-	-	0%	YES	-	-	0.0
	1017	Downstream of Chatham Pkwy on-ramp: 3-lane merge	5400-9000	2,424	2,573	149	6%	YES	-	-	6%	YES	-	-	3.0
	1018	Upstream of I-519 SB off-ramp: 2-lane freeway	5400-9000	2,424	2,601	177	7%	YES	-	-	7%	YES	-	-	3.5
	1019	Upstream of I-519 SB off-ramp: 3-lane diverge	5400-9000	2,424	2,539	115	5%	YES	-	-	5%	YES	-	-	2.3
	1020	Downstream of I-519 SB off-ramp: 2-lane freeway	5400-9000	1,548	1,717	169	11%	YES	-	-	11%	YES	-	-	4.2
	1021	Upstream of I-519 on-ramp: 2-diverge	5400-9000	1,548	1,692	144	9%	YES	-	-	9%	YES	-	-	3.6
	1022	Upstream of I-519 NB off-ramp: 4-weave	5400-9000	2,078	2,216	138	7%	YES	-	-	7%	YES	-	-	3.0
	1023	Downstream of I-519 NB off-ramp: 3-lane freeway	5400-9000	1,781	1,963	182	10%	YES	-	-	10%	YES	-	-	4.2
	1024	Downstream of I-519 on-ramp: 4-lane merge	5400-9000	2,621	2,439	-182	-7%	YES	-	-	-7%	YES	-	-	3.6
	1025	Downstream of I-519 on-ramp: 3-lane freeway	5400-9000	2,621	2,454	-167	-6%	YES	-	-	-6%	YES	-	-	3.3
	1026	Downstream of SR 204 off-ramp: 3-lane freeway	5400-9000	2,008	1,776	-232	-12%	YES	-	-	-12%	YES	-	-	5.3
I-16 Eastbound Ramps	1501	Pooler Pkwy off-ramp: 1-lane	5400-9000	297	332	35	12%	YES	35	YES	-	-	-	-	2.0
	1505	Pooler Pkwy on-ramp: 1-lane	5400-9000	396	424	28	7%	YES	28	YES	-	-	-	-	1.4
	1506	I-95 off-ramp going SB: 1-lane	5400-9000	231	304	73	32%	NO	73	YES	-	-	-	-	4.5
	1507	I-95 off-ramp going NB: 1-lane	5400-9000	167	162	-5	-3%	YES	-5	YES	-	-	-	-	0.4
	1508	I-95 on-ramp from SB: 1-lane	5400-9000	759	735	-24	-3%	YES	-	-	-3%	YES	-	-	0.9
	1509	I-95 on-ramp from NB: 1-lane	5400-9000	643	635	-8	-1%	YES	-8	YES	-	-	-	-	0.3

