Appendix C-2
VISSIM Development and Calibration Report

I-81 Viaduct Project

Onondaga County, New York

VISSIM DEVELOPMENT AND CALIBRATION REPORT

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Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

The New York State Department of Transportation (NYSDOT) is proposing to address the existing structural, geometric, and operational deficiencies of I-81 from approximately Colvin Street to Hiawatha Boulevard (the "I-81 Viaduct Project") in the City of Syracuse, New York. NYSDOT is also investigating modifications along I-690 between its interchange at West Street and Lodi Street and potential improvements on I-481 from its southern to northern termini. In cooperation with the Federal Highway Administration (FHWA), NYSDOT is preparing an Environmental Impact Statement (EIS) to summarize transportation, social, economic, and environmental impacts of four project alternatives, including No Build Alternative, one Viaduct Alternative, and two Community-Grid Alternatives.

Integral to the EIS process is the development of a traffic simulation model (VISSIM) that will be used to predict the outcome of the proposed roadway system changes and help select a preferred alternative. More specifically, the traffic simulation model would support the following activities:

- Identify existing and future traffic congestion/safety problems.
- Support the development of I-81 Viaduct Project alternatives.
- Provide information for project evaluation.
- Provide inputs for environmental or other analyses (e.g., cost-benefit analysis).
- Address specific concerns of the public and other project stakeholders.

The purpose of this technical memorandum is to document the methodology followed to build and calibrate a detailed VISSIM simulation model for the I-81 Viaduct Project. The methodology describes the approach, source data, assumptions, technical tools, and calibration and validation procedure for developing a VISSIM model capable of serving as a testing tool for the operation of roadway design alternatives and their impact on the transportation system. The methodology builds on currently available state-of-the-practice techniques, with a goal of providing reliable results to meet the Federal mandates and standards for accuracy.

2. VISSIM MODEL DEVELOPMENT

For the I-81 Viaduct Project, a VISSIM model was selected as the environment for simulation modeling and used to investigate detailed geometric and traffic operational and safety issues. The VISSIM model development involves a number of steps, including model area, analysis years, analysis peak periods, data input, base model development, and model calibration and validation. Establishing the model area, analysis years, analysis peak periods, data input, and base model development are discussed below, and model calibration and validation are discussed in Sections 3 and 4).

2.1 Overview of VISSIM Software

The I-81 Viaduct simulation models were developed using the VISSIM simulation software (Version 5.40-08) developed by PTV. VISSIM is a microscopic, time-step and behavior-based model which analyzes multi-modal traffic flows with the flexibility of modeling all types of geometries and traffic

control schemes. Therefore, VISSIM simulation modeling is a very useful tool to help predict the outcomes of a proposed change to the roadway system and assist in evaluating the advantages and disadvantages of design alternatives within the urban environment.

VISSIM can generate a wide range of performance measures for traffic operational analysis, and its trajectory files can be incorporated into FHWA's Surrogate Safety Assessment Model (SSAM) to produce surrogate safety measures used to quantify the likelihood of accident frequency and severity associated with the proposed alternatives. Furthermore, VISSIM simulation modeling can generate AVI files for 3-D simulation runs, to provide a visual tool to help convey operational performance of the improvement alternatives to non-technical audiences. More detailed descriptions of the VISSIM model can be found in the VISSIM User Manual – Version 5.40.

2.2 Simulation Study Area

The VISSIM model extents, as shown in Figure 1, consist of the I-81, I-690, I-481, and I-90 interstate system and surface streets that could be affected by the project, including Downtown Syracuse and University Hill, extending south to East Castle/Stratford Streets, north to Hiawatha Boulevard, west to South West Street, and east to Westcott Street. The model area was purposely defined as the area where a major shift in local traffic using alternate routes could occur as a result of the reconstruction or removal of the I-81 viaduct. The geographic scope and level of detail were developed specifically to allow for a detailed area-wide assessment of transportation needs and options.

2.3 Base Year/Future Analysis Years

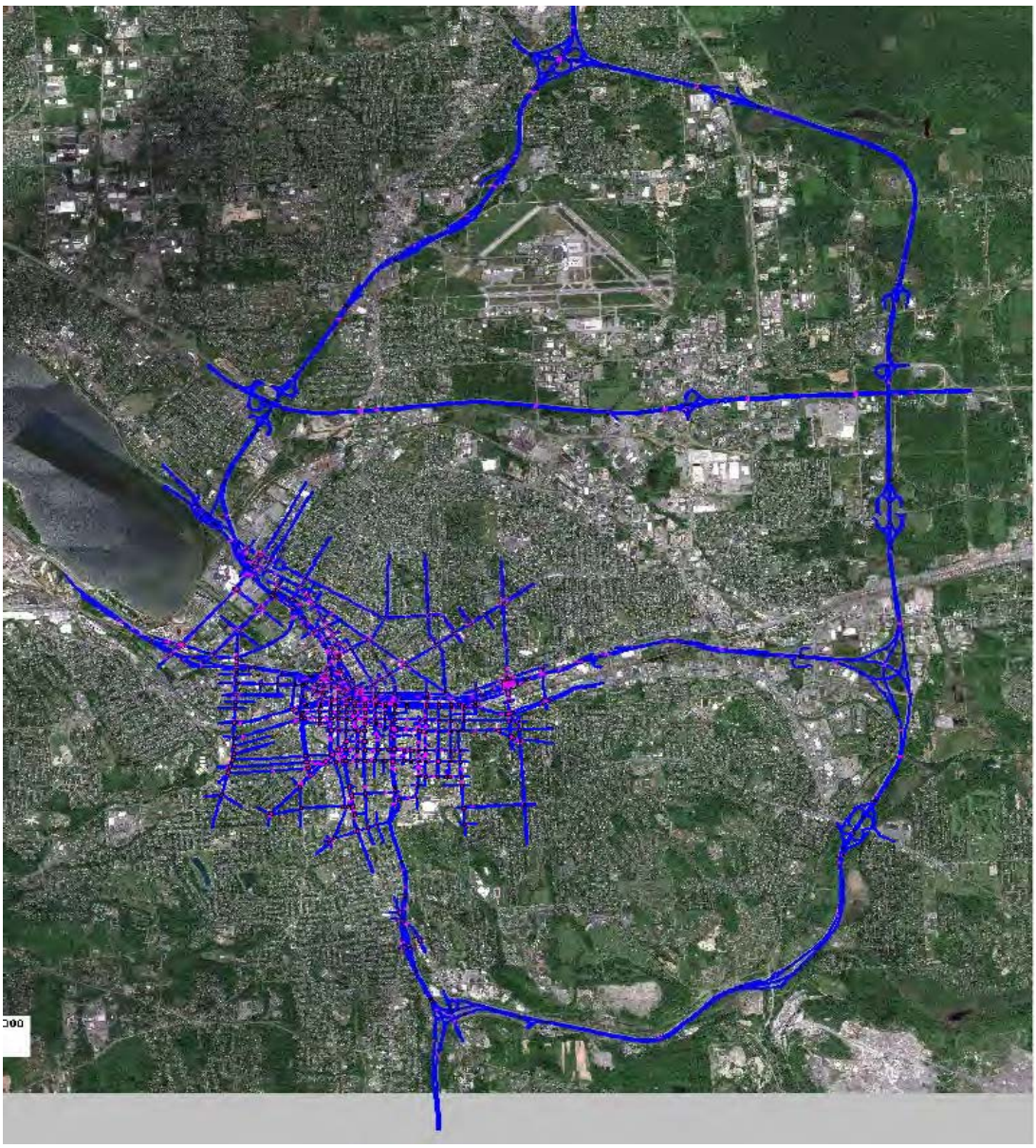
The base year selected for the VISSIM traffic analysis is 2013 and the future analysis years include the estimated-time-of-completion (ETC) year 2020 and design year 2050 (ETC+30). Traffic analysis during the worst-case construction year may also be performed if deemed necessary. The ETC year is the calendar year that the built project is expected to commence operation. The design year is the horizon year representing the end of the economic life of a proposed transportation improvement.

2.4 Analysis Peak Periods

For the future analysis years, the VISSIM simulation model requires input volumes generated by the Syracuse Metropolitan Transportation Council (SMTC) regional travel demand model which only provides hourly volume forecasts for each of four time periods – AM peak hour, midday off-peak hour, PM peak hour, and evening off-peak hour. Therefore, the VISSIM modeling periods for this project include the one-hour AM (7:30 – 8:30) and PM (4:30 – 5:30) periods in which traffic volumes reach their highest levels. These one-hour analysis periods are reasonable because:

- A vast majority of roadway segments within the project area do not have hourly volumes which are over-capacity
- A 30-minute seeding period (before the peak hour of interest) was used to reflect build-up of peak congestion or account for peak hour spreading
- Although traffic volumes were entered into the network in vehicles per hour (vph), vehicles enter the network based on a Poisson distribution, reflecting time-varying congestion or traffic fluctuations within the total modeling period.

Figure 1: VISSIM Model Network Extents



2.5. Data Collection and Preparation

A database of existing physical and operational characteristics of the study area was established to assist in the VISSIM model development, including existing traffic data, transit data, and roadway data. Since the VISSIM model is ultimately used to predict how well the roadways operate under

alternative scenarios and future analysis years, data related to future transportation projects to be implemented within the study area and future year traffic volume predictions also were assembled.

To minimize the cost and time for field data collection, this project adopted a three-step procedure to assemble the data:

- Identify readily available data from various public agencies.
- Review the available database to determine whether it is current and suitable for the VISSIM model development.
- Collect supplemental data for model development to fill the gaps and/or to update the available database.

After reviewing all readily available data pertaining to the study area, existing data was utilized to the greatest extent possible. However, additional data were required to supplement existing data, because the traffic network established for this project is larger than those of previous studies. Therefore, traffic data collection plans (see Appendix A) were prepared for collecting new automatic traffic recorder (ATR) volume counts, manual turning movement and vehicle classification counts, pedestrian crosswalk counts, and travel time surveys for those areas where available data did not exist. All data items collected and used for VISSIM model development are listed in Table 1 and the main data items are briefly described below.

Table 1: Data Items used for VISSIM Development

Data Item	Source(s)	VISSIM Incorporation
Road survey video data (2013)	I-81 Viaduct Project	Roadway geometry, turn restrictions, number of lanes, lane assignment
Streetview imagery	Google	Confirm roadway geometry, turn restrictions, parking regulations
Traffic signal timing plans	City of Syracuse, NYSDOT	Detector placement, signal phasing, splits, offsets
Synchro files (AM and PM weekday peak hours)	City of Syracuse, NYSDOT	Signal phasing, split, offset
Vehicle speed reports	I-81 Corridor Study, NYSDOT website	Speed distributions
ATR counts	I-81 Viaduct Project, I-81 Corridor Study, SMTC website, NYSDOT website	Route decision splits, vehicle inputs, vehicle compositions
Turning movement counts	I-81 Viaduct Project, I-81 Corridor Study, SMTC website, NYSDOT website	Route decision splits, vehicle inputs, vehicle compositions, pedestrian demand, bike demand
Vehicle classification counts	Stantec, NYSDOT website	Route decision splits, vehicle inputs, vehicle compositions
Map of Onondaga County bus	Centro website	Develop transit routes, route stops

routes		
Centro Bus Schedule	Centro website	Bus route schedule, bus demand along transit routes
Speed Limits Google earth.kmz	Google	Speed decision locations, desired speeds, vehicle compositions
Various field observations, notes, video logs	I-81 Viaduct Project	Fine calibration adjustments, matching traffic congestion pattern, queues
Vehicle travel times (select corridors)	I-81 Viaduct Project	Model validation
Existing conditions partial VISSIM network	I-81 Corridor Study	Sub-area base network coding, expanded upon
Pedestrian crossing counts	I-81 Viaduct Project, I-81 Corridor Study	Develop pedestrian-crossing at selected key intersections
Bicycle routes	City of Syracuse, SMTC	Incorporate bicycle exclusive lanes and shared lanes into network
List of planned transportation improvements	City of Syracuse, NYSDOT	Confirm roadway geometry, turn restrictions, number of lanes, lane assignment
Downtown Syracuse Two-Way Feasibility Technical Analysis Report	SMTC	Intersection configurations in corridors where two-way conversions are recommended/planned
Downtown Syracuse Two-Way Feasibility Technical Analysis Synchro Files	SMTC	Planned signal phasing, splits, offsets in downtown area
Turning movement forecasts for all intersections (AM and PM Peak hours)	SMTC Travel Demand Model	Route decision splits, vehicle inputs
Select link analysis query results	SMTC Travel Demand Model	Route decision splits, vehicle inputs
I-690 Teall/Beech VISSIM network	I-81 Viaduct Project	Base network for future configuration in I-690 study area
Pass through traffic study	I-81 Corridor Study	Vehicles travel through or around Syracuse without an internal origin or destination

2.5.1 Existing Traffic Data

Data related to travel and operational characteristics of the interstate system and key surface streets within the study area were collected. They include:

- Automatic Traffic Recorder (ATR) counts
- Turning movement counts (TMC)
- Vehicle classification
- Origin-destination information
- Travel time and delay
- On- and off-street parking
- Bicycle and pedestrian counts

Origin-destination (O-D) information represents O-D trip patterns generated from the SMTC regional travel demand model (Version 4.041) and recently validated by Airsage's O-D transportation planning data. Vehicle classification data include three mode categories: passenger cars, buses, and trucks (vehicles with two or more axles and six tires or more). ATR and TMC data were assembled to develop the base year (2013) balanced traffic volume diagrams used to establish traffic demands for use in the VISSIM simulation. Development of 2013 balanced volume diagrams involved the following steps:

- **Traffic count adjustments** – All available ATR and TMC data were digitized, and formatted into a single structured database. All counts collected prior to 2013 were factored using an annual growth rate of 0.3% (estimated from the SMTC model) to represent the common base year of 2013. Counts were adjusted from the month the count was taken to a "seasonal peak period" which represents average volume levels for the fall season, which is historically the busiest time of year within the study area.

- **Peak Hour Determination** – Counts taken at 15-minute intervals were summed to produce hourly volumes at increments of 15 minutes. The 60-minute windows with the greatest total vehicular volume were determined to be 7:30-8:30 AM and 4:30-5:30PM for the morning and afternoon commuter peaks, respectively.

- **Geo-Coding of Count Data** – A separate GIS database was created for visual reference and to support map creation. To accomplish this, each count was associated with a geographic point and each turning movement counted was associated with a corresponding GIS feature arrow. GIS feature arrows were jointed with count data to produce unbalanced traffic volume diagrams.

- **Data Mapping to VISSIM Network** – Every location where a link branches off into multiple connectors forms a "Route Decision". A spreadsheet was developed which assigns a particular turn movement from the dataset to every such connector in the VISSIM network.

- **Volume Balancing Procedure** – An algorithm was developed in Python, which invokes a bi-proportional procedure to vary link flows and turning movements iteratively in order to converge on a set of balanced volumes. The volume balancing algorithm was given the VISSIM network geometry and associated volumes for each peak period as input to produce a set of balanced volumes for the AM and PM peaks.

2.5.2 Existing Transit Data

An inventory of existing bus service and usage within the study area was collected and used in developing the simulations. The bus data include bus routes, schedules, bus stop locations and loading areas, ridership, and average dwell times.

2.5.3 Existing Roadway Data

A physical inventory of the major roadways was conducted within the study area to gather information about the existing roadway geometries and traffic control regulations, as follows:

- Lane, shoulder, and median widths
- Number of lanes
- Direction of travel
- Intersection configuration
- Traffic control devices (including signal, signs, and pavement markings)
- Posted speed limits
- Traffic/parking regulations
- Truck routes
- Off-street parking
- Horizontal and vertical clearances
- Alignment constraints
- Location and profile controls
- Typical roadway sections
- Sidewalks.

