Introduction and Overview

Purpose and Context of the Study

This project is part of a Federal Highway Administration (FHWA) research program to test and evaluate the TRANSIMS software tools in various regions and in a variety of applications. A proposal was submitted to FHWA by the Georgia Regional Transportation Authority (GRTA) in partnership with the Atlanta Regional Commission (ARC), the Georgia Environmental Protection Division (EPD), and AECOM Consult. The title of the proposal was "Using TRANSIMS to Quantify the Impacts of Planned Transportation Projects on Congestion and Air Quality".

The primary objectives of this study are:

Develop a TRANSIMS-based tool to quantify the potential congestion impacts of planned transportation projects that could be integrated into the project selection process for the Atlanta Regional Transportation Plan and Transportation Improvement Program.

Develop a TRANSIMS and MOVES-based tool to quantify the emissions impacts of planned transportation projects that could be used in health and exposure modeling and in the development of the State Implementation Plan. This tool could also be used in NEPA analysis and in $PM_{2.5}$ hot-spot analyses for transportation conformity purposes.

Objectives for the Peer Review

As part of the FHWA research program, each participant is asked to include at least two Peer Review meetings during the course of the study to review progress and make suggestions about how the research might be improved. This is the first Peer Review meeting for the Atlanta project. It comes after most of the TRANSIMS model development and validation work has been completed and prior to starting the model application phase.

The primary questions for the Peer Review Panel at this meeting are:

Does the TRANSIMS simulation generate reasonable/valid results?

Is there need to do more calibration / validation work?

How could the process and methods be improved?

Is the proposed methodology for using this tool for transportation project evaluation acceptable / theoretically sound?

Are there any major problems or benefits in integrating the TRANSIMS simulation with MOVES, the current ARC modeling process, or the activity-based demand models ARC is currently developing?

TRANSIMS Network Preparation

The general process of converting traditional regional model networks and trip tables to TRANSIMS format was initially developed as part of studies in Portland and Washington D.C. and refined through this effort. The following graphic depicts the overall conversion process for generating the TRANSIMS network files. It begins with several utilities that take link-node data in a variety of software formats and converts the information to generic TRANSIMS link and node files. This information is passed into the TransimsNet program to synthetically generate the physical characteristics of the roadway network – lane connectivity, pocket lanes, activity locations, parking lots, and access links. It also generates signal and sign warrants that are reviewed and edited before being converted to detailed signal timing information. Synthetic intersection controls and signal progression offsets are generated by the IntControl and Progression programs.

The link and node files are also used by the transit route conversion utilities to create the generic transit route files. Headways and run offsets by time period are added to each route record before the data are combined with the detailed roadway network to synthetically create the transit stops, schedules, and driver plans. Figure 1 depicts the overall conversion process from TP+ to TRANSIMS.