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph		
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
	1510	Dean forest off-ramp: 1-lane	5400-9000	466	442	-24	-5%	YES	-24	YES	-	-	-	-	1.1
	1514	Dean forest on-ramp: 1-lane	5400-9000	416	427	11	3%	YES	11	YES	-	-	-	-	0.5
	1515	Chatham Pkwy off-ramp: 1-lane	5400-9000	348	368	20	6%	YES	20	YES	-	-	-	-	1.1
	1518	Chatham Pkwy on-ramp: 1-lane	5400-9000	785	795	10	1%	YES	-	-	1%	YES	-	-	0.4
	1519	I-519 off-ramp going SB: 1-lane	5400-9000	876	868	-8	-1%	YES	-	-	-1%	YES	-	-	0.3
	1520	I-519 off-ramp going NB: 1-lane	5400-9000	297	286	-11	-4%	YES	-11	YES	-	-	-	-	0.7
	1521	I-519 on-ramp from NB: 1-lane	5400-9000	530	519	-11	-2%	YES	-11	YES	-	-	-	-	0.5
	1522	I-519 on-ramp from SB: 1-lane	5400-9000	1,512	1,673	161	11%	YES	-	-	11%	YES	-	-	4.0
	1523	I-519 on-ramp from SB: 1-lane	5400-9000	458	487	29	6%	YES	29	YES	-	-	-	-	1.3
	1524	SR 204 off-ramp: 2-lane	5400-9000	775	675	-100	-13%	YES	-	-	-13%	YES	-	-	3.7
	2001	Upstream of SR 204 on-ramp: 2-lane freeway	5400-9000	2,271	2,312	41	2%	YES	-	-	2%	YES	-	-	0.9
	2002	Downstream of SR 204 on-ramp: 4-lane merge	5400-9000	3,170	3,226	56	2%	YES	-	-	-	-	56	YES	1.0
	2003	Upstream of I-519 off-ramp: 3-lane freeway	5400-9000	3,170	3,246	76	2%	YES	-	-	-	-	76	YES	1.3
	2004	Downstream of I-519 off-ramp: 2-lane freeway	5400-9000	2,770	2,673	-97	-4%	YES	-	-	-	-	-97	YES	1.9
	2005	Upstream of I-519 SB off-ramp: 4-weave	5400-9000	3,528	3,813	285	8%	YES	-	-	-	-	285	YES	4.7
	2006	Downstream of I-519 SB off-ramp: 3-lane freeway	5400-9000	2,958	3,287	329	11%	YES	-	-	-	-	329	YES	5.9
	2007	Upstream of I-519 SB on-ramp: 2-lane freeway	5400-9000	2,958	3,291	333	11%	YES	-	-	-	-	333	YES	6.0
	2008	Downstream of I-519 off-ramp: 3-lane weave	5400-9000	3,252	3,551	299	9%	YES	-	-	-	-	299	YES	5.1
	2009	Downstream of I-519 off-ramp: 2-lane freeway	5400-9000	3,252	3,633	381	12%	YES	-	-	-	-	381	YES	6.5
	2010	Between Chatham Pkwy off-ramp and on-ramp: 2-lane freeway	5400-9000	2,879	3,100	221	8%	YES	-	-	-	-	221	YES	4.0
	2011	Downstream of Chatham Pkwy on-ramp: 3-lane merge	5400-9000	3,533	3,913	380	11%	YES	-	-	-	-	380	YES	6.2
	2012	Upstream of Dean Forest Rd off-ramp: 3-lane freeway	5400-9000	3,633	3,986	353	10%	YES	-	-	-	-	353	YES	5.7
I-16 Westbound	2013	Upstream of Dean Forest Rd off-ramp: 3-lane diverge	5400-9000	3,633	3,870	237	7%	YES	-	-	-	-	237	YES	3.9
	2014	Between Dean Forest Rd off-ramp and on-ramp: 2-lane freeway	5400-9000	3,043	3,418	375	12%	YES	-	-	-	-	375	YES	6.6
	2015	Downstream of Dean Forest Rd on-ramp: 2-lane freeway	5400-9000	3,660	3,923	263	7%	YES	-	-	-	-	263	YES	4.3
	2016	Upstream of Dean Forest Rd off-ramp: 2-lane freeway	5400-9000	3,660	3,990	330	9%	YES	-	-	-	-	330	YES	5.3
	2017	Upstream of I-95 NB off-ramp: 3-lane diverge	5400-9000	3,660	3,931	271	7%	YES	-	-	-	-	271	YES	4.4
	2018	Upstream of I-95 NB on-ramp: 2-lane freeway	5400-9000	2,626	2,881	255	10%	YES	-	-	10%	YES	-	-	4.9
	2019	Downstream of I-95 NB on-ramp: 3-lane weave	5400-9000	3,171	3,399	228	7%	YES	-	-	-	-	228	YES	4.0
	2020	Downstream of I-95 SB off-ramp: 3-lane merge	5400-9000	2,345	2,521	176	7%	YES	-	-	7%	YES	-	-	3.6
	2021	Upstream of I-95 SB on-ramp: 2-lane freeway	5400-9000	2,345	2,523	178	8%	YES	-	-	8%	YES	-	-	3.6
	2022	Downstream of I-95 SB on -ramp: 3-lane merge	5400-9000	2,696	2,859	163	6%	YES	-	-	6%	YES	-	-	3.1
	2023	Upstream of Pooler Pkwy off-ramp: 2-lane freeway	5400-9000	2,696	2,887	191	7%	YES	-	-	7%	YES	-	-	3.6
	2024	Between Pooler Pkwy off-ramp and on-ramp: 2-lane freeway	5400-9000	1,739	1,822	83	5%	YES	-	-	5%	YES	-	-	2.0
	2025	Upstream of Pooler Pkwy on-ramp: 3-lane merge	5400-9000	2,148	2,258	110	5%	YES	-	-	5%	YES	-	-	2.3