2.5.4 Future Transportation Projects

Future committed/programmed highway improvement projects were assembled for updating the VISSIM transportation networks for the forecast years of 2020 and 2050. A list of future highway improvement projects (obtained from SMTC) included, respectively, in 2020 and 2050 VISSIM networks is illustrated in Appendix B.

2.5.5 Future Traffic Volumes

The future year SMTC traffic volumes (including link volumes and turning movements) were compiled to establish traffic demand and route choice input for the VISSIM simulation. However, this demand data conversion is not straightforward due to the required volume adjustment process used to obtain future year traffic prediction. Therefore, an automatic interface program was developed to expedite the transfer of traffic data between the SMTC and VISSIM models, as shown in Figure 2. The basic steps in the data conversion process are summarized as follows:

- **Geometry Mapping** – To transfer information between the SMTC, VISSIM, and the intermediate modules, a program was developed to establish an index joining the geometric features of both model datasets.

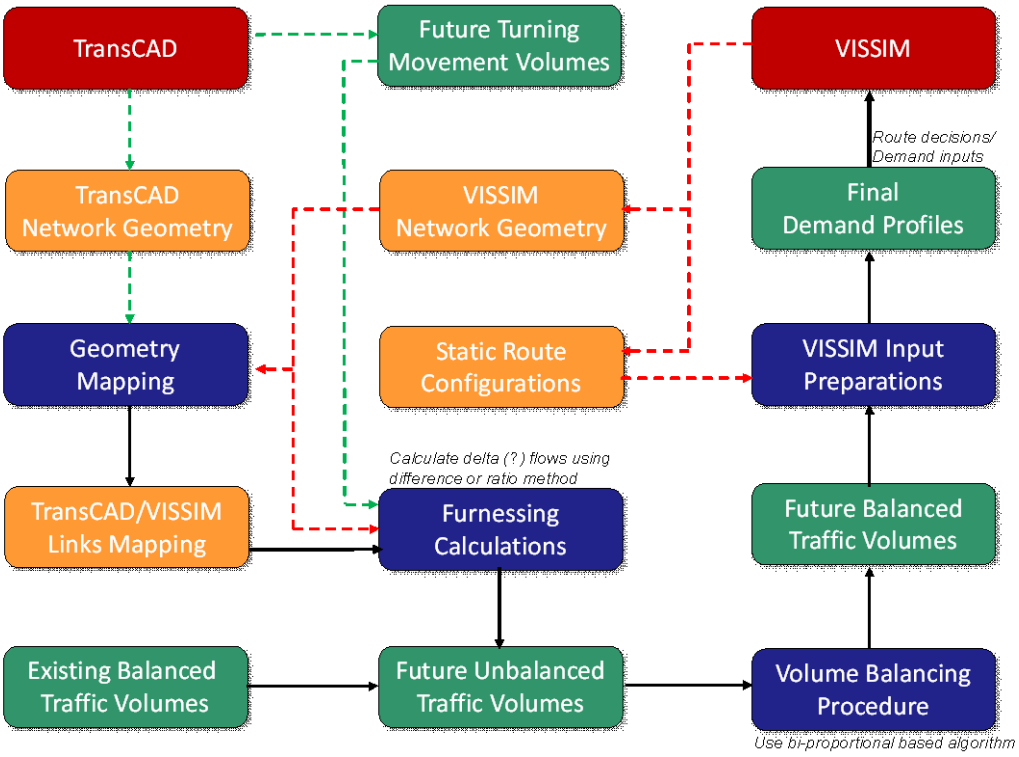
- **Furnessing Calculations** – The SMTC model's turning movement volumes were post-processed using a furnessing method where the numerical difference between the existing model volume and the future model volume from the SMTC output were added to the base year counts to capture the projected magnitude of change while minimizing model errors. For locations where the result was positive, the difference method was used. For locations where the computed result was negative, the ratio method was used.

- **Volume Balancing Procedure** – A script was created in Python to reconcile differences in counts after the modeled difference was applied the base year counts. This step was necessary because

subtle differences caused by the application of the ratio and difference method in adjacent areas. The volume balancing process was given the traffic study network geometry and volumes for all turning movements for each peak period as input and invoked a bi-proportional algorithm to produce a set of reconciled turning movement volumes for the AM and PM peaks.

- **VISSIM Input Preparations –** Roadway geometry, vehicle inputs, and static route configurations were coded in VISSIM to supply a skeletal framework upon which the final balanced demand profiles could be superimposed. Custom programs were developed to incorporate the processed traffic volumes into VISSIM demand profiles by associating them with and modifying individual network elements such as route decision split percentages and the hourly flow rate for each time interval for all entry links.

Figure 2: Generation of Future Demand Profiles for VISSIM



2.6 VISSIM Base Model Development

The VISSIM base model was developed and calibrated, and used for subsequent analyses of future scenarios or alternatives. The base model development involves the following steps:

- Geometry coding – An aerial photograph of the study area was imported into VISSIM and scale was established on this image by matching landmarks with the scaled aerial photograph. Links

and link connectors were then digitized over this background image, and various control and supply attributes were applied.

- Create speed profiles – define distributions of desired speeds for each vehicle type and develop vehicle acceleration and deceleration functions to represent the differences in a driver's behavior.
- Code signal control measures – include signal, stop signs, and yield conditions
- Enter speed changes – develop reduced speed areas for turn movements at intersections and place a desired speed decision at a location where a permanent speed change should become effective
- Code conflict points and priority rules – used to correctly replicate vehicle interactions, such as controlling any movements that may require yielding.
- Enter vehicle inputs – prepare traffic demand data in the forms of entry volumes and turning movements at intersections. Input vehicles would be classified by vehicle type (car, truck, and bus)
- Code vehicle routing – direct vehicles where to go.
- Determine the seeding (or warm-up) period.

Additional details for the base model development can be found in Table 2. Once the VISSIM base models were developed, they were run for the AM and PM peak hour scenarios. For each scenario, the error checking procedure was undertaken by reviewing the on-screen animation and model outputs to determine the model's accuracy in simulating field operations. Input coding error checking also was performed so that the later calibration process would not result in parameters that are distorted to compensate for overlooked coding errors.

Table 2: VISSIM Model Assumptions

Type	Category	Setting	Assumption	Reason
Base Data	Distribution	Desired speed	Linear and non-linear Distributions	Use posted speed limits + 5 mph as the upper bound of desired speed. Distributions were developed based on available data
		Turn-speed	Varies on turn-type and vehicle types	Linear distribution of 9 mph, 15 mph, 20 mph or 25 mph was defined for each turn according to its turn-type and vehicle type,
		Rolling-stop-speed	Some drivers don't make a full stop at "stop" sign	Speed Distribution was borrowed from the "VISSIM Standards Project", July 2012, DVRPC
Traffic	Vehicle Composition	Highways/ local streets	Vehicles classified by heavy truck, medium truck, bus and cars	Vehicle compositions were developed from available field data
Vehicle Inputs	Warm-up Time	All demand input links	30 minutes	Used the WSDOT VISSIM Protocol as guidance - 2.2.1 Seeding Period, September 2014

Signal Control	Controllers	Intersections	Fixed time (TOD) and actuated signal	Existing signal timing was used for 2013 signals
Stop/Yield Control	Stop/Yield Signs	Intersections	Some drivers don't make a full stop at "stop" sign	"Rolling Speed -Zones" was set up for some approaches at stop controlled intersections
Priority Control/ Conflict Area	Location	Intersections	Combinations of priority rules and conflict areas were used	Allows more flexibility to realistically capture existing conditions
Links/ Connectors	Lane Change	Lane change back distance	Varies on location	Lane change back distance and emergency stop vary by individual locations. The values are based on field observations
Routing Decisions	Static	Highways/ local streets	All vehicles types have same routes, but allowed to vary in certain areas	Typical routes, combined routes and routes with lane selection were used to capture lane utilization.
Detectors	Location	Signalized intersections	Varies on location	Detectors were placed according to Google map or available signal timing plans
Transit	Bus	Local streets	Bus routes would be bus-exclusive lane or shared lane	All bus routes coded shared lanes except NB Onondaga St between West St and Clinton St
Non-motorized	Pedestrian	Intersection pedestrian-Crossing	Crossing was coded at key intersections. No ped routes were coded between intersections	Due to lack of pedestrian O-D information
	Bicycle	Routes	Bike routes were coded either exclusive lane or shared lane	Due to lack of bicycle O-D information

3. MODEL PARAMETER CALIBRATION

Because the default values for the VISSIM input parameters were not calibrated using field data from the United States, they need to be revised to produce valid output that better correlates with local traffic conditions. Furthermore, parameter adjustments are necessary because no simulation models can include all the site-specific factors (including driver demographics, road conditions, etc.) that might affect capacity, driving behavior, and traffic operations. The purpose of this section is to describe a logical process used to calibrate and validate the VISSIM model so that it is capable of serving as a testing tool for the operation of roadway design alternatives and their impact on the transportation system.

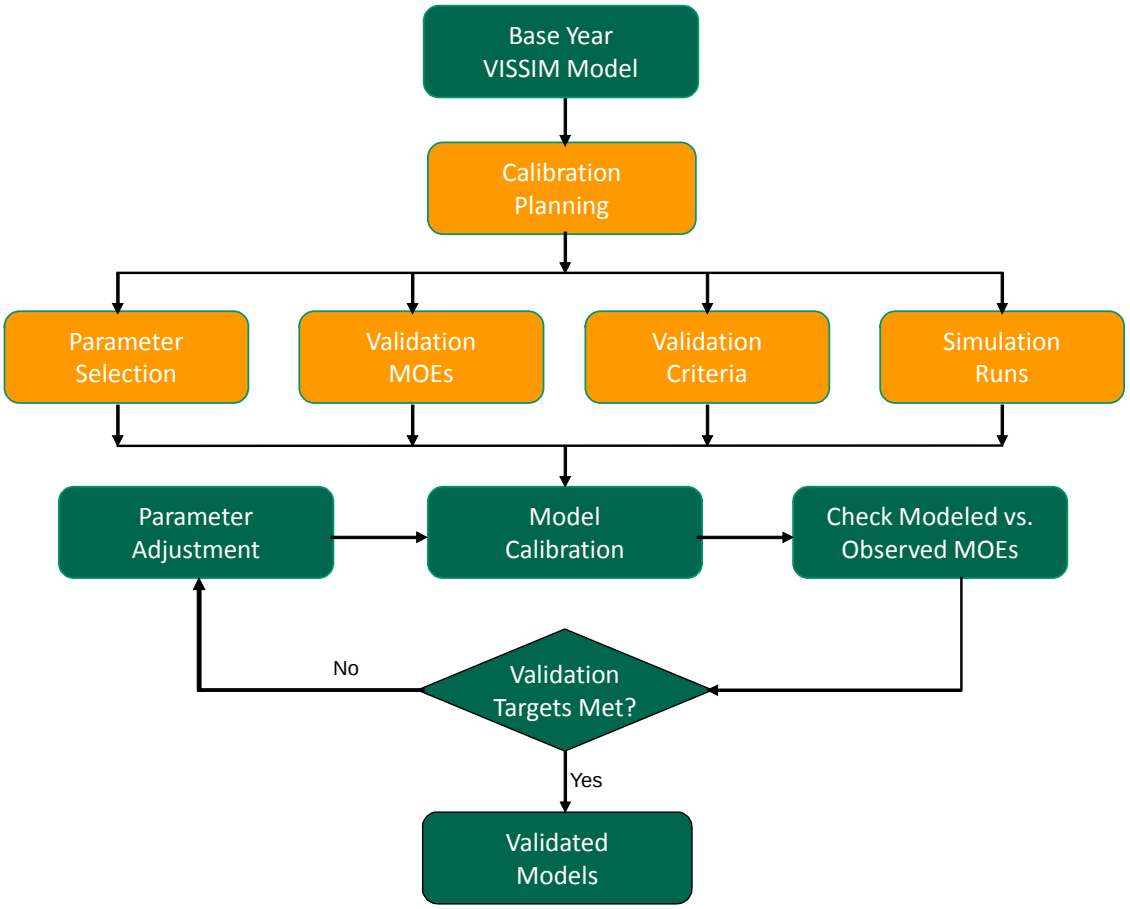
3.1 Calibration Procedure

Model calibration is an iterative process that involves adjusting model input parameters to produce a result that can reasonably represent the existing observed traffic conditions on the simulation network. Two major calibration methods have been documented, namely trial-and-error method (manual calibration) and systematic approach (automated calibration). This project used the trial-and-error method by adjusting parameters iteratively (often one parameter at a time) to obtain the best match possible between the model outputs and field measurements. A general model calibration procedure is illustrated in Figure 3 and can be summarized as follows:

- Identify appropriate model parameters to adjust or calibrate
- Select appropriate measures of effectiveness (MOEs) and data for validation
- Determine the number of simulation runs required to achieve a confidence level of 95% with a 5% margin of error for all MOEs.
- Identify validation criteria and targets
- Modify the selected parameters until the model generates results that closely replicate field measured traffic conditions or satisfy the validation targets

In summary, given the selected parameters for calibration, these parameters would be iteratively adjusted to achieve an acceptable level of accuracy. In this project, traffic volumes and travel times were used as the validation MOEs. The calibration target is to obtain the best match possible between the modeled and observed traffic volumes and travel times.

Figure 3: A General Framework of Model Parameter Calibration



3.2 Selection of Calibration Parameters

There are numerous input parameters in the VISSIM model that describe network geometry, traffic demand, general configuration, traffic control operation, traffic flow and vehicle characteristics, driver behavior, and route choice strategies. Typically, these input parameters have impacts on the simulation results in a way that is highly correlated to those of other parameters. Fixing one problem by adjusting multiple parameters could easily result in other problems somewhere else in the model. Therefore, the FHWA guidelines suggest selecting a reasonable number of parameters for adjustment to avoid a never-ending circular process and to keep the calibration effort manageable.

For the I-81 VISSIM model, the main calibration effort focused on driver behavior and vehicle parameters. Driver behavior parameters directly affect vehicle interaction, govern traffic movement over the simulation network, change the saturation flow rate on arterial and freeway links, and provide various types of drivers to the traffic stream, such as aggressive and passive drivers. The most-used calibration parameters include ten parameters (CC0-CC9) in Wiedemann's 1999 car following model; average standstill distance and desired safety distances in Wiedemann's 1974 car following model; and waiting time before diffusion and minimum headway (front/rear) in the lane changing algorithm.

Vehicle parameters represent the vehicle characteristics and operational performance of the traffic stream. Examples include traffic composition, vehicle length, desired speed, desired acceleration/deceleration, maximum acceleration/deceleration, and attributes associated with each vehicle type modeled. In addition, the need to adjust signal control parameters such as reaction to amber signal reduced safety distance close to a stop line also were examined. Finally, the simulation resolution was considered because it would impact on the response to traffic controls such as traffic signals or priority rules.

3.3 Measures of Effectiveness for Validation

The validation stage compares modeled values for chosen measures of Effectiveness (MOEs) to observed values for the same MOEs. The validation process is used to determine how closely the VISSIM model replicates real world field conditions. Three validation MOEs were selected for VISSIM model validation, including:

- Traffic volume – peak hour balanced traffic volume diagrams were developed using observed ATR and turning movement counts
- Travel time – using the "floating-car" method, peak hour travel times along several travel routes were collected and compared to modeled travel times.
- Field observations – include visual inspection of queuing, car-following characteristics, lane changing acceleration rates, and identification of congestion levels and bottlenecks.