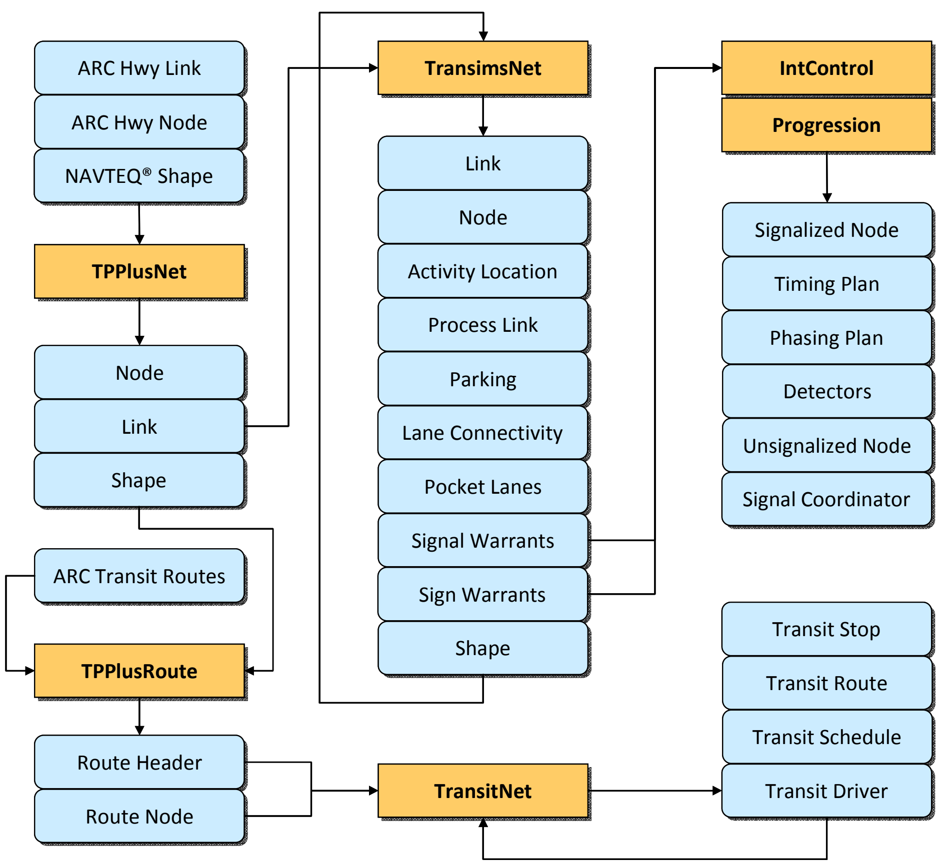


Figure 1: TRANSIMS network preparation process

Note that at each step in this process the ArcNet program can be used to generate ArcView Shape files to review and edit the information prior to proceeding to the next step. By reviewing and correcting the synthetic information early in the process, problems can be fixed before they get deeply embedded into a full TRANSIMS network. The ArcView image of the regional network is shown in Figure 2.