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow: All Links		Individual Link Flow: < 700 vph		Individual Link Flow: 700 vph to 2,700 vph		Individual Link Flow: > 2,700 vph		GEH Statistic
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
	2026	Upstream of Pooler Pkwy on-ramp: 2-lane freeway	5400-9000	2,148	2,281	133	6%	YES	-	-	6%	YES	-	-	2.8
I-16 Westbound Ramps	2501	SR 204 on-ramp: 2-lane	5400-9000	899	944	45	5%	YES	-	-	5%	YES	-	-	1.5
	2502	I-519 off-ramp going NB:1-lane	5400-9000	460	549	89	19%	NO	89	YES	-	-	-	-	4.0
	2503	I-519 off-ramp going SB: 1-lane	5400-9000	570	573	3	1%	YES	3	YES	-	-	-	-	0.1
	2504	I-519 on-ramp from NB:1-lane	5400-9000	1,140	1,196	56	5%	YES	-	-	5%	YES	-	-	1.6
	2505	I-519 on-ramp from SB:1-lane	5400-9000	916	918	2	0%	YES	-	-	0%	YES	-	-	0.1
	2506	I-519 on-ramp from SB:1-lane	5400-9000	402	400	-2	-1%	YES	-2	YES	-	-	-	-	0.1
	2507	Chatham Pkwy lane off-ramp: 1-lane	5400-9000	373	438	65	18%	NO	65	YES	-	-	-	-	3.2
	2510	Chatham Pkwy lane on-ramp: 1-lane	5400-9000	897	938	41	5%	YES	-	-	5%	YES	-	-	1.3
	2511	Dean forest lane off-ramp: 1-lane	5400-9000	490	467	-23	-5%	YES	-23	YES	-	-	-	-	1.1
	2514	Dean forest lane on-ramp: 1-lane	5400-9000	633	596	-37	-6%	YES	-37	YES	-	-	-	-	1.5
	2515	I-95 lane off-ramp going NB: 1-lane	5400-9000	1,034	1,099	65	6%	YES	-	-	6%	YES	-	-	2.0
	2516	I-95 lane off-ramp going SB: 1-lane	5400-9000	826	882	56	7%	YES	-	-	7%	YES	-	-	1.9
	2517	I-95 lane on-ramp from NB: 2-lane	5400-9000	543	536	-7	-1%	YES	-7	YES	-	-	-	-	0.3
	2518	I-95 lane on-ramp from SB: 1-lane	5400-9000	351	344	-7	-2%	YES	-7	YES	-	-	-	-	0.4
	2519	Pooler Pkwy lane off-ramp: 1-lane	5400-9000	957	1,058	101	11%	YES	-	-	11%	YES	-	-	3.2
	2523	Pooler Pkwy lane on-ramp: 1-lane	5400-9000	431	453	22	5%	YES	22	YES	-	-	-	-	1.1
I-95 Northbound	3001	Upstream of Abercorn Expy off-ramp:3-lane freeway	5400-9000	2,940	2,932	-8	0%	YES	-	-	-	-	-8	YES	0.2
	3002	Upstream of Abercorn Expy off-ramp:4-lane diverge	5400-9000	2,940	2,867	-73	-2%	YES	-	-	-	-	-73	YES	1.4
	3003	Between Abercorn Expy off-ramp and on-ramp: 3-lane freeway	5400-9000	2,274	2,262	-12	-1%	YES	-	-	-1%	YES	-	-	0.3
	3004	Downstream of Abercorn Expy on-ramp:4-lane merge	5400-9000	2,717	2,661	-56	-2%	YES	-	-	-	-	-56	YES	1.1
	3005	Upstream of I-16 EB off-ramp:3-lane freeway	5400-9000	2,717	2,699	-18	-1%	YES	-	-	-	-	-18	YES	0.4
	3006	Upstream of I-16 EB off-ramp:4-lane diverge	5400-9000	2,717	2,643	-74	-3%	YES	-	-	-	-	-74	YES	1.4
	3007	Upstream of I-16 on-ramp from EB: 3-lane freeway	5400-9000	2,074	2,054	-20	-1%	YES	-	-	-1%	YES	-	-	0.4
	3008	Between I-16 on-ramp from EB and I-16 WB off-ramp:4-lane weave	5400-9000	2,241	2,196	-45	-2%	YES	-	-	-2%	YES	-	-	1.0
	3009	Downstream of I-16 WB off-ramp: 3-lane merge	5400-9000	1,527	1,672	145	9%	YES	-	-	9%	YES	-	-	3.6
	3010	Upstream of I-16 WB on-ramp:3-lane freeway	5400-9000	1,527	1,667	140	9%	YES	-	-	9%	YES	-	-	3.5
	3011	Downstream of I-16 WB on-ramp: 4-lane merge	5400-9000	2,561	2,761	200	8%	YES	-	-	8%	YES	-	-	3.9
	3012	Downstream of I-16 WB on-ramp: 3-lane freeway	5400-9000	2,561	2,784	223	9%	YES	-	-	9%	YES	-	-	4.3
	3013	Between Louisville off-ramp and on ramp: 3-lane freeway	5400-9000	2,134	2,400	266	12%	YES	-	-	12%	YES	-	-	5.6
	3014	Downstream of Louisville on-ramp: 4-lane merge	5400-9000	2,955	3,149	194	7%	YES	-	-	-	-	194	YES	3.5
	3015	Downstream of Louisville on-ramp: 3-lane freeway	5400-9000	2,955	3,191	236	8%	YES	-	-	-	-	236	YES	4.3
I-95 Northbound Ramps (Excludes I-16 Ramps)	3501	Abercorn Expy off-ramp: 1-lane	5400-9000	666	654	-12	-2%	YES	-12	YES	-	-	-	-	0.5
	3504	Abercorn Expy on-ramp: 1-lane	5400-9000	443	427	-16	-4%	YES	-16	YES	-	-	-	-	0.8
	3505	Louisville Rd off-ramp: 1-lane	5400-9000	427	376	-51	-12%	YES	-51	YES	-	-	-	-	2.6