3.4 Validation Criteria and Targets

VISSIM model validation was conducted according to the validation guidelines recommended by FHWA's document: *Traffic Analysis Toolbox Volume III – Guidelines for Applying Traffic Microsimulation Modeling Software* (Federal Highway Administration, August 2003). Table 3 shows the FHWA's validation criteria and acceptance targets for volumes, travel time, and bottleneck locations.

Table 3: Validation Criteria and Targets

Criteria/Measures	Acceptance Targets
Individual Hourly Link Flows	
Within 15%, for 700 vph < flow < 2,700 vph	> 85% of cases
Within 100 vph, for flow < 700 vph	> 85% of cases
Within 400 vph, for flow > 2,700 vph	> 85% of cases
Sum of all link volumes	Within 5% of sum of all link counts
GEH < 5 for individual link volumes	> 85% of cases
GEH for sum of all flows	GEH < 4 for sum of all link counts
Journey Travel Times	
Within 15% (or 1 min, if higher)	> 85% of cases
Visual Audits	

Bottlenecks (Queuing)	To analyst's satisfaction

In Table 3, the GEH (Geoffrey E. Havers) statistic, a modified chi-square statistic that accounts for both absolute and relative errors, is defined as:

$$GEH_i = \sqrt{\frac{2(M_i - O_i)^2}{(M_i + O_i)}}$$

where M_i and O_i are the modeled and observed hourly flows on link i, respectively. A GEH value of less than 5 is considered as a good match between the modeled and observed hourly flows. The validation criteria and targets in Table 3 can be summarized as follows:

- The modeled link volumes would be within ±15% of the observed volumes for flows between 700 and 2,700 vehicles per hour (vph), within ±100 vph for flows less than 700 vph, or within ±400 vph for flows greater than 2700 vph. These targets must be satisfied for 85% of the cases;
- The sum of (modeled) link flows is within ±5% of the actual sum of all link flows
- The GEH statistic would be less than 5 for individual link flows for 85% of the cases;
- Sum of all link flows have a GEH statistic less than 4;
- The modeled travel times would be within ±15% of (or ±1 minute different from) observed travel times for more than 85% of the measured travel time routes.
- Bottlenecks create visually acceptable queuing and agree with observed conditions

3.5 Simulation Runs

VISSIM models rely on random numbers to release vehicles, assign vehicle type, and determine their behavior as the vehicles move through the network. Therefore, multiple simulation runs using different seed numbers are required to obtain an average traffic condition of a specific scenario. The required number of simulation runs was calculated using the formula outlined in FHWA's *Traffic Analysis Toolbox Volume III (page 107):*

$$CI_{(1-\alpha)\%} = \frac{2t_{(1-\alpha/2),N-1}s}{\sqrt{N}}$$

where

$CI_{(1-\alpha)\%}$ = (1-α)% confidence interval for the true mean, where α is the level of significance which equals the probability of the true mean not lying within the confidence interval. CI is also known as the maximum allowable error of the estimate which equals μe, where μ is the mean and e is the margin of error, usually specified as a fraction of μ.

$t_{(1-\alpha/2),N-1}$ = critical value of the two-tailed t-distribution at the confidence interval of 1-α and N-1 degree of freedom.

s = the estimate of the real standard deviation

N = number of simulation runs required

Note that the above formula calculates the required number of simulation runs (N) for a specific performance measure only. If there is more than one performance measure of interest, we need to

determine N for each measure and take the largest value of N to be the required number of simulation runs, i.e., N = Max (N_1, N_2, …..,N_n). Also note that the above formula requires an iterative procedure to estimate the final number of simulation runs because the degree of freedom (N-1) associated with the t-statistic is based on the total number of runs N needed to achieve a desired accuracy. To this end, the following procedure was used:

- Select three performance measures including total delay time, average speed, and average delay time per vehicle.
- Conduct an initial set of 11 simulation runs.
- Use simulation results to calculate the mean and standard deviation for each performance measure
- Assume a 95% level of confidence and use a 5% margin of error to calculate a desired confidence interval (CI) for each performance measure
- Set N equal to 2 and use the above formula to calculate the corresponding confidence interval (CI)
- Continue the process by increasing N, until the calculated confidence interval is less than or equal to the desired confidence interval
- Determine N required for each performance measure and take the largest value of N to be the required number of simulation runs.

Based on the above procedure, the required number of simulation runs for the total delay time, average speed, and average delay time per vehicle performance measures were determined to be 6, 4, and 10 runs, respectively. Therefore, 10 simulation runs are required to achieve a confidence level of 95% with a 5% margin of error for all performance measures. The final calibration statistics represent an average of these 10 simulation runs.

3.6 Parameter Refinement

The model calibration was accomplished by adjusting the default values of the VISSIM parameters so that the model results could reproduce local driver behavior and traffic performance characteristics. As suggested in the FHWA guidelines, one should select a reasonable number of parameters for adjustment to avoid a never-ending circular process and to keep the calibration effort manageable. After reviewing all the VISSIM parameters, attention was given to the parameters in model components related to driver behavior, including:

- Freeway car following (Wiedemann 99) parameters – Parameters related to headway time, following variation, following threshold, and standstill acceleration were calibrated to represent the observed following behavior, break-down conditions, and recovery from break-down conditions. These parameters are also the most influential when calibrating maximum flow rates for mainline freeway sections.

- Arterial car following (Wiedemann 74) parameters – To reflect local driver behavior, Wiedemann 74 car following parameters were calibrated by re-defining the distance that a vehicle can see forward or backward, the distance between stopped cars, and the safety distance between two vehicles. Particularly, two parameters of “additive part of desired safety distance” and “multiple part of desired safety distance” were calibrated so that they could generate results as close to the maximum service flow rate of HCM 2010 as possible.

- Lane change parameters – Lane change parameters (same for both freeway and arterial links) were also calibrated to better reflect real world lane changing conditions, particularly in those merging, diverging, and weaving areas. Modifying a combination of the maximum and accepted deceleration rates for the merging (own) and trailing vehicles as well as the car following headway parameter can give throughput priority to the mainline section or the ramp section. Freeway diverges are most affected by the necessary lane changing and lane change distance parameters. Weaving sections use both merging and diverging section calibration parameters.

Calibrated driver behavior parameter values by roadway segment type are provided for freeways and arterials in Tables 4 and 5, respectively. Detailed descriptions of each parameter can be found in "*VISSIM Version 5.40 User Manual*". Singular values represent global adjustments inherited by all segments of the specified type. Where ranges are given, unique values were assigned to differing network elements to represent local conditions as accurately as possible. The adjusted values fall within ranges that are considered reasonable according to common practice in order to maintain the integrity of the processes they represent.

In addition to driver behavior parameters, attention also was given to vehicle parameters, such as traffic composition, vehicle length, speed distribution, and maximum acceleration and deceleration rates. Once the above parameters were set with acceptable overall model performance, local fine tuning was performed for individual roadway segments and intersections by adjusting conflict areas, priority rules, and routing decisions. As an additional calibration step, driver yield behavior to pedestrians at right turn locations was calibrated in the VISSIM models to match observed conditions.

Table 4: Calibrated Parameter Values by Segment Type - Freeways

Parameter	Default Value	Calibrated Value	
		Basic Segments	**Merges, Diverges, and Weaves**
Car Following (Wiedemann '99)			
CC0 Standstill distance	4.92 ft	default	default
CC1 Headway time	0.90 s	0.50 s	default
CC2 'Following' variation	13.12 ft	default	20.01 ft
CC3 Threshold for entering 'following'	-8.00 s	default	-5.00 s
CC4 Negative 'following' threshold	-0.35 ft/s	default	-0.25 ft/s
CC5 Positive 'following' threshold	0.35 ft/s	default	0.25 ft/s
CC6 Speed dependency of oscillation	11.44	default	default
CC7 Oscillation acceleration	0.82 ft/s^2	default	default
CC8 Standstill acceleration	11.48 ft/s^2	default	12.01 ft/s^2
CC9 Acceleration at 50 mph	4.92 ft/s^2	default	4.99 ft/s^2
Look ahead distance	0 ft - 820 ft	80 ft - 1000 ft	default

Look back distance	0 ft - 492 ft	25 ft - 400 ft	default
Lane Changing			
Maximum deceleration (own)	-13.12 ft/s^2	default	-14.99 ft/s^2
Maximum deceleration (trail)	-9.84 ft/s^2	default	-12.01 ft/s^2
-1 ft/s^2 per distance	200 ft	default	default
Accepted deceleration (own)	-3.28 ft/s^2	default	default
Accepted deceleration (trail)	-1.64 ft/s^2	default	default
Waiting time before diffusion	60 s	default	30 s
Min. headway (front/rear)	1.64 ft	default	1.51 ft
Safety distance reduction factor	0.60	0.2 - 0.25	0.10
Max. dec. for cooperative braking	-9.84 ft/s^2	default	-29.53 ft/s^2
Cooperative lane change	unchecked	checked	checked

Table 5: Calibrated Parameter Values by Segment Type - Arterials

Parameter	Default Value	Calibrated Value	
		Basic Segments	**Merges, Diverges, and Weaves**
Car Following (Wiedemann '74)			
Average standstill distance	6.56 ft	default	4.99 ft
Additive part of safety distance	2.00	1.75	default
Multiplicative part of safety distance	3.00	2.75	default
Look ahead distance	0 ft - 820 ft	default	200 ft - 900 ft
Look back distance	0 ft - 492 ft	default	100 ft - 500 ft
Lane Changing			
Maximum deceleration (own)	-13.12 ft/s^2	default	-16.01 ft/s^2
Maximum deceleration (trail)	-9.84 ft/s^2	default	-12.01ft/s^2
-1 ft/s^2 per distance	100 ft	default	default
Accepted deceleration (own)	-3.28 ft/s^2	default	-4.99 ft/s^2
Accepted deceleration (trail)	-1.64 ft/s^2	default	-4.99 ft/s^2
Waiting time before diffusion	60 s	default	30 s - 120 s
Min. headway (front/rear)	1.64 ft	default	default
Safety distance reduction factor	0.60	default	0.20 - 0.30
Max. dec. for cooperative braking	-9.84 ft/s^2	default	-29.53 ft/s^2

Advanced merging	checked	checked	checked
Cooperative lane change	unchecked	checked	checked

4. MODEL VALIDATION RESULTS

After calibrating model parameters to reflect the prevailing conditions of the study area, model validation focused on comparing quantitative and qualitative model output against existing field data to verify that the existing model is operating similar to the actual field conditions. Model output statistics represent an average of 10 simulation runs to achieve a confidence level of 95% with a 5% margin of error for all performance measures. Each simulation run was set to 5,400 seconds and the data were collected from 1,800 seconds to 5,400 seconds, for a total of one and a half hours.

Following the FHWA's guidance, the model's ability to match field observed traffic volumes and travel times along key routes was examind, as well as reviewing bottlenecks and queues between the model and the field. Traffic volumes, travel times, and bottlenecks and queues were validated based on the criteria listed in Table 3.

4.1 Traffic Volumes

A summary of link volume validation statistics for the AM and PM peak hours is presented in Table 6. The FHWA microsimulation guidelines require that link volumes for at least 85 percent of cases meet the following criteria:

- For volumes less than 700 vehicles per hour (vph), within 100 vph
- For volumes between 700 and 2,700 vph, within 15%
- For volumes greater than 2,700 vph, within 400 vph

Table 6 shows that the link volume calibration results meet the criteria for the three volume categories. Note that the VISSIM network does not have arterial link volumes more than 2,700 vph and, therefore, their corresponding cells do not show percentages. Table 6 also shows that the sum of all freeway or arterial link flows is within 5 percent of the sums of all freeway or arterial link counts. In addition, more than 98 percent of freeway or arterial links have a GEH below 5, which is substantially larger than the acceptance criteria of 85 percent in the FHWA guidance. A detailed listing of the freeway and arterial link count GEH validation statistics for the AM and PM peak hours are presented in Appendices C-F.

Table 6: Traffic Volume Validation Summary

Criteria/Measures	Targets	AM Peak Hour			PM Peak Hour		
		Freeway	Arterial	Total	Freeway	Arterial	Total
Within 100 vph, for flow < 700 vph	> 85%	100%	100%	100%	100%	100%	100%
Within 15%, for 700 vph < flow < 2,700 vph	> 85%	100%	100%	100%	100%	100%	100%
Within 400 vph, for flow >	> 85%	85%	--	85%	100%	--	100%

2,700 vph							
Within 5%, for sum of all link volumes	< 5%	2%	4%	2%	1%	4%	1%
GEH < 5 for individual link flows	> 85%	98%	100%	99%	100%	100%	100%

4.2 Travel Time

Travel time information was checked by comparing average travel time data obtained from the field to those generated from the models within the simulation period. Travel time comparisons were performed for the eleven routes (or twenty-two routes by direction) in the network and for the AM and PM peak hours, respectively. Based on travel time criteria described in Table 3, the modeled travel times should be within ±15% of (or ±1 minute different from) observed travel times for more than 85% of the measured travel time routes. Percent differences for most routes in Tables 7 and 8 are found to be within ±15%. The modeled travel times on southbound West Street in the AM peak hour (17.3%) and northbound West Street in the PM peak hour (19.6%) are not within ±15% of observed travel times. However, since the differences between the modeled and observed travel times are less than one minute, all routes achieved travel-time validation targets established by FHWA.