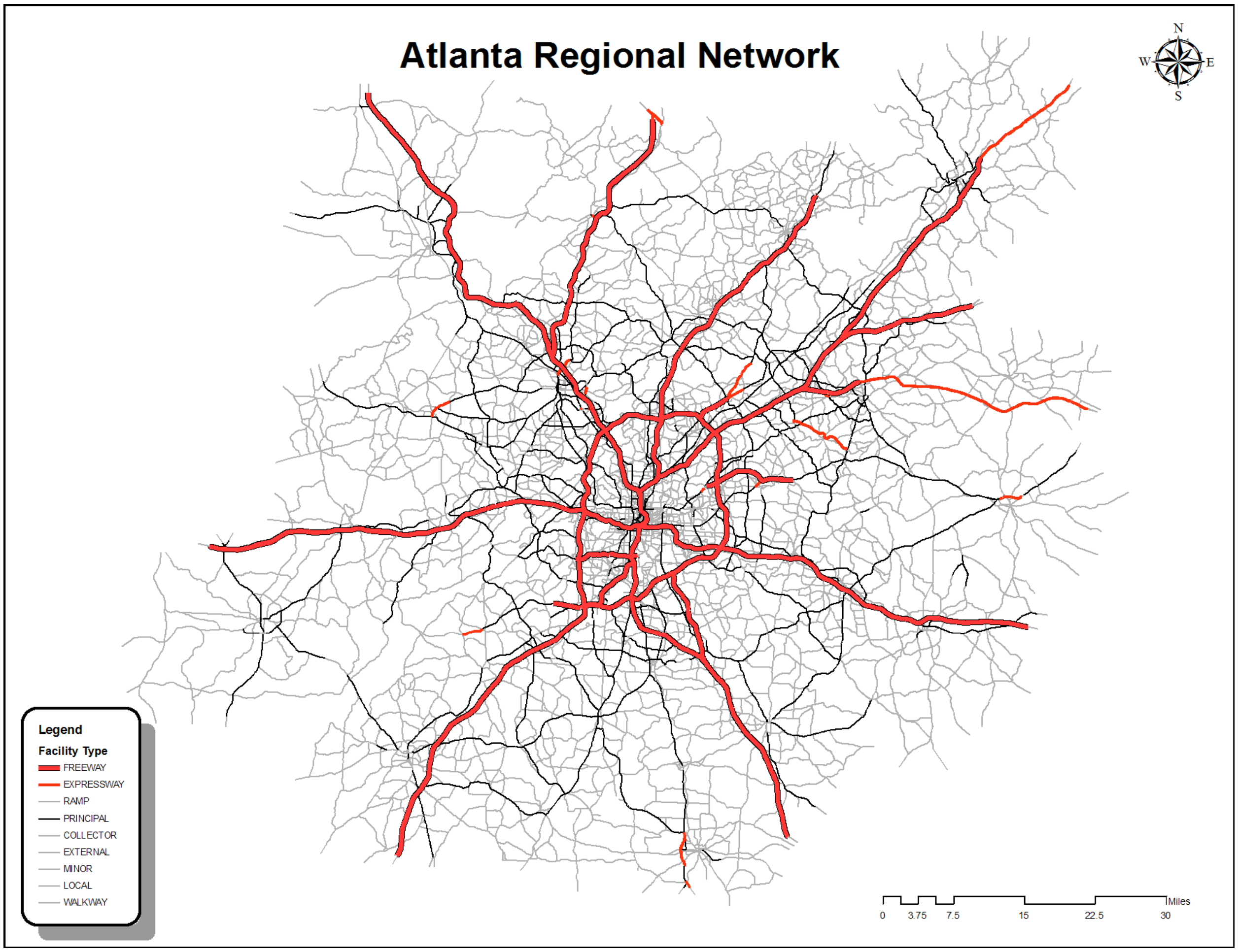


Figure 2: Resulting regional ARC TRANSIMS network

Signal Warrants

The signal warrants generated by the synthetic network development process classify intersections based on the facility types of the approach roadways and the surrounding land-use density. Facility type / area type parameters are calibrated to generate an appropriate traffic signal warrant for a given area. For this study, actual traffic signal locations were available for three counties: Gwinnett, Cobb and DeKalb. This information was used to calibrate parameters that closely match the observed data.

The following images show the locations of signal warrants and traffic signals before and after the adjustment. The red stars are actual traffic signal locations and the blue circles with centers are the output signal warrants. Note there are many more signals identified in the observed data than there are intersections in the ARC network. The ARC network is a regional planning network and as such only includes collector and above facilities. Intersections with local streets and driveways to shopping centers and major employers that have traffic signals in the real world can not be included in the regional planning simulation. On the other hand, the algorithms used to load vehicles to the network within TRANSIMS compensate for the lack of signal controls by being less restrictive than a literal approach would require.