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph		
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met	
	3508	Louisville Rd on-ramp: 1-lane	5400-9000	821	786	-35	-4%	YES	-	-	-4%	YES	-	-	1.2
I-95 Southbound	4001	Upstream of Louisville Rd off-ramp: 3-lane freeway	5400-9000	3,116	3,108	-8	0%	YES	-	-	-	-	-8	YES	0.1
	4002	Upstream of Louisville Rd off-ramp: 4-lane diverge	5400-9000	3,116	3,026	-90	-3%	YES	-	-	-	-	-90	YES	1.6
	4003	Between Louisville off-ramp and on ramp: 3-lane freeway	5400-9000	2,548	2,531	-17	-1%	YES	-	-	-1%	YES	-	-	0.3
	4004	Downstream of Louisville on-ramp: 4-lane merge	5400-9000	3,152	3,092	-60	-2%	YES	-	-	-	-	-60	YES	1.1
	4005	Downstream of Louisville on-ramp: 3-lane freeway	5400-9000	3,152	3,109	-43	-1%	YES	-	-	-	-	-43	YES	0.8
	4006	Upstream of I-16 WB off-ramp:4-lane diverge	5400-9000	3,152	3,067	-85	-3%	YES	-	-	-	-	-85	YES	1.5
	4007	Upstream of I-16 WB on-ramp:3-lane freeway	5400-9000	2,801	2,752	-49	-2%	YES	-	-	-	-	-49	YES	0.9
	4008	Between I-16 on-ramp from WB and I-16 EB off-ramp:4-lane weave	5400-9000	3,641	3,614	-27	-1%	YES	-	-	-	-	-27	YES	0.4
	4009	Downstream of I-16 WB off ramp: 4 lane merge	5400-9000	2,882	2,887	5	0%	YES	-	-	-	-	5	YES	0.1
	4010	Upstream of I-16 EB on-ramp:3-lane freeway	5400-9000	2,882	2,882	0	0%	YES	-	-	-	-	0	YES	0.0
	4011	Downstream of I-16 EB on-ramp:4-lane merge	5400-9000	3,113	3,165	52	2%	YES	-	-	-	-	52	YES	0.9
	4012	Upstream of Abercorn Expy off-ramp:3-lane freeway	5400-9000	3,113	3,208	95	3%	YES	-	-	-	-	95	YES	1.7
	4013	Upstream of Abercorn Expy off-ramp:4-lane diverge	5400-9000	3,113	3,158	45	1%	YES	-	-	-	-	45	YES	0.8
	4014	Between Abercorn Expy off-ramp and on-ramp: 3-lane freeway	5400-9000	2,362	2,445	83	4%	YES	-	-	4%	YES	-	-	1.7
	4015	Downstream of Abercorn Expy on-ramp:4-lane merge	5400-9000	2,939	2,977	38	1%	YES	-	-	-	-	38	YES	0.7
	4016	Downstream of Abercorn Expy on-ramp:4-lane freeway	5400-9000	2,939	3,019	80	3%	YES	-	-	-	-	80	YES	1.5
I-95 Southbound Ramps (Excludes I-16 Ramps)	4501	Louisville Rd off-ramp: 1-lane	5400-9000	568	564	-4	-1%	YES	-4	YES	-	-	-	-	0.2
	4504	Louisville Rd on-ramp: 1-lane	5400-9000	604	585	-19	-3%	YES	-19	YES	-	-	-	-	0.8
	4505	Ft. Argyle off-ramp: 1-lane	5400-9000	766	752	-14	-2%	YES	-	-	-2%	YES	-	-	0.5
	4508	Ft. Argyle on-ramp: 1-lane	5400-9000	577	563	-14	-2%	YES	-14	YES	-	-	-	-	0.6
I-516 Northbound and Ramps (Excludes I-16 Ramps)	5001	Upstream of Tremont Rd on-ramp: 2-lane freeway	5400-9000	2,562	2,857	295	12%	YES	-	-	12%	YES	-	-	5.7
	5002	Downstream of Tremont Rd on-ramp: 3-lane weave	5400-9000	2,981	3,144	163	5%	YES	-	-	-	-	163	YES	2.9
	5003	Downstream of off-ramp to I-16 EB and WB: 2-lane freeway	5400-9000	1,469	1,456	-13	-1%	YES	-	-	-1%	YES	-	-	0.3
	5004	Downstream of on-ramp from I-16 EB:3-lane merge	5400-9000	1,766	1,730	-36	-2%	YES	-	-	-2%	YES	-	-	0.9
	5005	Upstream of on-ramp from I-16 WB:2-lane freeway	5400-9000	1,766	1,742	-24	-1%	YES	-	-	-1%	YES	-	-	0.6
	5006	Between I-16 WB on-ramp and W Gwinnett St off-ramp: 3-lane weave	5400-9000	2,166	2,268	102	5%	YES	-	-	5%	YES	-	-	2.2
	5007	Downstream of W Gwinnett St off-ramp: 2-lane	5400-9000	1,825	1,965	140	8%	YES	-	-	8%	YES	-	-	3.2
	5501	Tremont Rd on-ramp: 1-lane	5400-9000	312	289	-23	-7%	YES	-23	YES	-	-	-	-	1.3
	5502	W Gwinnett St off-ramp: 1-lane	5400-9000	343	331	-12	-4%	YES	-12	YES	-	-	-	-	0.7
I-516 Southbound and Ramps (Excludes I-16 Ramps)	6001	Upstream of W Gwinnett St off-ramp: 2-lane	5400-9000	1,981	2,057	76	4%	YES	-	-	4%	YES	-	-	1.7
	6002	Between W Gwinnett St on-ramp and I-16 EB off-ramp: 3-lane weave	5400-9000	2,411	2,456	45	2%	YES	-	-	2%	YES	-	-	0.9
	6003	Downstream of off-ramp to I-16 WB and EB: 2-lane freeway	5400-9000	1,495	1,559	64	4%	YES	-	-	4%	YES	-	-	1.6
	6004	Downstream of on-ramp from I-16 WB: 3-lane merge	5400-9000	1,965	2,115	150	8%	YES	-	-	8%	YES	-	-	3.3
	6005	Upstream of on-ramp from I-16 EB: 2-lane freeway	5400-9000	1,965	2,116	151	8%	YES	-	-	8%	YES	-	-	3.4