Table 7: Travel Time Validation Summary – AM Peak Hour

Route Name	Dir	Length (mi)	Travel Time (min)		Difference	
			Observed	Modeled	Actual	Percent
I-81 from Exit 17 to Exit 29N	NB	12.0	12.4	13.1	0.8	6.1%
	SB	11.5	12.3	13.9	1.6	13.0%
I-481 from Exit 2 to Exit 8	NB	14.0	12.8	13.3	0.5	3.8%
	SB	14.0	12.8	13.3	0.5	4.0%
I-690 from Exit 8 to Exit 17	EB	8.0	8.8	9.7	0.9	9.8%
	WB	8.0	7.8	8.8	1.1	13.6%
Fayette St from West St to Walnut Ave	EB	1.3	5.1	5.9	0.8	14.7%
	WB	1.3	5.6	6.4	0.8	13.7%
Adams St from West St to Comstock Ave	EB	1.5	7.5	8.1	0.6	8.4%
Harrison St from Comstock Ave to S West St	WB	1.4	7.9	7.7	-0.1	-1.5%
State St from Adams St to Butternut St	NB	1.1	6.2	5.7	-0.5	-7.6%
Clinton St from Webster Landing to Adams St	SB	0.8	4.7	4.2	-0.5	-11.6%
West St from Genesee St To Adams St	NB	0.8	2.1	2.4	0.2	10.2%
	SB	0.8	1.5	1.8	0.3	17.3%
Irving Ave from E Raynor St to Fayette St	NB	0.8	4.5	4.2	-0.3	-5.9%
	SB	0.8	4.3	4.0	-0.3	-7.4%
Almond St from Van Burn St to Burnet St	NB	1.0	4.9	4.3	-0.7	-13.4%
	SB	1.1	5.5	5.8	0.4	6.8%

Table 8: Travel Time Validation Summary – PM Peak Hour

Route Name	Dir	Length (mi)	Travel Time		Difference	
			Observed	Modeled	Actual	Percent
I-81 from Exit 17 to Exit 29N	NB	12.0	16.0	13.7	-2.3	-14.4%
	SB	11.5	12.2	12.7	0.6	4.5%
I-481 from Exit 2 to Exit 8	NB	14.0	13.1	13.3	0.2	1.7%
	SB	14.0	13.1	13.3	0.2	1.4%
I-690 from Exit 8 to Exit 17	EB	8.0	8.5	9.4	1.0	11.2%
	WB	8.0	8.5	9.5	0.9	10.8%
Fayette St from West St to Walnut Ave	EB	1.3	6.0	5.2	-0.9	-14.3%
	WB	1.3	7.5	6.4	-1.1	-14.5%
Adams St from West St to Comstock Ave	EB	1.5	7.8	8.5	0.7	8.8%
Harrison St from Comstock Ave to S West St	WB	1.4	7.5	7.4	-0.2	-2.4%
State St from Adams St to Butternut St	NB	1.1	7.6	6.6	-1.1	-14.0%
Clinton St from Webster Landing to Adams St	SB	0.8	4.6	4.9	0.3	6.9%
West St from Genesee St To Adams St	NB	0.8	2.1	2.5	0.4	19.6%
	SB	0.8	1.4	1.5	0.1	4.1%
Irving Ave from E Raynor St to Fayette St	NB	0.8	4.0	3.7	-0.3	-7.4%
	SB	0.8	5.7	5.7	0.1	1.6%
Almond St from Van Burn St to Burnet St	NB	1.0	5.7	5.5	-0.2	-3.0%
	SB	1.1	5.6	5.5	-0.1	-2.0%

4.3 Bottlenecks/Freeway Queuing

A final step in the calibration and validation process is to conduct a visual inspection of congestion levels between a visual output of the model and observed field conditions. Field observations noted a major bottleneck on southbound I-81 at Exit 18 as a source of chronic congestion in the AM peak hour causing queues to propagate upstream through the merge with the entrance-ramp from eastbound I-690 and extending as far north as I-81 Exit 23A-23B-22/Destiny USA. Southbound I-81 Interchange 19 traffic exiting to Clinton and Salina Streets also was observed to for a queue on the exit-ramp due to signal inefficiency at downstream intersections and insufficient queue storage during the AM peak hour. Field observations in the PM peak hour confirmed pockets of congestion and slowdowns along northbound I-81 from Exit 24A-24B-23/Liverpool extending south through the weaving section between the Harrison Street entrance-ramp and the eastbound I-690 exit-ramp. In addition, multiple approaches to the Almond Street intersections at Harrison and Adams Streets were found to be heavily saturated during the AM and PM peak hours. Special emphasis was given to

reproducing these definitive congestion patterns as part of the calibration effort (e.g., adjusting driver behavior parameters such as car following and lane change) until they were well represented in the models. At completion of the visual validation process, the VISSIM model was considered to function as observed in the field during peak hour periods.

5. CONCLUSIONS

This technical memorandum documents the methodology followed to build and calibrate detailed VISSIM simulation models for the I-81 Viaduct Project. The approach, data collection, assumptions, and technical tools built on currently available state-of-the-practice techniques, with a goal of providing reliable results to meet the Federal mandates and standards for accuracy. The VISSIM models were calibrated in accordance with the calibration acceptance criteria recommended by FHWA. Detailed link volume counts, route travel times, and observed bottleneck locations have been used to validate the VISSIM models for both AM and PM peak hours. Disaggregated and aggregated validation statistics presented within this memorandum show that the base year (2013) VISSIM models are valid and stable. Therefore, the models can be used as the basis for development of all future No Build and Build condition models.

APPENDIX A:
TRAFFIC DATA COLLECTION PLANS

ATR Volume Counts

Obtain continuous ATR volume counts at forty-two (42) unidirectional highway locations for one week period to establish traffic flow variations, to provide average hourly traffic volume estimates, and to adjust manual traffic counts taken on different weekdays to a common basis. The contractor must calibrate the raw ATR axle counts in order to represent the total number of vehicles. The proposed ATR count locations are shown below.

Expressways - Mainline

1. I-81 mainline NB between Exits 16A and 16
2. I-81 mainline SB between Exits 16A and 16
3. I-690 mainline EB between Exits 14 and 15
4. I-690 mainline WB between Exits 14 and 15

Note: 1 and 2 above shall be counted simultaneously, as shall 3 and 4.

Expressways - Ramp

1. I-81 NB off-ramp to I-481 EB
2. I-81 NB on-ramp from I-481 WB
3. I-81 NB off-ramp to S. Salina St/E. Calthrop Ave
4. I-81 NB on-ramp from S. Salina St/E. Calthrop Ave
5. I-81 NB on-ramp from E. Colvin St
6. I-81 NB off-ramp to Almond St/Harrison St
7. I-81 NB on-ramp from Almond St/Harrison St
8. I-81 NB off-ramp to I-690 EB
9. I-81 NB off-ramp to I-690 WB
10. I-81 NB on-ramp from I-690 WB
11. I-81 NB on-ramp from Pearl St
12. I-81 SB off-ramp to Franklin St/West St
13. I-81 SB off-ramp to Clinton St/Salina St
14. I-81 SB off-ramp to I-690 EB
15. I-81 SB on-ramp from I-690 EB
16. I-81 SB on-ramp from I-690 WB
17. I-81 SB off-ramp to Adams St/Harrison St
18. I-81 SB on-ramp from Almond St/E. Adams St
19. I-81 SB off-ramp to S. State St/Salina St/Brighton St
20. I-81 SB on-ramp from S. State St/Salina St/Brighton St
21. I-81 SB off-ramp to I-481 EB
22. I-81 SB on-ramp from I-481WB
23. I-690 WB off-ramp to Teall Ave
24. I-690 WB on-ramp from Teall Ave
25. I-690 WB off-ramp to N. Townsend St/Downtown
26. I-690 WB off-ramp to N. West St
27. I-690 WB off-ramp to N. West St
28. I-690 WB off-ramp to N. Geddes St
29. I-690 WB on-ramp from Bear St W.
30. I-690 WB on-ramp from Hiawatha Blvd W.
31. I-690 EB off-ramp to Hiawatha Blvd W.
32. I-690 EB off-ramp to Bear St W.

33. I-690 EB on-ramp from N. Geddes St
34. I-690 EB off-ramp to N. West St
35. I-690 EB on-ramp from N. West St
36. I-690 EB on-ramp from McBride St
37. I-690 EB off-ramp to Teall Ave
38. I-690 EB on-ramp from Teall Ave

Manual Turning Movement/Vehicle Classification Counts

Conduct manual turning movement counts in three categories (i.e., cars, buses and trucks) in 15-minute intervals during the morning (6:00 – 10:00 AM), midday (11:00 AM – 2:00 PM) and the afternoon (3:00 – 7:00 PM) peak periods on one (1) mid-weekday, i.e., Tuesday, Wednesday or Thursday, at twenty-eight (28) intersections identified below.

Local Streets - Intersection

1. Park St and Court St
2. Butternut St and Park St
3. W. Onondaga St and S. West St
4. W. Onondaga St and Tallman St
5. W. Onondaga St and W. Adams St
6. Tallman St and Midland Ave
7. Cortland Ave and W. Castle St
8. S. State St and Burt St
9. S. State St and E. Castle St
10. Burt St and Almond St
11. Park St and Oak St
12. Lodi St, Oak St and Burnet Ave
13. E Fayette St and University Ave
14. E.Genesee.st and Comstock Ave
15. Burnet St and Teall Ave
16. Erie Blvd E. and Teall Ave
17. E. Fayette St and Westcott St
18. E. Genesee St and Westcott St
19. Euclid Ave and Westcott St
20. E. Hiawatha Blvd and Park St
21. E. Hiawatha Blvd and Solar St
22. Bear St and Solar St
23. Bear St and Van Rensselaer St
24. South Ave and Slocum Ave
25. Van Buren St and Renwick Ave
26. N. State St and Butternut St
27. E. Genesee St and Irving Ave
28. University Ave and Waverly Ave

Pedestrian Crosswalk Counts

Perform pedestrian crosswalk counts during the three peak periods (6:00 – 10:00 AM, 11:00 AM – 2:00 PM and 3:00 – 7:00 PM) on one (1) mid-weekday concurrently with other manual traffic counts at twenty-two (22) locations specified below:

Local Streets - Intersection

1. S. State St and Erie Blvd W.
2. S. State St and W. Water St
3. S. State St and W. Washington St
4. S. State St and W. Fayette St
5. S. State St and W. Genesee St
6. S. State St and E. Jefferson St
7. S. State St and Harrison St
8. S. State St and E. Adams St
9. Harrison St and Montgomery St
10. Harrison St and S. Warren St
11. Harrison St and S. Salina St
12. E. Jefferson St and Montgomery St
13. E. Jefferson St and Warren St
14. E. Jefferson St and Salina St
15. Irving Ave and W. Genesee St
16. Irving Ave and Harrison St
17. Irving Ave and E. Adams St
18. Irving Ave and Waverly Ave
19. University Ave and W. Genesee St
20. University Ave and Harrison St
21. University Ave and E. Adams St
22. University Ave and Waverly Ave

Travel Time and Speed Runs

Conduct travel time and delay runs on ten (10) major travel routes in the study area using the “floating car” method to obtain a minimum of 3 runs in each travel direction during the AM (6:00 – 10:00 AM), Midday (11:00 AM – 2:00 PM) and PM (3:00 – 7:00 PM) peak periods for one (1) typical weekday. Elapsed time, mileage, delays, and the reason of delays (e.g., accident, signal, vehicle breakdown, etc.) will be recorded at the designated checkpoints, i.e., interchanges and major cross streets, over a predetermined travel route. The travel time and speed runs will be conducted concurrent with the other traffic counts. The proposed 10 major travel routes are presented below.

Expressways

1. I-81 NB from I-81/I-481 Interchange on the south to I-81/I-481 Interchange on the north
2. I-81 SB from I-81/I-481 Interchange on the north to I-81/I-481 Interchange on the south
3. I-481 NB from I-81/I-481 Interchange on the south to I-81/I-481 Interchange on the north

4. I-481 SB from I-81/I-481 Interchange on the north to I-81/I-481 Interchange on the south
5. I-690 WB from I-481/I-690 Interchange on the east to I-690/State Route 695 Interchange on the west
6. I-690 EB from I-690/State Route 695 Interchange on the west to I-481/I-690 Interchange on the east

Local Streets

1. Irving Ave NB from E Raynor Ave to E Fayette St
2. Irving Ave SB from E Fayette St to Raynor Ave
3. Almond St NB from Van Buren St to Burnet Ave
4. Almond St SB from Burnet Ave to Van Buren St
5. State St NB from E Adams St to Butternut St
6. Clinton St SB from Webster Landing to E Adams St
7. West St NB from Adams St to Genesee St
8. West St SB from Genesee St to Adams St
9. Harrison St WB from Comstock Ave to S. West St
10. E. Adams St EB from West St to Comstock Ave
11. E Fayette St WB from Walnut Ave to West St
12. E Fayette St EB from West St to Walnut Ave

APPENDIX B:
PROJECTS FOR INCLUSION IN FUTURE MODELS (DRAFT 5-8-14)

NYSDOT – Future Base

- **Third lane of Frontage Road:** Beginning at Exit 23B, the on ramp from Carousel Center Drive to the Interstate 81 Southbound Frontage Road (SR 936F), a third lane will be constructed southward to Bear Street. Traffic from the ramp will default into this lane upon reaching the service road (the ramp is currently controlled by a Yield sign and has no acceleration lane). The intersection with Bear Street will be reconfigured by virtue of the elimination of the existing slip ramp from the Frontage Road southbound to bear Street westbound (2020)

  The existing right turn slip ramp, currently operating with a Yield sign at the Bear St/Frontage Rd intersection will be reconfigured to continue as right lane only and, controlled by the traffic signal. No conceptual/detailed intersection configuration drawings are available for this "future" project. (It appears no detailed signal timing for this intersection due to too earlier to project implementation, we will use its adjacent intersection signal timing)

- **Route 5 widening:** Widen section of highway from 2 lanes to provide for a center turn lane consistent with the highway sections at either end. (2030) (There are sections if Route 5 in the study area it is unclear where this change affects.

  This section relates to Route 5 between Ike Dixon Rd and Bennetts Corners Road in the Town of Elbridge that is outside the viaduct study area.

City of Syracuse – By 2020

- E Gene is 2 lanes from Forman to the city line, with a couple of 3 lane cross sections (i.e., two-way center turn lane)

  The City of Syracuse restriped E Genesee St from Cherry St to Salt Springs Rd last year and through work on the Connective Corridor (E Genesee St from Forman Park to University Ave). E Genesee from Salt Springs Rd to the eastern city line is currently 2 lanes with a few 3 lane cross section. Center turn lanes are intermixed throughout the entire E Genesee St corridor. For additional details, please contact the City DPW.

- S Salina 2-3 lanes from Dorwin Ave up to Water. We are looking to do one section with two NB lanes between W Onondaga and Warren. (Unsure of implementation timeline. 2015 maybe?)

  Based on update from City DPW, Dorwin Ave to Water St would be 2 lanes, with one section between Onondaga and Warren with 2 NB lanes and 1 SB lane. For lane widths, City DPW anticipates between 10 and 12 feet.

- Erie Blvd W: 3 lane cross section between Clinton St and W Gene (2015)
  Lane widths unknown at this time. Potentially 12' lanes with TWCTL. There has been discussion of "floating" parking and a two-way cycle track without the TWCTL. (We will code the TWCTL though this is uncertain at this time).

- Closure of parts of Water Street (partially implemented. Make it local access only.) *University Ave to Walnut Ave.*

- **Waverly Ave Lane Reduction:** Removal of one lane in each direction on Waverly Ave between Comstock Ave and S. Crouse Ave. Current configuration of 2 lanes in each direction will be reduced to 1 lane in each direction with left turn bays at appropriate intersections.
    - *Waverly EB onto University NB: 120' storage bay*
    - *Waverly EB onto Crouse NB: 70' storage bay*
    - *Waverly WB onto Irving SB: 90' storage bay*

- **Comstock Ave Lane Reduction:** Removal of one lane in each direction on Comstock Ave between Euclid Ave and Waverly Ave. Current configuration of 2 lanes in each direction will be reduced to 1 lane in each direction with left turn bays at appropriate intersections.

  Please contact the City DPW. (Need to contact city DPW, otherwise assume a storage length based on LT volume & standard 12' lane width).

- **West Street:** reduced to 2 NB /2 SB lanes.

  Starts at the railroad bridge on the north to roughly Shonnard St on the south. Check with Region staff for additional details as several meetings have occurred between City, NYSDOT and others. (Assume 2 NB/2 SB lanes are between railroad bridge and Shonnard St)

City of Syracuse – By 2030

- S Geddes: have 2 SB lanes, 1 NB lane between Fayette and Shonnard, with the typical 3 lanes cross section elsewhere. (Just a concept plan at this point)
- James Street (State to Grant/Shotwell): 3 lane cross section (Conceptual/detailed lane configuration whichever is available).

  Project recommended in SMTC's James Street Road Diet report (i.e., Alternative 2). Report available on the SMTC website at: http://www.smtcmpo.org/finalreps.asp?fy=2011&ShowAll=0. Synchro and/or VISSUM files are available and would contain detailed information perhaps not noted in the final report.