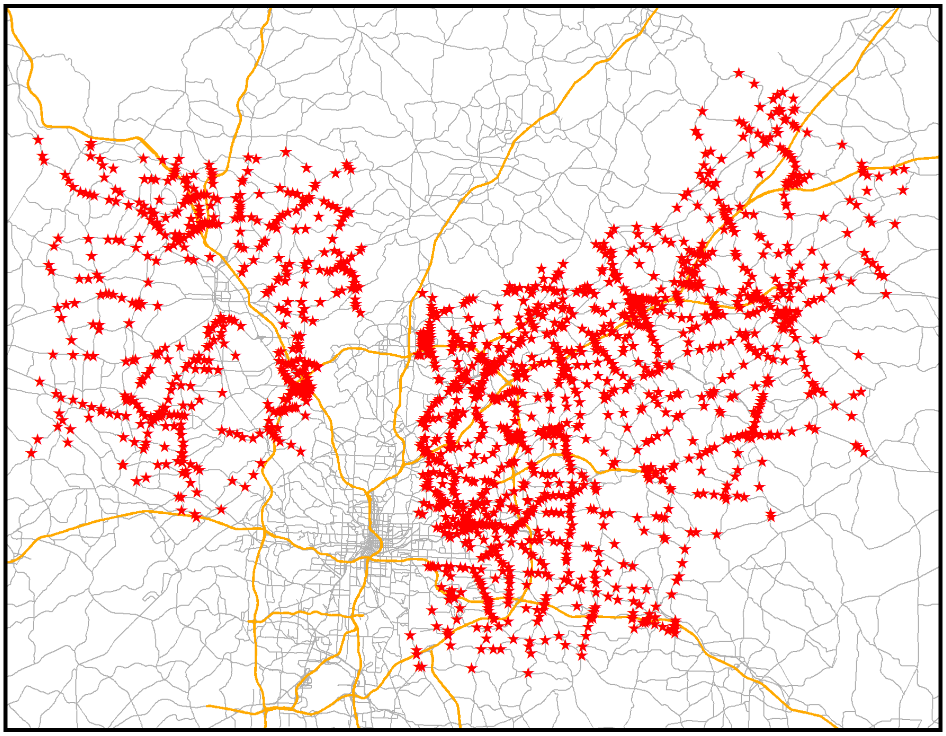


Figure 3: Location of actual traffic signals

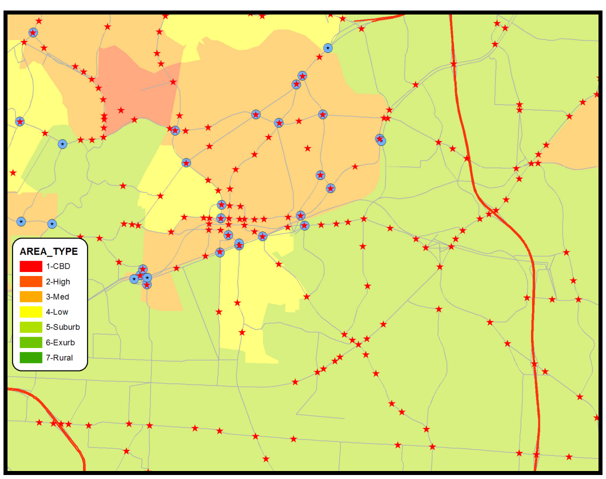


Figure 4: Before signal warrants calibration

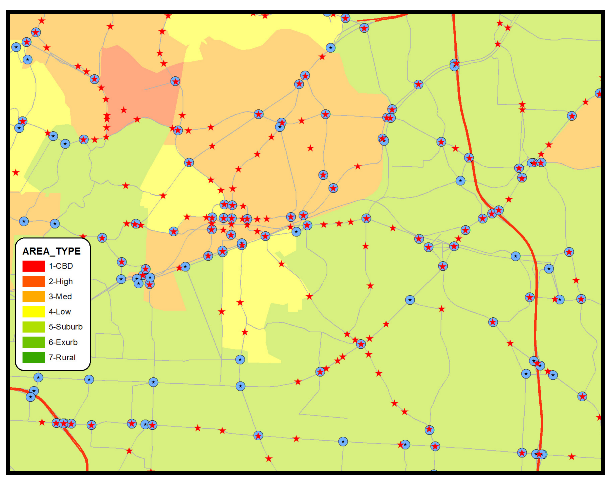


Figure 5: After signal warrants calibration

ARC's Conflated Network

The process in Atlanta was somewhat different from other model conversion efforts in that ARC had refined their traditional TP+ stick network using roadway shapes provided by NAVTEQ. ARC's conflated TP+ highway network includes shape files and street names for each link in addition to the basic link and node data. TRANSIMS can read these shape files and use them to generate the detailed TRANSIMS network. This information is especially helpful in accurately modeling intersection configurations, lane connectivity, pocket lanes, and signal and sign warrants. It also makes complex freeway interchanges much easier to visualize and interpret. Without this information, understanding and editing complex network coding is extremely difficult. It would also make the simulation results more difficult to use and debug.