Roadway	VISSIM Link Number	Location	Hour	Peak Hour Count Volume (vph)	VISSIM Model Volume (vph)	Difference	Individual Link Flow								GEH Statistic	
							All Links		< 700 vph		700 vph to 2,700 vph		> 2,700 vph			
							Within 15%vph	Criteria Met	Within 100vph	Criteria Met	Within 15%	Criteria Met	Within 400vph	Criteria Met		
	6006	Upstream of Tremont Rd off-ramp: 3-lane weave	5400-9000	2,841	3,001	160	6%	YES	-	-	-	-	160	YES	3.0	
	6007	Downstream of Tremont Rd on-ramp: 2-lane freeway	5400-9000	2,769	2,825	56	2%	YES	-	-	-	-	56	YES	1.1	
	6501	W Gwinnett St on-ramp: 1-lane	5400-9000	430	418	-12	-3%	YES	-12	YES	-	-	-	-	0.6	
	6502	Tremont Rd off-ramp: 1-lane	5400-9000	172	173	1	1%	YES	1	YES	-	-	-	-	0.1	
Total				**263,357**	**274,198**	**10,841**										
Sum of all Link Flows					**4.1%**											
Sum of all Link Flows (Flows > 85% and GEH Statistic < 5)					**YES**											
Total Count							141	138	30	30	70	70	41	41	141	128
Individual Links							**98%**		**100%**		**100%**		**100%**		**91%**	
Individual Links (Flows met for >85% Cases and GEH Statistic < 5 for 85% of Cases)							**YES**		**YES**		**YES**		**YES**		**YES**	