- Closure of Taylor St (between Clinton & Salina)
- Conversion of downtown streets to 2 way

  Draft final report and all associated Synchro files have been transmitted to NYSDOT. Technical Memorandum 2 of the draft final report contains tables of "typical" sections for each proposed two-way street (number of lanes/widths). Preferred streets are:
    - *Clinton St – Herald Pl to Adams St*

- *Warren St – Willow St to Washington St*
- *Montgomery St – Erie Blvd to Adams St*
- *Jefferson St – Montgomery St to State St*

City of Syracuse – By 2040

- Roundabouts at:
  - W Onondaga / Salina / Harrison
  - Clinton / W Onondaga

- Erie Boulevard East being reduced to a 2 or 4 lane cross section.

APPENDIX C: ARTERIAL TRAFFIC VOLUME COMPARISON – AM PEAK HOUR

Arterial Traffic Volume Comparison – AM Peak Hour

Route	Segment	Dir	Travel Volume		Difference		GEH
			Observed	Modeled	Actual	Percent	
West St	Genesee St and Erie Blvd	NB	999	964	-35	-4%	1.1
		SB	1819	1750	-69	-4%	1.6
	Erie Blvd and Fayette St	NB	647	625	-22	-3%	0.9
		SB	1577	1511	-66	-4%	1.7
	Fayette St and Gifford St	NB	509	514	5	1%	0.2
		SB	1052	1017	-35	-3%	1.1
	Gifford St and Seymour St	NB	426	427	1	0%	0.0
		SB	1048	1032	-16	-2%	0.5
	South of Seymour St	NB	450	380	-70	-16%	3.4
		SB	972	862	-110	-11%	3.6
Clinton St	North of James St	SB	612	561	-51	-8%	2.1
	James St and Erie Blvd	SB	829	761	-68	-8%	2.4
	Erie Blvd and Fayette St	SB	792	737	-55	-7%	2.0
	Fayette St and Harrison St	SB	673	614	-59	-9%	2.3
	Harrison St and Adams St	SB	237	230	-7	-3%	0.5
	South of Adams St	SB	110	112	2	2%	0.2
Salina St	North of James St	NB	207	208	1	1%	0.1
		SB	859	824	-35	-4%	1.2
	James St and Erie Blvd	NB	252	264	12	5%	0.8
		SB	552	510	-42	-8%	1.8
	Erie Blvd and Fayette St	NB	295	327	32	11%	1.8
		SB	398	386	-12	-3%	0.6
	Fayette St and Harrison St	NB	377	411	34	9%	1.7
		SB	348	368	20	6%	1.1
	Harrison St and Adams St	NB	303	336	33	11%	1.8
		SB	354	410	56	16%	2.9
	South of Adams St	NB	447	457	10	2%	0.5
		SB	325	318	-7	-2%	0.4
State St	North of James St	NB	382	397	15	4%	0.7
		SB	476	438	-38	-8%	1.8
	James St and Erie Blvd	NB	212	222	10	5%	0.7
		SB	541	510	-31	-6%	1.3
	Erie Blvd and Fayette St	NB	270	281	11	4%	0.7
		SB	602	586	-16	-3%	0.6
	Fayette St and Harrison St	NB	149	161	12	8%	1.0
		SB	501	478	-23	-5%	1.0
	Harrison St and Adams St	NB	129	151	22	17%	1.8
		SB	262	264	2	1%	0.1
	South of Adams St	NB	228	239	11	5%	0.7
		SB	133	137	4	3%	0.3
Townsend St	North of James St	NB	220	224	4	2%	0.3
		SB	172	166	-6	-3%	0.4
	James St and Erie Blvd	NB	81	70	-11	-14%	1.3
		SB	220	204	-16	-7%	1.1
	Erie Blvd and Fayette St	NB	176	172	-4	-2%	0.3
		SB	1036	893	-143	-14%	4.6
	Fayette St and Harrison St	NB	492	450	-42	-8%	1.9
		SB	954	952	-2	0%	0.1
	Harrison St and Adams St	NB	213	197	-16	-7%	1.1
		SB	510	482	-28	-6%	1.3
	South of Adams St	NB	107	103	-4	-4%	0.4
		SB	251	236	-15	-6%	1.0
Almond St	North of James St	NB	108	106	-2	-2%	0.2
		SB	132	131	-1	-1%	0.1
	James St and Erie Blvd	NB	192	196	4	2%	0.3
		SB	215	215	0	0%	0.0
	Erie Blvd and Fayette St	NB	295	290	-5	-2%	0.3
		SB	289	246	-43	-15%	2.6
	Fayette St and Harrison St	NB	700	687	-13	-2%	0.5
		SB	1477	1331	-146	-10%	3.9
	Harrison St and Adams St	NB	1400	1325	-75	-5%	2.0
		SB	1488	1329	-159	-11%	4.2
	South of Adams St	NB	154	163	9	6%	0.7

		SB	469	455	-14	-3%	0.7
Irving Ave	Fayette and Genesee St	NB	111	112	1	1%	0.1
		SB	379	313	-66	-18%	3.6
	Genesee St and Harrison St	NB	121	124	3	3%	0.3
		SB	582	589	7	1%	0.3
	Harrison St and Adams St	NB	318	300	-18	-6%	1.0
		SB	340	346	6	2%	0.3
	South of Adams St	NB	265	262	-3	-1%	0.2
		SB	889	772	-117	-13%	4.1
Crouse Ave	North of Erie Blvd	NB	219	210	-9	-4%	0.6
		SB	239	236	-3	-1%	0.2
	Erie Blvd and Fayette St	NB	111	107	-4	-4%	0.4
		SB	232	228	-4	-2%	0.3
	Fayette and Genesee St	NB	97	85	-12	-12%	1.2
		SB	74	73	-1	-2%	0.1
	Genesee St and Harrison	NB	164	149	-15	-9%	1.2
	Harrison St and Adams St	NB	357	272	-85	-24%	4.8
	South of Adams St	NB	339	325	-14	-4%	0.8
University Ave	North of Erie Blvd	NB	78	69	-9	-12%	1.1
		SB	200	199	-1	-1%	0.1
	Erie Blvd and Fayette St	NB	28	24	-4	-15%	0.8
		SB	241	237	-4	-2%	0.3
	Fayette and Genesee St	NB	41	38	-3	-7%	0.5
		SB	277	278	1	0%	0.0
	Genesee St and Harrison St	NB	78	74	-4	-5%	0.5
		SB	434	428	-6	-1%	0.3
	Harrison St and Adams St	NB	90	81	-9	-10%	1.0
		SB	267	263	-4	-2%	0.3
	South of Adams St	NB	52	48	-4	-7%	0.5
		SB	366	351	-15	-4%	0.8
Comstock Ave	Genesee St and Harrison St	NB	288	275	-13	-5%	0.8
		SB	162	154	-8	-5%	0.6
	Harrison St and Adams St	NB	317	302	-15	-5%	0.9
	South of Adams St	NB	294	281	-13	-4%	0.8

APPENDIX D:
ARTERIAL TRAFFIC VOLUME COMPARISON – PM PEAK HOUR

Arterial Traffic Volume Comparison – PM Peak Hour

Route	Segment	Dir	Travel Volume		Difference		GEH
			Observed	Modeled	Actual	Percent	
West St	Genesee St and Erie Blvd	NB	2004	1898	-106	-5%	2.4
		SB	1680	1631	-49	-3%	1.2
	Erie Blvd and Fayette St	NB	1206	1137	-70	-6%	2.0
		SB	1566	1501	-65	-4%	1.7
	Fayette St and Gifford St	NB	796	785	-11	-1%	0.4
		SB	721	720	-1	0%	0.0
	Gifford St and Seymour St	NB	579	564	-15	-3%	0.6
		SB	757	764	7	1%	0.3
	South of Seymour St	NB	443	369	-74	-17%	3.7
		SB	663	636	-28	-4%	1.1
Clinton St	North of James St	SB	284	293	9	3%	0.5
	James St and Erie Blvd	SB	556	525	-31	-5%	1.3
	Erie Blvd and Fayette St	SB	354	344	-10	-3%	0.5
	Fayette St and Harrison St	SB	362	342	-19	-5%	1.0
	Harrison St and Adams St	SB	334	309	-25	-7%	1.4
	South of Adams St	SB	218	157	-62	-28%	4.5
Salina St	North of James St	NB	374	349	-25	-7%	1.3
		SB	367	377	10	3%	0.5
	James St and Erie Blvd	NB	450	412	-38	-8%	1.8
		SB	346	339	-7	-2%	0.4
	Erie Blvd and Fayette St	NB	487	447	-40	-8%	1.8
		SB	328	327	-1	0%	0.0
	Fayette St and Harrison St	NB	498	469	-29	-6%	1.3
		SB	291	309	18	6%	1.0
	Harrison St and Adams St	NB	301	293	-8	-3%	0.5
		SB	375	420	45	12%	2.2
	South of Adams St	NB	478	475	-3	-1%	0.2
		SB	363	345	-18	-5%	1.0
State St	North of James St	NB	941	889	-52	-6%	1.7
		SB	293	268	-25	-9%	1.5
	James St and Erie Blvd	NB	747	720	-27	-4%	1.0
		SB	303	285	-18	-6%	1.1
	Erie Blvd and Fayette St	NB	487	475	-12	-2%	0.5
		SB	232	214	-18	-8%	1.2
	Fayette St and Harrison St	NB	224	224	0	0%	0.0
		SB	346	320	-26	-8%	1.4
	Harrison St and Adams St	NB	159	167	9	5%	0.7
		SB	313	298	-15	-5%	0.8
	South of Adams St	NB	206	207	1	1%	0.1
		SB	142	134	-8	-6%	0.7
Townsend St	North of James St	NB	284	282	-2	-1%	0.1
		SB	247	241	-6	-3%	0.4
	James St and Erie Blvd	NB	199	169	-31	-15%	2.3
		SB	253	237	-17	-7%	1.1
	Erie Blvd and Fayette St	NB	469	440	-28	-6%	1.3
		SB	467	392	-76	-16%	3.7
	Fayette St and Harrison St	NB	419	387	-31	-8%	1.6
		SB	440	410	-30	-7%	1.4
	Harrison St and Adams St	NB	305	275	-30	-10%	1.8
		SB	431	399	-32	-8%	1.6
	South of Adams St	NB	225	222	-3	-1%	0.2
		SB	147	132	-15	-10%	1.2
Almond St	North of James St	NB	229	224	-5	-2%	0.3
		SB	171	170	-1	-1%	0.1
	James St and Erie Blvd	NB	274	266	-8	-3%	0.5
		SB	268	269	1	1%	0.1
	Erie Blvd and Fayette St	NB	380	358	-22	-6%	1.1
		SB	306	261	-45	-15%	2.7
	Fayette St and Harrison St	NB	504	476	-28	-6%	1.3
		SB	959	934	-25	-3%	0.8
	Harrison St and Adams St	NB	2058	1853	-206	-10%	4.7
		SB	1162	1117	-44	-4%	1.3
	South of Adams St	NB	440	442	2	0%	0.1

		SB	257	259	1	0%	0.1
Irving Ave	Fayette and Genesee St	NB	141	144	2	2%	0.2
		SB	120	121	2	1%	0.2
	Genesee St and Harrison St	NB	261	258	-3	-1%	0.2
		SB	347	348	1	0%	0.0
	Harrison St and Adams St	NB	606	592	-15	-2%	0.6
		SB	153	163	10	6%	0.8
	South of Adams St	NB	563	566	3	1%	0.1
		SB	413	394	-19	-5%	0.9
Crouse Ave	North of Erie Blvd	NB	241	237	-5	-2%	0.3
		SB	232	232	-1	0%	0.1
	Erie Blvd and Fayette St	NB	286	278	-8	-3%	0.5
		SB	208	201	-7	-4%	0.5
	Fayette and Genesee St	NB	203	191	-11	-6%	0.8
		SB	100	100	-1	-1%	0.1
	Genesee St and Harrison	NB	335	330	-5	-2%	0.3
	Harrison St and Adams St	NB	512	417	-94	-18%	4.4
	South of Adams St	NB	425	416	-10	-2%	0.5
University Ave	North of Erie Blvd	NB	56	55	-1	-2%	0.2
		SB	128	128	0	0%	0.0
	Erie Blvd and Fayette St	NB	81	82	1	1%	0.1
		SB	124	125	1	1%	0.1
	Fayette and Genesee St	NB	96	99	2	2%	0.2
		SB	181	179	-2	-1%	0.2
	Genesee St and Harrison St	NB	133	137	4	3%	0.4
		SB	217	213	-4	-2%	0.3
	Harrison St and Adams St	NB	290	277	-13	-4%	0.8
		SB	155	153	-2	-2%	0.2
	South of Adams St	NB	92	91	-2	-2%	0.2
		SB	239	238	-1	-1%	0.1
Comstock Ave	Genesee St and Harrison St	NB	305	291	-14	-5%	0.8
		SB	67	63	-3	-5%	0.4
	Harrison St and Adams St	NB	514	470	-45	-9%	2.0
	South of Adams St	NB	245	233	-12	-5%	0.8

APPENDIX E:
FREEWAY TRAFFIC VOLUME COMPARISON – AM PEAK HOUR

Freeway Traffic Volume Comparison – AM Peak Hour

Route	Segment	Dir	Travel Volume		Difference		GEH
			Observed	Modeled	Actual	Percent	
I-81	Exit 16 on-ramp and Exit 16A	NB	1142	1192	49	4.3%	1.4
	Exit 16A off- and on-ramps	NB	519	538	19	3.7%	0.8
	Exit 16A on-ramp and Exit 17	NB	1662	1602	-60	-3.6%	1.5
	Exit 17 off- and on-ramps	NB	1578	1580	2	0.1%	0.0
	Exit 17 Brighten Ave on-ramp and Exit 17 Colvin St on-ramp	NB	2317	2313	-5	-0.2%	0.1
	Exit 17 on-ramp and Exit 18	NB	2871	2841	-29	-1.0%	0.5
	Exit 18 off- and on-ramps	NB	1918	1935	18	0.9%	0.4
	Exit 18 on-ramp and I-690 East off-ramp	NB	2686	2676	-9	-0.3%	0.2
	I-690 EB on ramp and I-690 WB on-ramp	NB	1727	1725	-2	-0.1%	0.0
	Exit 19 on-ramp and Exit 20 on-ramp	NB	944	942	-2	-0.2%	0.1
	WB I-690 on-ramp and Salina St on-ramp	NB	1795	1624	-172	-9.6%	4.2
	Salina St on-ramp and Butternut St on-ramp	NB	2050	2026	-24	-1.2%	0.5
	Butternut St on-ramp and Genant Dr off-ramp	NB	2463	2398	-65	-2.6%	1.3
	Exit 22 off- and on-ramps	NB	2208	2149	-59	-2.7%	1.3
	Exit 22 on-ramp and Exit 23 /Exits 24A and 24B	NB	2427	2361	-66	-2.7%	1.4
	Exit 23 off-and on-ramps	NB	1506	1485	-20	-1.3%	0.5
	Exit 23 on-ramp and Exit 25	NB	2214	2187	-27	-1.2%	0.6
	Exit 25 off- and on-ramps	NB	1789	1743	-47	-2.6%	1.1
	Exit 25 on-ramp and Exit 25A	NB	1971	1928	-43	-2.2%	1.0
	I-90 on-ramp and US 11 off-ramp	NB	2206	2182	-24	-1.1%	0.5
	Exit 25A off- and on-ramps	NB	1690	1668	-21	-1.3%	0.5
	Exit 25A on-ramp and Exit 26	NB	2206	2182	-24	-1.1%	0.5
	Exit 26 and Exits 27-28	NB	1537	1521	-16	-1.0%	0.4
	Exit 27-28 and Exit 27 on-ramp	NB	1005	1010	5	0.5%	0.2
	Exit 27 on-ramp and Exit 28 on-ramp	NB	1417	1420	3	0.2%	0.1
	Airport Blvd on-ramp and E Taft Rd on-ramp	NB	1417	1416	-1	0.0%	0.0
	Exit 28 on-ramp and Exit 29S	NB	1768	1768	0	0.0%	0.0
	Exit 29S and Exit 29N on-ramp	NB	1646	1642	-4	-0.2%	0.1
	Exit 29N on- and off-ramps	NB	1725	1727	2	0.1%	0.0
	Exit 29N and Exit 29S on-ramp	NB	1200	1200	0	0.0%	0.0
	Exit 29S on-ramp and Exit 30	NB	1533	1520	-13	-0.8%	0.3
	Exit 30 on-ramp and Exit 29N	SB	3487	3483	-4	-0.1%	0.1
	Exit 29N and Exit 29S on-ramp	SB	3341	3332	-9	-0.3%	0.2
	Exit 29S and Exit 29N on-ramp	SB	2823	2823	0	0.0%	0.0
	Exit 29S on- and off-ramps	SB	3545	3538	-7	-0.2%	0.1
	Exit 29N on-ramp and Exit 28	SB	4597	4565	-32	-0.7%	0.5
	Exit 28 and Exits 27-26	SB	4106	4099	-7	-0.2%	0.1
	Airport Blvd on-ramp and Airport Blvd off-ramp	SB	3510	3515	5	0.1%	0.1
	Exit 27 on-ramp and Exit 26 on-ramp	SB	4070	4074	4	0.1%	0.1
	NY 370 on-ramp and Old Liverpool Rd on-ramp	SB	3938	3643	-294	-7.5%	4.8
	Exit 26 on-ramp and Exit 25A	SB	4743	4746	4	0.1%	0.1
	Exit 25A off-and on-ramps	SB	4347	4342	-5	-0.1%	0.1
	Exit 25 off- and on-ramps	SB	3991	3920	-71	-1.8%	1.1
	Exit 25 on-ramp and Exits 23A and 23B and Exit 22	SB	4505	4453	-52	-1.2%	0.8
	Exit 25A on-ramp and Exit 25	SB	4742	4661	-81	-1.7%	1.2
	Exits 23A and 23B and Exit 22 and Old Liverpool Rd on-ramp	SB	3386	3201	-185	-5.5%	3.2
	Onondaga Lake Pkwy on-ramp and Exit 22 on-ramp	SB	5017	4634	-383	-7.6%	5.5
	Exit 21 off- and on-ramps	SB	5061	4601	-460	-9.1%	6.6
	Exit 21 on-ramp and Exit 20	SB	5239	4729	-510	-9.7%	7.2
	Clinton St off-ramp and Butternut St off-ramp	SB	4463	4003	-460	-10.3%	7.1