TRANSIMS also uses link shapes to validate link lengths and calculate the coordinate location of parking lots, transit stops, and activity locations. Since activity locations are assigned to regional traffic analysis zones for distributing zone-based trip tables, having accurate locations for the activity locations greatly simplifies the point-in-polygon methods used to relate activity locations to zone boundaries.

Figure 6: Detailed downtown network

ARC Network Enhancements

During the initial network review process, the TRANSIMS Router and Microsimulator were used to identify locations where the ARC regional network included connectivity problems or missing facilities. In these situations, the Microsimulator did not have adequate capacity to accommodate the demand resulting in large cascading queues. Aerial photos were used to review the network in these areas and identify network coding problems. In most cases a correction to ARC's regional network or conflation process was made to address the situation. The following are a few examples of such corrections:

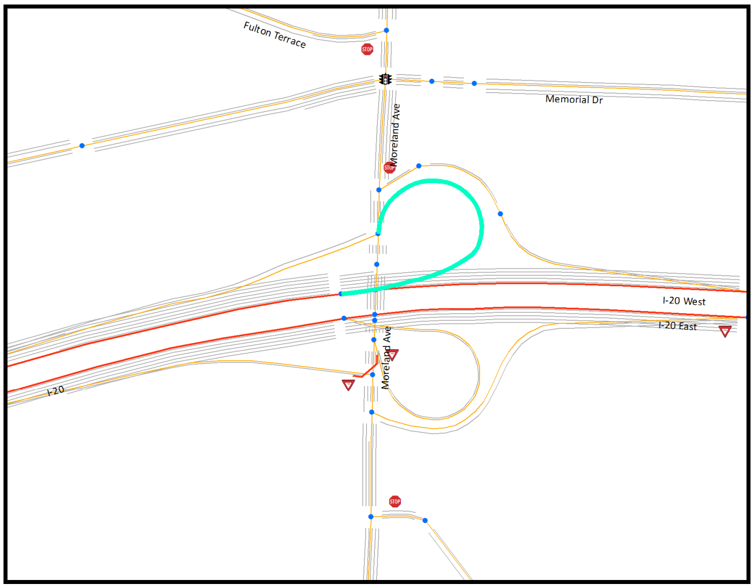