8.1.3 Sum of All Link Flows

The sum of individual link flows for all freeway and arterial links within the VISSIM network was compared to the sum of existing condition traffic volumes for these links. Both the a.m. and p.m. peak period models followed similar trend in terms of percent difference within each hour of the peak period. Table 23 provides a summary of the sum of link flows for the a.m. and p.m. peak periods. At a network level, the percent difference between modeled and observed volumes has to be within FHWA's 5 percent calibration target criteria (Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, Page 64, Section 5.6). Both a.m. and p.m. peak hour difference percentages are below FHWA's 5 percent calibration target area.

Table 23: Sum of Link Flows

Peak Period	Simulation Hour	Sum of all Link Flows (Observed)	Sum of all Link Flows (Modeled)	Difference	Difference Percentage (%)	Criteria	Criteria Met
A.M.	Peak	237,757	232,742	-5,015	-2.1%	±5%	YES
P.M.	Peak	263,357	274,198	+10,841	+4.1%	±5%	YES

8.2 Travel Time/Speed Data (Modeled Versus Observed)

Travel time segments were defined in both the a.m. and p.m. peak period VISSIM models to generate the modeled travel time information in the form of text files. To identify and quantify congestion in the network, travel time data were collected in the field using probe vehicles to assist in the calibration process. Travel time runs were conducted in February 2016. The average values of all travel time runs were used for the VISSIM model calibration. The field-collected travel time data are provided in Table 1 in Section 3 of this report. The modeled travel times were compared to the field-collected travel time information. Tables 24 and 25 present the travel time calibration results for the a.m. and p.m. peak hour models, respectively. According to FHWA's toolbox III, the criteria for travel times are met if the modeled travel times are within 15 percent of the field-measured travel time information (Page 64, Section 5.6). The calibrated a.m. peak period model met the criteria for travel time, with 94 percent of the freeway segments evaluated producing modeled values within the minimum and maximum travel times observed in the field. Therefore, it can be concluded that the a.m. peak model accurately reflects the field-observed travel times. Similar to the a.m. peak period, the calibrated p.m. peak period model met the criteria for travel time. Approximately 89 percent of the freeway segments evaluated produced modeled values within the minimum and maximum travel times observed in the field. Therefore, it can be concluded that the p.m. peak model accurately reflects the field-observed travel times.

8.3 Visual Audits for Bottlenecks

Field visits were conducted to identify visual bottlenecks, speed drop zones, and maximum backup of queues in the study area. Visual audits of the simulation runs were performed to verify the formation of these bottlenecks/queues in the a.m. and p.m. peak period VISSIM models. Based on the visual audits performed, the a.m. and p.m. peak period simulation models reasonably replicate the bottlenecks, speed drop zones, and maximum backup of queues in the study area.