	I-690 East off and on-ramps	SB	2968	2663	-304	-10.3%	5.7
	EB I-690 onramp and Adams St off-ramp	SB	3366	2821	-545	-16.2%	9.8
	Adams St off-ramp and Adams St on-ramp	SB	2101	1905	-197	-9.4%	4.4
	Exit 18 and I-690 West on-ramp	SB	1626	1439	-187	-11.5%	4.8
	I-690 West onramp and Exit 18 on-ramp	SB	2101	1913	-188	-8.9%	4.2
	Exit 18 and Exit 17	SB	2292	2087	-205	-9.0%	4.4
	Exit 17 off- and on-ramps	SB	1011	929	-82	-8.2%	2.6
	Exit 16A off- and on-ramps	SB	1082	1002	-80	-7.4%	2.5
	Exit 17 on-ramp and Exit 16A off-ramp	SB	1403	1287	-116	-8.2%	3.2
	Exit 16A on-ramp and Exit 16 off-ramp	SB	1436	1383	-54	-3.7%	1.4
	I-481 Off-ramp	NB	624	654	31	4.9%	1.2
	I-481 on-ramp	NB	1143	1125	-18	-1.6%	0.5
	S. Salina St, Brighton Av off-ramp	NB	84	87	3	3.8%	0.3
	S. Salina St, Brighton Av on-ramp	NB	740	737	-3	-0.4%	0.1
	E Colvin St onramp	NB	553	547	-6	-1.2%	0.3
	Adams St, Harrison St off-ramp	NB	953	946	-6	-0.7%	0.2
	Adams St, Harrison St on-ramp	NB	769	753	-16	-2.1%	0.6
	EB I-690 off-ramp	NB	958	963	5	0.5%	0.1
	EB I-690 on-ramp	NB	1254	1122	-133	-10.6%	3.9
	WB I-690 off-ramp	NB	783	756	-27	-3.5%	1.0
	WB I-690 on-ramp	NB	852	853	2	0.2%	0.1
	Salina St on-ramp	NB	255	219	-37	-14.3%	2.4
	Butternut St on-ramp	NB	414	379	-35	-8.3%	1.7
	Genant Dr off-ramp	NB	255	253	-2	-0.7%	0.1
	Sunset St onramp	NB	219	217	-2	-1.1%	0.2
	Hiawatha off-ramp	NB	921	895	-26	-2.8%	0.9
	7th N St off-ramp	NB	425	415	-10	-2.3%	0.5
	7th N St onramp	NB	181	180	-2	-1.1%	0.1
	I-90 off-ramp	NB	281	274	-7	-2.4%	0.4
	I-90 on-ramp	NB	516	514	-1	-0.3%	0.1
	US 11 off-ramp	NB	669	660	-9	-1.3%	0.3
	Airport Blvd off-ramp	NB	532	514	-18	-3.3%	0.8
	Airport Blvd on-ramp	NB	412	408	-4	-0.9%	0.2
	E Taft Rd onramp	NB	351	348	-2	-0.7%	0.1
	EB I-481 off-ramp	NB	122	124	2	1.4%	0.2
	EB I-481 on-ramp	NB	80	80	0	0.4%	0.0
	WB I-481 off-ramp	NB	525	527	1	0.3%	0.1
	WB I-481 on-ramp	NB	333	333	0	0.1%	0.0
	I-481 off-ramp	SB	320	280	-40	-12.6%	2.3
	I-481 on-ramp	SB	354	377	23	6.5%	1.2
	S. Salina St, Brighton Av off-ramp	SB	1281	1157	-123	-9.6%	3.5
	S. Salina St, Brighton Av on-ramp	SB	392	358	-33	-8.5%	1.7
	Adams St, Harrison St off-ramp	SB	1626	1526	-100	-6.1%	2.5
	Adams St, Harrison St on-ramp	SB	191	163	-28	-14.6%	2.1
	WB I-690 on-ramp	SB	476	471	-5	-1.0%	0.2
	EB I-690 on-ramp	SB	1254	1122	-133	-10.6%	3.9
	EB I-690 off-ramp	SB	854	739	-115	-13.4%	4.1
	Clinton St off-ramp	SB	1494	1339	-156	-10.4%	4.1
	Butternut St off-ramp	SB	773	672	-101	-13.0%	3.8
	Genant Dr on-ramp	SB	179	170	-9	-5.1%	0.7
	Genant Dr off-ramp	SB	351	322	-29	-8.3%	1.6
	Genant Dr on-ramp	SB	397	369	-28	-7.1%	1.5
	NY 370 on-ramp	SB	1081	988	-92	-8.5%	2.9
	Old Liverpool Rd on-ramp	SB	552	525	-27	-4.9%	1.2
	Onondaga Lake Pkwy off-ramp	SB	1119	1083	-35	-3.1%	1.1
	7th N St off-ramp	SB	751	750	-1	-0.2%	0.0
	7th N St on-ramp	SB	515	513	-2	-0.4%	0.1
	I-90 on-ramp	SB	395	392	-3	-0.7%	0.1
	I-90 off-ramp	SB	396	395	-1	-0.2%	0.0
	US 11 on-ramp	SB	673	671	-2	-0.3%	0.1
	Airport Blvd on-ramp	SB	560	556	-4	-0.8%	0.2
	Airport Blvd off-ramp	SB	596	577	-19	-3.2%	0.8
	E Taft Rd off-ramp	SB	491	471	-20	-4.1%	0.9
	EB I-481 on-ramp	SB	1774	1727	-47	-2.7%	1.1
	EB I-481 off-ramp	SB	723	708	-14	-2.0%	0.5
	WB I-481 on-ramp	SB	204	211	7	3.3%	0.5

	WB I-481 off-ramp	SB	146	140	-5	-3.6%	0.4
I-690	Exit 7 and Exit 8 on-ramp	EB	4746	4722	-24	-0.5%	0.3
	Willls Ave on-ramp and Hawthawa Blvd off-ramp	EB	4879	4852	-28	-0.6%	0.4
	Exit 8 and Exit 9	EB	4252	4231	-21	-0.5%	0.3
	Exit 9 and Exit 10 on-ramp	EB	3831	3791	-41	-1.1%	0.7
	Geddes St onramp and West St off-ramp	EB	4192	4113	-79	-1.9%	1.2
	West St off-ramp and West St onramp	EB	3043	2906	-137	-4.5%	2.5
	I-81 South off- and on-ramps	EB	2221	2204	-17	-0.8%	0.4
	McBride on-ramp and I-81 on-ramp	EB	3303	3189	-114	-3.5%	2.0
	I-81 North on-ramp and Exit 14	EB	4260	4013	-248	-5.8%	3.9
	Exit 14 off- and on-ramps	EB	3210	3136	-73	-2.3%	1.3
	Teall Ave on-ramp and S Midler Ave off-ramp	EB	3480	3414	-66	-1.9%	1.1
	Exit 15 off and on-ramps	EB	2505	2439	-66	-2.6%	1.3
	Exit 15 on-ramp and Exits 16S-N and Exit 17	EB	2678	2628	-50	-1.9%	1.0
	Exit 16S-N off- and on-ramps	EB	1135	1118	-17	-1.5%	0.5
	Exit 16S-N on-ramp and Exit 17 on-ramp	EB	1276	1268	-8	-0.6%	0.2
	Bridge St on-ramp and EB I690 on-ramp	EB	1455	1446	-9	-0.6%	0.2
	Bridge St off-ramp and WB I690 off-ramp	WB	3329	3366	36	1.1%	0.6
	Exit 17 and Exits 16N-S	WB	2632	2666	33	1.3%	0.6
	Exit 16N-S off- and on-ramps	WB	2148	2187	38	1.8%	0.8
	S Midler Ave off-ramp and Thompson Rd on-ramp	WB	3860	3881	22	0.6%	0.3
	Exit 15 off- and on-ramps	WB	3617	3655	37	1.0%	0.6
	Teall Ave off-ramp and S Midler Ave on-ramp	WB	3949	3974	25	0.6%	0.4
	Exit 14 off- and on-ramps	WB	3402	3400	-2	-0.1%	0.0
	Exit 14 on-ramp and I-81 South off-ramp	WB	4122	4061	-61	-1.5%	1.0
	Townsend St off-ramp and WB I-690 on-ramp	WB	3645	3657	12	0.3%	0.2
	Exit 13 and I-81 North off-ramp	WB	2239	2218	-21	-0.9%	0.4
	I-81 North off- and on-ramps	WB	1386	1364	-23	-1.6%	0.6
	West St off-ramp and WB I-690 off-ramp	WB	2168	2002	-166	-7.7%	3.6
	Exit 11 off- and onramps	WB	1548	1530	-18	-1.1%	0.5
	Exit 11 on-ramp and Exit 10	WB	1835	1814	-21	-1.1%	0.5
	Exit 10 and Exit 9 on-ramp	WB	1207	1207	-1	-0.1%	0.0
	Exit 9 on-ramp and Exit 8 on-ramp	WB	1687	1646	-41	-2.4%	1.0
	Exit 8 on-ramp and Exit 7	WB	1939	1906	-33	-1.7%	0.8
	Hawthawa Blvd off-ramp	EB	627	609	-18	-2.8%	0.7
	Bear St off-ramp	EB	420	418	-3	-0.6%	0.1
	Geddes St on-ramp	EB	361	351	-10	-2.8%	0.5
	West St off-ramp	EB	1148	1094	-54	-4.7%	1.6
	West St on-ramp	EB	435	446	11	2.5%	0.5
	McBride on-ramp	EB	229	212	-18	-7.7%	1.2
	Teall Ave off-ramp	EB	1050	1022	-28	-2.7%	0.9
	Teall Ave on-ramp	EB	271	271	0	0.1%	0.0
	S Midler Ave off-ramp	EB	974	944	-30	-3.1%	1.0
	S Midler Ave on-ramp	EB	173	172	-1	-0.6%	0.1
	Thompson Rd off-ramp	EB	1543	1513	-30	-1.9%	0.8
	Thompson Rd on-ramp	EB	141	145	4	2.8%	0.3
	Bridge St on-ramp	EB	179	178	-2	-0.9%	0.1
	Willls Ave on-ramp	EB	133	131	-2	-1.5%	0.2
	Hawthawa Blvd on-ramp	WB	252	247	-5	-2.1%	0.3
	Bear St on-ramp	WB	479	437	-42	-8.8%	2.0
	Geddes St off-ramp	WB	627	615	-13	-2.0%	0.5
	West St on-ramp	WB	288	288	0	-0.1%	0.0
	West St off-ramp	WB	620	592	-28	-4.5%	1.1
	Townsend St off-ramp	WB	1405	1418	13	0.9%	0.3
	Teall Ave on-ramp	WB	720	682	-38	-5.3%	1.4
	Teall Ave off-ramp	WB	546	536	-10	-1.9%	0.4
	S Midler Ave on-ramp	WB	332	330	-2	-0.6%	0.1
	S Midler Ave off-ramp	WB	242	239	-3	-1.3%	0.2
	Thompson Rd on-ramp	WB	1712	1706	-5	-0.3%	0.1
	Thompson Rd off-ramp	WB	484	482	-2	-0.4%	0.1
	Bridge St off-amp	WB	697	703	6	0.9%	0.2

I-481	I-81 on-ramps and Exit 1	NB	944	934	-10	-1.1%	0.3
	Exit 1 off and on-ramps	NB	825	820	-4	-0.5%	0.1
	Exit 1 and Exit 2	NB	1327	1327	0	0.0%	0.0
	Exit 2 off and on-ramps	NB	1104	1111	6	0.6%	0.2
	Exit 3E on-ramp and Exit 3W	NB	1698	1702	4	0.2%	0.1
	Exit 2 on-ramp and Exit 3E	NB	1699	1704	5	0.3%	0.1
	Exit 3E off- and on-ramps	NB	1451	1467	16	1.1%	0.4
	Exit 3W off- and on-ramps	NB	1450	1475	25	1.7%	0.6
	Exit 3W on-ramp and Exit 4	NB	3311	3329	17	0.5%	0.3
	Exit 4 off-ramp and Exit 4 on-ramp	NB	1407	1398	-9	-0.7%	0.2
	Exit 4 on-ramp and Exit 5E	NB	2135	2112	-24	-1.1%	0.5
	Exit 5E off- and on-ramps	NB	2006	1974	-32	-1.6%	0.7
	Exit 5E on-ramp and Exit 5W	NB	2092	2064	-28	-1.4%	0.6
	WB Kirkville Rd on-ramp and I-90 off-ramp	NB	1666	1652	-14	-0.9%	0.4
	Exit 5W off- and on-ramps	NB	1487	1475	-11	-0.8%	0.3
	Exit 5W on-ramp and Exit 6	NB	1666	1652	-14	-0.9%	0.4
	Exit 6 off and on-ramps	NB	1157	1159	2	0.1%	0.1
	I90 onramp and US 298 off-ramp	NB	1471	1470	-1	-0.1%	0.0
	Exit 7 off- and on- ramps	NB	1007	1015	8	0.8%	0.2
	Exit 7 on-ramp and Exit 8	NB	1105	1117	11	1.0%	0.3
	Exit 8 off- and on-ramps	NB	799	815	16	1.9%	0.5
	Exit 8 on-ramp and Exit 9N	NB	1130	1145	15	1.3%	0.4
	Exit 9N off- and on-ramps	NB	797	813	16	2.0%	0.6
	Exit 9N on-ramp and Exit 9S	NB	1322	1340	18	1.4%	0.5
	Exit 9S off- and on-ramps	NB	1118	1134	16	1.4%	0.5
	Before WB I-481 off-ramp	NB	1263	1255	-8	-0.6%	0.2
	Before EB I-481 on-ramp	SB	3311	3298	-13	-0.4%	0.2
	Exit 9S on-ramp and Exit 9N	SB	2259	2274	15	0.6%	0.3
	Exit 9S off- and on-ramps	SB	1537	1559	22	1.4%	0.6
	Exit 9N off- and on-ramps	SB	2180	2202	22	1.0%	0.5
	Exit 9N on-ramp and Exit 8	SB	2302	2325	23	1.0%	0.5
	Exit 8 off- and on-ramps	SB	1626	1657	31	1.9%	0.8
	Exit 8 on-ramp and Exit 7	SB	2050	2084	33	1.6%	0.7
	Exit 7 off- and on-ramps	SB	1542	1576	34	2.2%	0.9
	Exit 7 and Exit 6	SB	1941	1981	40	2.1%	0.9
	Exit 6 off- and on-ramps	SB	1690	1743	53	3.1%	1.3
	Exit 6 and Exit 5W	SB	2380	2434	55	2.3%	1.1
	Exit 5W off- and on-ramps	SB	2081	2120	40	1.9%	0.9
	Exit 5W on-ramp and Exit 5E	SB	2405	2437	31	1.3%	0.6
	Exit 5E off- and on-ramps	SB	2223	2257	34	1.5%	0.7
	Exit 5E on-ramp and Exit 4	SB	2602	2643	41	1.6%	0.8
	Exit 4 off-ramp and Exit 4 on-ramp	SB	1177	1199	22	1.8%	0.6
	Exit 4 on-ramp and Exit 3W	SB	1904	1926	22	1.2%	0.5
	Exit 3W on-ramp and Exit 3E	SB	1967	1979	13	0.7%	0.3
	Exit 3W off- and on-ramps	SB	1688	1708	20	1.2%	0.5
	Exit 3E off and on-ramps	SB	1087	1115	27	2.5%	0.8
	Exit 3E on-ramp and Exit 2	SB	1204	1227	23	1.9%	0.7
	Exit 3E on-ramp and Exit 2	SB	1204	1228	25	2.0%	0.7
	Exit 2 off- and on-ramps	SB	851	869	18	2.1%	0.6
	Exit 2 on-ramp and Exit 1	SB	1338	1354	15	1.1%	0.4
	I-81 North off-ramp and E. Brighton Av on-ramp	SB	441	428	-12	-2.8%	0.6
	I-81 North and I-81 South ramps	SB	795	806	11	1.4%	0.4
	I-81 North off-ramp and E. Brighton Av on-ramp	SB	1143	1125	-18	-1.6%	0.5
	Rock Cut Rd off-ramp	NB	119	116	-4	-3.0%	0.3
	Rock Cut Rd on -ramp	NB	503	491	-11	-2.2%	0.5
	Jamesville Rd off-ramp	NB	223	215	-8	-3.5%	0.5
	Jamesville Rd on-ramp	NB	595	592	-3	-0.4%	0.1
	EB US 5 off-ramp	NB	248	238	-10	-4.1%	0.7
	WB US 5 on-ramp	NB	1861	1855	-6	-0.3%	0.1
	EB US 5 on-ramp	NB	247	246	-1	-0.2%	0.0
	WB US 5 off-ramp	NB	248	241	-7	-2.9%	0.5
	WB I690 off-ramp	NB	1905	1926	22	1.1%	0.5
	EB I690 onramp	NB	729	710	-19	-2.5%	0.7
	EB Kirkville Rd on-ramp	NB	86	85	-1	-1.5%	0.1

	EB Kirkville Rd off-ramp	NB	129	131	2	1.7%	0.2
	WB Kirkville Rd off-ramp	NB	605	593	-13	-2.1%	0.5
	WB Kirkville Rd on-ramp	NB	180	179	-1	-0.5%	0.1
	I90 off-ramp	NB	509	489	-21	-4.0%	0.9
	I90 on-ramp	NB	314	312	-2	-0.5%	0.1
	US 298 of-ramp	NB	463	453	-11	-2.3%	0.5
	US 298 on-ramp	NB	98	97	-1	-0.9%	0.1
	Northern Blvd off-ramp	NB	306	298	-7	-2.4%	0.4
	Northern Blvd on-ramp	NB	331	329	-2	-0.6%	0.1
	Brighton Ave off-ramp	SB	544	541	-3	-0.5%	0.1
	Jamesville Rd off-ramp	SB	353	361	8	2.2%	0.4
	Jamesville Rd on-ramp	SB	488	486	-2	-0.3%	0.1
	WB US 5 off-ramp	SB	217	218	2	0.8%	0.1
	EB US 5 on-ramp	SB	116	116	0	-0.3%	0.0
	EB US 5 off-ramp	SB	879	880	1	0.1%	0.0
	WB US 5 on-ramp	SB	279	278	-1	-0.2%	0.0
	EB I690 on-ramp	SB	727	733	7	0.9%	0.2
	WB I690 off-ramp	SB	1425	1446	21	1.5%	0.6
	EB Kirkville Rd on-ramp	SB	379	377	-2	-0.5%	0.1
	EB Kirkville Rd off-ramp	SB	182	177	-5	-2.6%	0.3
	WB Kirkville Rd on-ramp	SB	325	322	-2	-0.7%	0.1
	WB Kirkville Rd off-ramp	SB	299	310	11	3.6%	0.6
	I90 off-ramp	SB	251	239	-12	-4.9%	0.8
	I90 on-ramp	SB	690	691	1	0.2%	0.0
	US 298 off-ramp	SB	508	499	-9	-1.7%	0.4
	US 298 on-ramp	SB	399	397	-1	-0.3%	0.1
	Northern Blvd on-ramp	SB	424	424	0	-0.1%	0.0
	Northern Blvd off-ramp	SB	676	666	-10	-1.5%	0.4

APPENDIX F:
FREEWAY TRAFFIC VOLUME COMPARISON – PM PEAK HOUR

Freeway Traffic Volume Comparison – PM Peak Hour

Route	Segment	Dir	Travel Volume		Difference		GEH
			Observed	Modeled	Actual	Percent	
I-81	Exit 16 on-ramp and Exit 16A	NB	1408	1457	49	3.5%	1.3
	Exit 16A off- and on-ramps	NB	971	995	24	2.4%	0.8
	Exit 16A on-ramp and Exit 17	NB	1635	1645	10	0.6%	0.2
	Exit 17 off- and on-ramps	NB	1515	1550	35	2.3%	0.9
	Exit 17 Brighten Ave on-ramp and Exit 17 Colvin St on-ramp	NB	2178	2175	-3	-0.2%	0.1
	Exit 17 on-ramp and Exit 18	NB	2937	2911	-27	-0.9%	0.5
	Exit 18 off- and on-ramps	NB	2096	2111	15	0.7%	0.3
	Exit 18 on-ramp and I-690 East off-ramp	NB	4534	4427	-107	-2.4%	1.6
	I-690 EB on ramp and I-690 WB on-ramp	NB	3571	3526	-46	-1.3%	0.8
	Exit 19 on-ramp and Exit 20 on-ramp	NB	2422	2348	-73	-3.0%	1.5
	WB I-690 on-ramp and Salina St on-ramp	NB	3625	3463	-163	-4.5%	2.7
	Salina St on-ramp and Butternut St on-ramp	NB	4764	4604	-160	-3.4%	2.3
	Butternut St on-ramp and Genant Dr off-ramp	NB	5787	5550	-237	-4.1%	3.1
	Exit 22 off- and on-ramps	NB	5349	5183	-165	-3.1%	2.3
	Exit 22 on-ramp and Exit 23 /Exits 24A and 24B	NB	5897	5716	-182	-3.1%	2.4
	Exit 23 off-and on-ramps	NB	3617	3530	-87	-2.4%	1.5
	Exit 23 on-ramp and Exit 25	NB	4666	4574	-92	-2.0%	1.4
	Exit 25 off- and on-ramps	NB	4305	4172	-133	-3.1%	2.0
	Exit 25 on-ramp and Exit 25A	NB	4781	4658	-122	-2.6%	1.8
	I-90 on-ramp and US 11 off-ramp	NB	4957	4866	-91	-1.8%	1.3
	Exit 25A off- and on-ramps	NB	4410	4319	-91	-2.1%	1.4
	Exit 25A on-ramp and Exit 26	NB	4957	4866	-91	-1.8%	1.3
	Exit 26 and Exits 27-28	NB	3699	3629	-70	-1.9%	1.2
	Exit 27-28 and Exit 27 on-ramp	NB	2831	2802	-30	-1.0%	0.6
	Exit 27 on-ramp and Exit 28 on-ramp	NB	3515	3488	-28	-0.8%	0.5
	Airport Blvd on-ramp and E Taft Rd on-ramp	NB	3515	3482	-33	-0.9%	0.6
	Exit 28 on-ramp and Exit 29S	NB	4031	4000	-31	-0.8%	0.5
	Exit 29S and Exit 29N on-ramp	NB	3782	3741	-41	-1.1%	0.7
	Exit 29N on- and off-ramps	NB	3950	3921	-29	-0.7%	0.5
	Exit 29N and Exit 29S on-ramp	NB	2342	2337	-5	-0.2%	0.1
	Exit 29S on-ramp and Exit 30	NB	3119	3031	-88	-2.8%	1.6
	Exit 30 on-ramp and Exit 29N	SB	1864	1888	24	1.3%	0.6
	Exit 29N and Exit 29S on-ramp	SB	1710	1740	30	1.7%	0.7
	Exit 29S and Exit 29N on-ramp	SB	1554	1571	17	1.1%	0.4
	Exit 29S on- and off-ramps	SB	1877	1904	27	1.4%	0.6
	Exit 29N on-ramp and Exit 28	SB	2551	2599	48	1.9%	0.9
	Exit 28 and Exits 27-26	SB	2235	2295	61	2.7%	1.3
	Airport Blvd on-ramp and Airport Blvd off-ramp	SB	1822	1886	65	3.5%	1.5
	Exit 27 on-ramp and Exit 26 on-ramp	SB	2547	2609	62	2.4%	1.2
	NY 370 on-ramp and Old Liverpool Rd on-ramp	SB	2718	2722	5	0.2%	0.1
	Exit 26 on-ramp and Exit 25A	SB	3706	3765	60	1.6%	1.0
	Exit 25A off-and on-ramps	SB	3142	3209	67	2.1%	1.2
	Exit 25 off- and on-ramps	SB	2889	2908	19	0.6%	0.3
	Exit 25 on-ramp and Exits 23A and 23B and Exit 22	SB	3367	3415	48	1.4%	0.8
	Exit 25A on-ramp and Exit 25	SB	3473	3489	16	0.5%	0.3
	Exits 23A and 23B and Exit 22 and Old Liverpool Rd on-ramp	SB	2295	2351	55	2.4%	1.2
	Onondaga Lake Pkwy on-ramp and Exit 22 on-ramp	SB	3220	3241	21	0.6%	0.4
	Exit 21 off- and on-ramps	SB	3425	3384	-41	-1.2%	0.7
	Exit 21 on-ramp and Exit 20	SB	3778	3702	-76	-2.0%	1.2

	Clinton St off-ramp and Butternut St off-ramp	SB	3353	3304	-48	-1.4%	0.8
	I-690 East off and on-ramps	SB	2841	2815	-27	-0.9%	0.5
	EB I-690 onramp and Adams St off-ramp	SB	2495	2467	-28	-1.1%	0.6
	Adams St off-ramp and Adams St on-ramp	SB	2427	2437	9	0.4%	0.2
	Exit 18 and I-690 West on-ramp	SB	1907	1935	28	1.4%	0.6
	I-690 West onramp and Exit 18 on-ramp	SB	2427	2444	16	0.7%	0.3
	Exit 18 and Exit 17	SB	3394	3365	-29	-0.8%	0.5
	Exit 17 off- and on-ramps	SB	1957	1965	8	0.4%	0.2
	Exit 16A off- and on-ramps	SB	1465	1475	10	0.7%	0.2
	Exit 17 on-ramp and Exit 16A off-ramp	SB	2373	2364	-8	-0.3%	0.2
	Exit 16A on-ramp and Exit 16 off-ramp	SB	2074	2089	15	0.7%	0.3
	I-481 Off-ramp	NB	437	459	22	4.9%	1.0
	I-481 on-ramp	NB	658	649	-9	-1.4%	0.4
	S. Salina St, Brighton Av off-ramp	NB	90	91	1	0.8%	0.1
	S. Salina St, Brighton Av on-ramp	NB	637	632	-5	-0.8%	0.2
	E Colvin St onramp	NB	759	752	-6	-0.8%	0.2
	Adams St, Harrison St off-ramp	NB	841	839	-2	-0.3%	0.1
	Adams St, Harrison St on-ramp	NB	2437	2367	-69	-2.9%	1.4
	EB I-690 off-ramp	NB	963	946	-17	-1.8%	0.6
	EB I-690 on-ramp	NB	818	815	-3	-0.4%	0.1
	WB I-690 off-ramp	NB	1150	1123	-28	-2.4%	0.8
	WB I-690 on-ramp	NB	1203	1180	-23	-1.9%	0.7
	Salina St on-ramp	NB	1138	1048	-89	-7.8%	2.7
	Butternut St on-ramp	NB	1022	964	-58	-5.7%	1.9
	Genant Dr off-ramp	NB	440	426	-14	-3.1%	0.7
	Sunset St onramp	NB	548	533	-15	-2.7%	0.6
	Hiawatha off-ramp	NB	2281	2182	-99	-4.3%	2.1
	7th N St off-ramp	NB	362	346	-15	-4.2%	0.8
	7th N St onramp	NB	476	475	-1	-0.1%	0.0
	I-90 off-ramp	NB	345	367	22	6.5%	1.2
	I-90 on-ramp	NB	546	546	-1	-0.1%	0.0
	US 11 off-ramp	NB	1258	1228	-30	-2.4%	0.8
	Airport Blvd off-ramp	NB	867	837	-30	-3.5%	1.0
	Airport Blvd on-ramp	NB	684	680	-5	-0.7%	0.2
	E Taft Rd onramp	NB	516	515	-1	-0.2%	0.0
	EB I-481 off-ramp	NB	249	248	-1	-0.5%	0.1
	EB I-481 on-ramp	NB	168	169	0	0.3%	0.0
	WB I-481 off-ramp	NB	1608	1582	-26	-1.6%	0.7
	WB I-481 on-ramp	NB	777	776	0	0.0%	0.0
	I-481 off-ramp	SB	907	881	-27	-2.9%	0.9
	I-481 on-ramp	SB	609	602	-7	-1.1%	0.3
	S. Salina St, Brighton Av off-ramp	SB	1437	1381	-56	-3.9%	1.5
	S. Salina St, Brighton Av on-ramp	SB	415	397	-18	-4.2%	0.9
	Adams St, Harrison St off-ramp	SB	588	572	-16	-2.8%	0.7
	Adams St, Harrison St on-ramp	SB	966	903	-63	-6.5%	2.1
	WB I-690 on-ramp	SB	520	504	-16	-3.1%	0.7
	EB I-690 on-ramp	SB	818	815	-3	-0.4%	0.1
	EB I-690 off-ramp	SB	1166	1131	-36	-3.0%	1.0
	Clinton St off-ramp	SB	512	472	-40	-7.7%	1.8
	Butternut St off-ramp	SB	426	411	-15	-3.6%	0.8
	Genant Dr on-ramp	SB	352	335	-18	-5.0%	1.0
	Genant Dr off-ramp	SB	325	319	-6	-1.7%	0.3
	Genant Dr on-ramp	SB	528	486	-42	-8.0%	1.9
	NY 370 on-ramp	SB	503	456	-46	-9.2%	2.1
	Old Liverpool Rd on-ramp	SB	422	405	-17	-4.1%	0.9
	Onondaga Lake Pkwy off-ramp	SB	1071	1068	-4	-0.3%	0.1
	7th N St off-ramp	SB	583	590	7	1.2%	0.3
	7th N St on-ramp	SB	477	476	-1	-0.2%	0.1
	I-90 on-ramp	SB	331	329	-2	-0.7%	0.1
	I-90 off-ramp	SB	564	555	-9	-1.7%	0.4
	US 11 on-ramp	SB	1158	1157	-2	-0.2%	0.1
	Airport Blvd on-ramp	SB	726	721	-4	-0.6%	0.2
	Airport Blvd off-ramp	SB	413	395	-17	-4.2%	0.9
	E Taft Rd off-ramp	SB	317	299	-17	-5.4%	1.0
	EB I-481 on-ramp	SB	997	1017	20	2.0%	0.6