Table 24: Existing Conditions – Travel Time Comparison – A.M. Peak Hour

Direction	Approximate Locations		Distance (mi)	Observed			Modeled		Threshold Met?
				Travel Time (MM:SS)	15% Range (MM:SS)		Travel Time (MM:SS)	Speed (mph)	
	From	To		Average	Min	Max			
I-16 EB	Pooler	SR204 Split	10.3	13:13	11:14	15:12	14:17	43	**YES**
	Pooler	W Gwinnett	10.6	17:55	15:14	20:36	15:15	42	**YES**
	Pooler	Ogeechee	11.4	14:06	11:59	16:13	15:14	45	**YES**
I-16 WB	SR204 Split	Pooler	10.3	9:51	8:22	11:20	10:34	58	**YES**
	SR204 Split	Abercorn	13.1	15:58	13:34	18:22	14:25	55	**YES**
	SR204 Split	Louisville	11.2	11:19	9:37	13:01	10:55	62	**YES**
I-95 NB	Abercorn	Louisville	9.5	8:16	7:01	9:30	8:55	64	**YES**
	Abercorn	SR204 Split	13.1	14:55	12:41	17:09	16:39	47	**YES**
	Abercorn	W Gwinnett	13.5	16:31	14:02	19:00	17:51	45	**YES**
I-95 SB	Louisville	Abercorn	9.5	8:02	6:49	9:14	9:03	63	**YES**
	Louisville	SR204 Split	11.2	14:26	12:16	16:36	15:45	43	**YES**
	Louisville	Ogeechee	12.0	16:07	13:42	18:32	16:46	43	**YES**
I-516 NB	Ogeechee	Pooler	11.4	12:49	10:54	14:44	12:05	57	**YES**
	Ogeechee	Louisville	12.0	14:11	12:03	16:19	12:25	58	**YES**
	Ogeechee	W Gwinnett	2.5	2:41	2:17	3:05	2:52	52	**YES**
I-516 SB	W Gwinnett	Pooler	10.6	11:49	10:03	13:35	10:42	59	**YES**
	W Gwinnett	Abercorn	13.5	20:06	17:05	23:07	14:41	55	**NO**
	W Gwinnett	Ogeechee	2.5	2:47	2:22	3:12	2:53	52	**YES**
Travel Time (Meet Threshold for >85% of cases)									**94%**

Table 25: Existing Conditions – Travel Time Comparison – P.M. Peak Hour

Direction	Approximate Locations		Distance (mi)	Observed			Modeled		Threshold Met?
				Travel Time (MM:SS)	15% Range (MM:SS)		Travel Time (MM:SS)	Speed (mph)	
	From	To		Average	Min	Max			
I-16 EB	Pooler	SR204 Split	10.3	10:59	9:20	12:37	10:32	59	YES
	Pooler	W Gwinnett	10.6	14:01	11:55	16:07	11:33	55	NO
	Pooler	Ogeechee	11.4	13:39	11:36	15:42	11:44	58	YES
I-16 WB	SR204 Split	Pooler	10.3	11:34	9:50	13:18	13:07	47	YES
	SR204 Split	Abercorn	13.1	17:11	14:36	19:45	16:17	48	YES
	SR204 Split	Louisville	11.2	14:24	12:14	16:34	13:12	51	YES
I-95 NB	Abercorn	Louisville	9.5	8:02	6:49	9:14	8:54	64	YES
	Abercorn	SR204 Split	13.1	12:25	10:33	14:17	13:10	60	YES
	Abercorn	W Gwinnett	13.5	15:00	12:45	17:14	14:15	57	YES
I-95 SB	Louisville	Abercorn	9.5	8:16	7:01	9:30	8:58	64	YES
	Louisville	SR204 Split	11.2	12:00	10:12	13:48	11:35	58	YES
	Louisville	Ogeechee	12.0	12:39	10:45	14:32	12:47	56	YES
I-516 NB	Ogeechee	Pooler	11.4	15:41	13:20	18:02	14:33	47	YES
	Ogeechee	Louisville	12.0	18:13	15:29	20:57	14:42	49	NO
	Ogeechee	W Gwinnett	2.5	2:47	2:22	3:12	2:53	52	YES
I-516 SB	W Gwinnett	Pooler	10.6	12:25	10:33	14:16	13:33	47	YES
	W Gwinnett	Abercorn	13.5	18:47	15:58	21:36	16:51	48	YES
	W Gwinnett	Ogeechee	2.5	2:41	2:17	3:05	2:54	52	YES
Travel Time (Meet Threshold for >85% of cases)									**89%**

9 SUMMARY

This report documents the VISSIM existing conditions model development and calibration effort for the a.m. and p.m. peak periods in the study area. These models will serve as the basis for comparison of future alternatives. FHWA's Traffic Analysis Toolbox Volume III calibration criteria for traffic volumes, travel times, and speeds for the a.m. and p.m. peak period VISSIM models were met. Visual audits of the VISSIM simulation showed buildup and dissipation of congestion consistent with field observations. The VISSIM existing condition models reflect the existing traffic operations during the a.m. and p.m. peak periods in the study area. Calibrated VISSIM and Synchro files are included in Appendix C.

Changes to the calibration parameters used in the VISSIM existing conditions models might be required for future build conditions if geometric improvements are proposed to address capacity issues near the bottleneck locations identified in the existing conditions. Any changes made to the existing conditions calibration parameters in the future build condition VISSIM models will be documented in the IMR.