	EB I-481 off-ramp	SB	323	327	5	1.4%	0.3
	WB I-481 on-ramp	SB	167	167	1	0.3%	0.0
	WB I-481 off-ramp	SB	153	145	-8	-5.5%	0.7
I-690	Exit 7 and Exit 8 on-ramp	EB	2367	2391	24	1.0%	0.5
	WillIs Ave on-ramp and Hawthawa Blvd off-ramp	EB	2621	2642	21	0.8%	0.4
	Exit 8 and Exit 9	EB	1951	1972	21	1.1%	0.5
	Exit 9 and Exit 10 on-ramp	EB	1710	1736	26	1.5%	0.6
	Geddes St onramp and West St off-ramp	EB	2332	2360	28	1.2%	0.6
	West St off-ramp and West St onramp	EB	2139	2128	-11	-0.5%	0.2
	I-81 South off- and on-ramps	EB	1861	1858	-3	-0.2%	0.1
	McBride on-ramp and I-81 on-ramp	EB	3993	3946	-47	-1.2%	0.8
	I-81 North on-ramp and Exit 14	EB	4957	4735	-223	-4.5%	3.2
	Exit 14 off- and on-ramps	EB	4178	4150	-27	-0.7%	0.4
	Teall Ave on-ramp and S Midler Ave off-ramp	EB	4649	4614	-36	-0.8%	0.5
	Exit 15 off and on-ramps	EB	3871	3809	-62	-1.6%	1.0
	Exit 15 on-ramp and Exits 16S-N and Exit 17	EB	4185	4142	-43	-1.0%	0.7
	Exit 16S-N off- and on-ramps	EB	2492	2481	-11	-0.5%	0.2
	Exit 16S-N on-ramp and Exit 17 on-ramp	EB	2982	2981	-2	-0.1%	0.0
	Bridge St on-ramp and EB I690 on-ramp	EB	3513	3511	-3	-0.1%	0.0
	Bridge St off-ramp and WB I690 off-ramp	WB	2168	2189	21	1.0%	0.4
	Exit 17 and Exits 16N-S	WB	1745	1753	8	0.5%	0.2
	Exit 16N-S off- and on-ramps	WB	1390	1404	14	1.0%	0.4
	S Midler Ave off-ramp and Thompson Rd on-ramp	WB	3740	3739	-1	0.0%	0.0
	Exit 15 off- and on-ramps	WB	3324	3333	9	0.3%	0.1
	Teall Ave off-ramp and S Midler Ave on-ramp	WB	4058	4055	-3	-0.1%	0.0
	Exit 14 off- and on-ramps	WB	3599	3569	-31	-0.8%	0.5
	Exit 14 on-ramp and I-81 South off-ramp	WB	4581	4379	-202	-4.4%	3.0
	Townsend St off-ramp and WB I-690 on-ramp	WB	4062	3957	-105	-2.6%	1.7
	Exit 13 and I-81 North off-ramp	WB	3456	3326	-130	-3.8%	2.2
	I-81 North off- and on-ramps	WB	2254	2139	-115	-5.1%	2.5
	West St off-ramp and WB I-690 off-ramp	WB	3405	3312	-93	-2.7%	1.6
	Exit 11 off- and onramps	WB	2694	2599	-95	-3.5%	1.8
	Exit 11 on-ramp and Exit 10	WB	3790	3662	-128	-3.4%	2.1
	Exit 10 and Exit 9 on-ramp	WB	3023	2941	-82	-2.7%	1.5
	Exit 9 on-ramp and Exit 8 on-ramp	WB	3938	3802	-136	-3.5%	2.2
	Exit 8 on-ramp and Exit 7	WB	4453	4334	-120	-2.7%	1.8
	Hawthawa Blvd off-ramp	EB	670	663	-8	-1.2%	0.3
	Bear St off-ramp	EB	241	234	-7	-3.0%	0.5
	Geddes St on-ramp	EB	622	612	-9	-1.5%	0.4
	West St off-ramp	EB	193	191	-2	-1.0%	0.1
	West St on-ramp	EB	539	527	-12	-2.2%	0.5
	McBride on-ramp	EB	964	906	-59	-6.1%	1.9
	Teall Ave off-ramp	EB	780	757	-23	-2.9%	0.8
	Teall Ave on-ramp	EB	471	446	-25	-5.4%	1.2
	S Midler Ave off-ramp	EB	778	758	-20	-2.6%	0.7
	S Midler Ave on-ramp	EB	314	314	1	0.2%	0.0
	Thompson Rd off-ramp	EB	1693	1666	-27	-1.6%	0.7
	Thompson Rd on-ramp	EB	490	492	1	0.3%	0.1
	Bridge St on-ramp	EB	531	529	-2	-0.4%	0.1
	WillIs Ave on-ramp	EB	254	254	0	0.0%	0.0
	Hawthawa Blvd on-ramp	WB	515	509	-6	-1.1%	0.3
	Bear St on-ramp	WB	915	865	-50	-5.4%	1.7
	Geddes St off-ramp	WB	767	746	-21	-2.8%	0.8
	West St on-ramp	WB	1095	1053	-42	-3.8%	1.3
	West St off-ramp	WB	712	670	-42	-5.9%	1.6
	Townsend St off-ramp	WB	607	598	-9	-1.5%	0.4
	Teall Ave on-ramp	WB	981	838	-142	-14.5%	4.7
	Teall Ave off-ramp	WB	459	451	-8	-1.7%	0.4
	S Midler Ave on-ramp	WB	733	729	-4	-0.5%	0.1
	S Midler Ave off-ramp	WB	415	413	-2	-0.6%	0.1
	Thompson Rd on-ramp	WB	2349	2342	-7	-0.3%	0.2

	Thompson Rd off-ramp	WB	354	353	-2	-0.5%	0.1
	Bridge St off-amp	WB	423	435	12	2.8%	0.6
I-481	I-81 on-ramps and Exit 1	NB	1344	1342	-2	-0.2%	0.1
	Exit 1 off and on-ramps	NB	991	997	6	0.6%	0.2
	Exit 1 and Exit 2	NB	1361	1365	4	0.3%	0.1
	Exit 2 off and on-ramps	NB	907	922	15	1.6%	0.5
	Exit 3E on-ramp and Exit 3W	NB	1532	1541	9	0.6%	0.2
	Exit 2 on-ramp and Exit 3E	NB	1429	1442	13	0.9%	0.4
	Exit 3E off- and on-ramps	NB	1179	1199	21	1.8%	0.6
	Exit 3W off- and on-ramps	NB	1305	1326	21	1.6%	0.6
	Exit 3W on-ramp and Exit 4	NB	2658	2677	19	0.7%	0.4
	Exit 4 off-ramp and Exit 4 on-ramp	NB	1407	1429	22	1.6%	0.6
	Exit 4 on-ramp and Exit 5E	NB	2902	2911	9	0.3%	0.2
	Exit 5E off- and on-ramps	NB	2428	2442	13	0.6%	0.3
	Exit 5E on-ramp and Exit 5W	NB	2678	2699	21	0.8%	0.4
	WB Kirkville Rd on-ramp and I-90 off-ramp	NB	2506	2527	21	0.8%	0.4
	Exit 5W off- and on-ramps	NB	2349	2371	22	1.0%	0.5
	Exit 5W on-ramp and Exit 6	NB	2506	2527	21	0.8%	0.4
	Exit 6 off and on-ramps	NB	1414	1423	9	0.7%	0.2
	I90 onramp and US 298 off-ramp	NB	1801	1808	8	0.4%	0.2
	Exit 7 off- and on- ramps	NB	1328	1346	18	1.3%	0.5
	Exit 7 on-ramp and Exit 8	NB	1811	1825	15	0.8%	0.3
	Exit 8 off- and on-ramps	NB	1425	1438	13	0.9%	0.3
	Exit 8 on-ramp and Exit 9N	NB	2567	2577	10	0.4%	0.2
	Exit 9N off- and on-ramps	NB	1790	1796	6	0.3%	0.1
	Exit 9N on-ramp and Exit 9S	NB	3398	3380	-18	-0.5%	0.3
	Exit 9S off- and on-ramps	NB	3231	3220	-11	-0.3%	0.2
	Before WB I-481 off-ramp	NB	3385	3312	-72	-2.1%	1.3
	Before EB I-481 on-ramp	SB	1954	1998	44	2.3%	1.0
	Exit 9S on-ramp and Exit 9N	SB	1280	1307	27	2.1%	0.8
	Exit 9S off- and on-ramps	SB	957	976	19	2.0%	0.6
	Exit 9N off- and on-ramps	SB	1112	1145	33	2.9%	1.0
	Exit 9N on-ramp and Exit 8	SB	1361	1394	33	2.4%	0.9
	Exit 8 off- and on-ramps	SB	1051	1089	38	3.6%	1.2
	Exit 8 on-ramp and Exit 7	SB	1287	1326	39	3.0%	1.1
	Exit 7 off- and on-ramps	SB	1157	1198	41	3.5%	1.2
	Exit 7 and Exit 6	SB	1720	1765	45	2.6%	1.1
	Exit 6 off- and on-ramps	SB	1380	1425	46	3.3%	1.2
	Exit 6 and Exit 5W	SB	2001	2048	47	2.4%	1.0
	Exit 5W off- and on-ramps	SB	1870	1905	35	1.9%	0.8
	Exit 5W on-ramp and Exit 5E	SB	1999	2026	27	1.3%	0.6
	Exit 5E off- and on-ramps	SB	1752	1780	28	1.6%	0.7
	Exit 5E on-ramp and Exit 4	SB	2329	2364	35	1.5%	0.7
	Exit 4 off-ramp and Exit 4 on-ramp	SB	1412	1422	10	0.7%	0.3
	Exit 4 on-ramp and Exit 3W	SB	3430	3446	16	0.5%	0.3
	Exit 3W on-ramp and Exit 3E	SB	3383	3382	-1	0.0%	0.0
	Exit 3W off- and on-ramps	SB	3073	3083	9	0.3%	0.2
	Exit 3E off and on-ramps	SB	1535	1550	16	1.0%	0.4
	Exit 3E on-ramp and Exit 2	SB	1904	1911	7	0.4%	0.2
	Exit 3E on-ramp and Exit 2	SB	1904	1908	4	0.2%	0.1
	Exit 2 off- and on-ramps	SB	1218	1218	0	0.0%	0.0
	Exit 2 on-ramp and Exit 1	SB	1472	1475	3	0.2%	0.1
	I-81 North off-ramp and E. Brighton Av on-ramp	SB	131	131	0	-0.1%	0.0
	I-81 North and I-81 South ramps	SB	740	732	-8	-1.1%	0.3
	I-81 North off-ramp and E. Brighton Av on-ramp	SB	658	649	-9	-1.4%	0.4
	Rock Cut Rd off-ramp	NB	353	346	-7	-2.0%	0.4
	Rock Cut Rd on -ramp	NB	369	360	-9	-2.5%	0.5
	Jamesville Rd off-ramp	NB	454	441	-13	-2.8%	0.6
	Jamesville Rd on-ramp	NB	522	520	-2	-0.4%	0.1
	EB US 5 off-ramp	NB	250	244	-7	-2.7%	0.4
	WB US 5 on-ramp	NB	1352	1351	-2	-0.1%	0.0
	EB US 5 on-ramp	NB	353	352	-1	-0.2%	0.0
	WB US 5 off-ramp	NB	226	225	-1	-0.5%	0.1
	WB I690 off-ramp	NB	1251	1246	-5	-0.4%	0.1

	EB I690 onramp	NB	1496	1475	-21	-1.4%	0.5
	EB Kirkville Rd on-ramp	NB	250	250	1	0.3%	0.1
	EB Kirkville Rd off-ramp	NB	474	460	-15	-3.1%	0.7
	WB Kirkville Rd off-ramp	NB	329	335	5	1.6%	0.3
	WB Kirkville Rd on-ramp	NB	157	156	-1	-0.7%	0.1
	I90 off-ramp	NB	1092	1095	2	0.2%	0.1
	I90 on-ramp	NB	387	385	-2	-0.4%	0.1
	US 298 of-ramp	NB	472	462	-10	-2.1%	0.5
	US 298 on-ramp	NB	483	480	-3	-0.5%	0.1
	Northern Blvd off-ramp	NB	386	380	-7	-1.7%	0.3
	Northern Blvd on-ramp	NB	1142	1137	-5	-0.4%	0.1
	Brighton Ave off-ramp	SB	732	737	5	0.7%	0.2
	Jamesville Rd off-ramp	SB	686	696	10	1.5%	0.4
	Jamesville Rd on-ramp	SB	254	254	0	0.0%	0.0
	WB US 5 off-ramp	SB	356	364	7	2.0%	0.4
	EB US 5 on-ramp	SB	369	368	-1	-0.2%	0.0
	EB US 5 off-ramp	SB	1848	1851	3	0.1%	0.1
	WB US 5 on-ramp	SB	310	309	0	0.0%	0.0
	EB I690 on-ramp	SB	2017	2029	12	0.6%	0.3
	WB I690 off-ramp	SB	917	941	24	2.7%	0.8
	EB Kirkville Rd on-ramp	SB	578	577	-1	-0.1%	0.0
	EB Kirkville Rd off-ramp	SB	248	244	-3	-1.4%	0.2
	WB Kirkville Rd on-ramp	SB	129	128	-2	-1.4%	0.2
	WB Kirkville Rd off-ramp	SB	131	137	6	4.3%	0.5
	I90 off-ramp	SB	340	341	0	0.1%	0.0
	I90 on-ramp	SB	622	622	0	0.1%	0.0
	US 298 off-ramp	SB	130	123	-6	-4.9%	0.6
	US 298 on-ramp	SB	563	562	-1	-0.2%	0.1
	Northern Blvd on-ramp	SB	235	233	-2	-0.9%	0.1
	Northern Blvd off-ramp	SB	310	302	-8	-2.4%	0.4