10 REFERENCES

1. Dowling, R., A. Skabardonis, and V. Alexiadis. 2004. Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Software. FHWA. U.S. Department of Transportation. July.
2. Gomes, Gabriel, Adolf May, and Roberto Horowitz. 2004. Calibration of VISSIM for a Congested Freeway. California PATH Research Report – UCB-ITS-PRR-2004-4. March.
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4. FHWA. 2010. Interstate System Access Informational Guide. U.S. Department of Transportation. Office of Infrastructure. August.
5. Mai, C., McDaniel-Wilson, C., Norval, D., Upton, D., Auth, J., Schuytema, P., Abbott, S., and R. Delahanty. 2011. Protocol for VISSIM Simulation. Oregon Department of Transportation. June.
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8. Oregon Department of Transportation. 2016. PTV Vision Software Network Setup Guide. May.
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APPENDIX A

Volume Projection Approach and Existing Year Volumes (Submitted Electronically)

Department of Transportation
State of Georgia

INTERDEPARTMENT CORRESPONDENCE

FILE Chatham County
P.I. # 0012757, 0012758

OFFICE Planning

DATE March 5, 2016

FROM Cynthia L. VanDyke, State Transportation Planning Administrator

TO Albert Shelby, State Program Delivery Engineer
Attention: Andrew Hoening

SUBJECT **Reviewed** Existing Traffic Diagrams, and Traffic Forecasting Methodology Document for I-16 FROM I-95 TO I-516 and I-16 @ I-95 INTERCHANGE RECONSTRUCTION

Per request, we have reviewed the consultant's existing traffic diagrams, Traffic Forecasting Methodology document for the above projects. Based on the information furnished, we find the existing traffic diagrams, traffic forecasting methodology document to be satisfactory and recommend a notice to proceed to conduct traffic forecasting for the above project.

If you have any questions concerning this information please contact Andre Washington at (404) 631-1925.

CLV/AMW

APPENDIX B

Quality Control Sheets

ARCADIS INFRASTRUCTURE DIVISION
QA/QC ACKNOWLEDGEMENT FORM

Project Name:	I-16 at I-95 Interchange Reconstruction
Project No.:	GAGEC004 (PI# 0012757 and 0012758)
Facility/Project Location:	Savannah, GA
Discipline:	Infrastructures
Work Product: (briefly describe the work being reviewed)	Existing condition VISSIM calibration report.
Milestone: (briefly describe the status of work product being reviewed)	The report is going to be submitted to GDOT for approval.

Detail Check

If Independent Technical Review is required, attach a 2nd QA/QC form. Check with PM for appropriate level of review.

Independent Technical Review

Minimum ITR Scope

1. Has ARCADIS complied with the scope and contract (attached)?
2. Has the standard of care for the industry been applied (e.g., have the appropriate standards and accepted practices been followed)?
3. Are the assumptions and conclusions reasonable?

Notes to Reviewer:

N/A

Attachments: Attach mark-ups, back-check document, or comment summary for each iteration as appropriate.

Quality Review Signoff: Signoff signifies that all QA/QC functions have been conducted in accordance with ARCADIS policy and meet client requirements and the project-specific Quality Control Plan.

Preparer:	Reza Taromi [signature]	**Date Submitted for Review:**	6/24/2016
Reviewer:	Jody Peace [signature]	**Date Review Completed:**	6/29/2016
Preparer Backcheck:	Reza Taromi [signature]	**Date Backcheck Completed:**	7/1/2016
Revisions Incorporated by:	Reza Taromi [signature]	**Date Incorporation Completed:**	7/6/2016
Verification:	Jody Peace [signature]	**Date of Verification:**	7/6/2016

Preparer – Staff responsible for work and self-checking for errors and omissions throughout preparation.
Reviewer – Detail Check: scan or hardcopy (yellow = correct, red = revision); electronic files (show revisions in tracked changes or comment box). ITR: mark up document with comments or attach separate page. At a minimum, respond to questions above and any others relevant to attached scope or technical criteria.
Preparer Backcheck – Concur (check mark/accept changes); do not concur (X mark/comment box). See PM or senior technical staff as appropriate for resolution of non-concurrence.
Revisions Incorporated by Preparer or Other Staff; attach Preparer Back-check document.
Verification by – Assigned QC reviewers verify incorporation of revisions.

APPENDIX C

VISSIM and Synchro Files (Submitted Electronically)

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