Figure 7: Ramp from north bound Moreland Ave to I-20 WB was missing

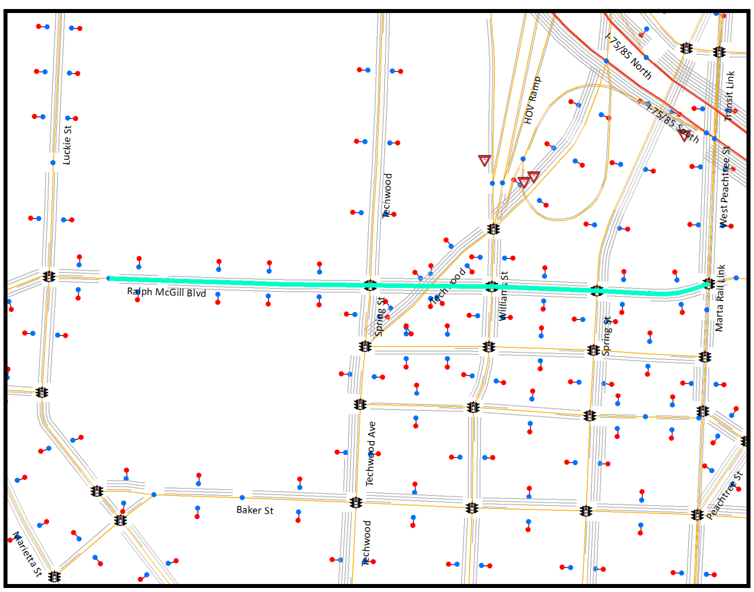


Figure 8: Two-way Ralph McGill Blvd. was incorrectly coded as one-way street

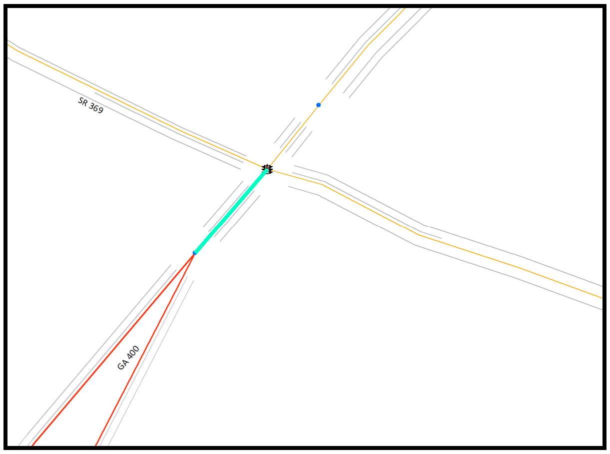


Figure 9: The northern end of GA 400 was incorrectly coded as one-way south

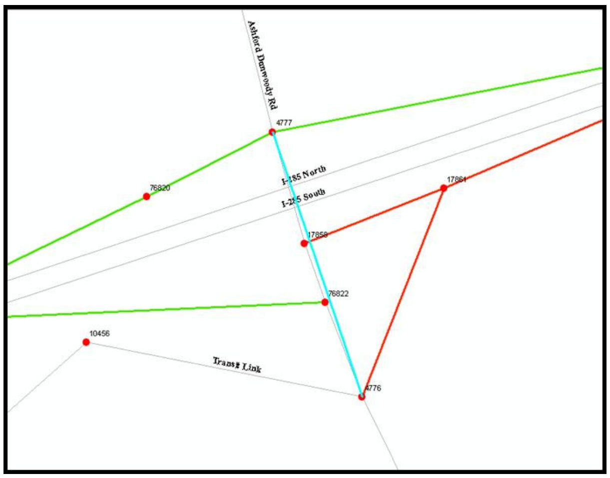


Figure 10: The EB off-ramp from I-285 did not have access to NB Ashford Dunwoody Rd

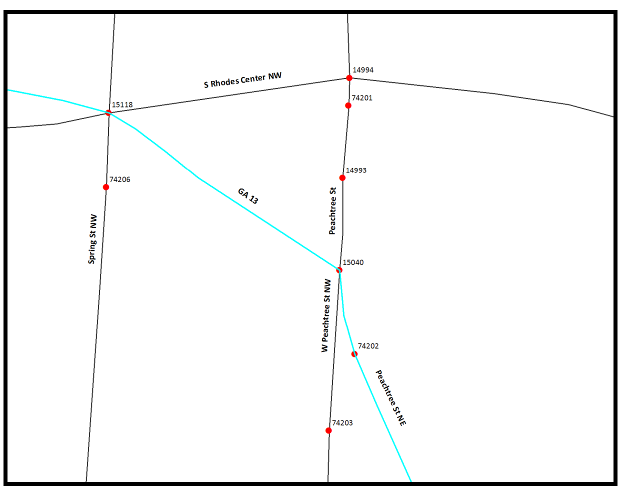


Figure 11: Northbound Peachtree St NE allowed left turn onto GA 13 incorrectly

HOV Lane Coding

The Atlanta network includes left lane HOV designations on the radial freeways shown in Figure 12. To simulate this operation within TP+, ARC coded separate parallel links with HOV restrictions and short two-way connection links to the main freeway facilities at each entry or exit ramp (see Figure 13). This enables the TP+ software to load the HOV traffic from the ramp to the HOV lane without interacting with the traffic on the freeway. This coding technique is not unusual for travel demand forecasting models. Unfortunately it has major implications for TRANSIMS and other traffic operations tools.

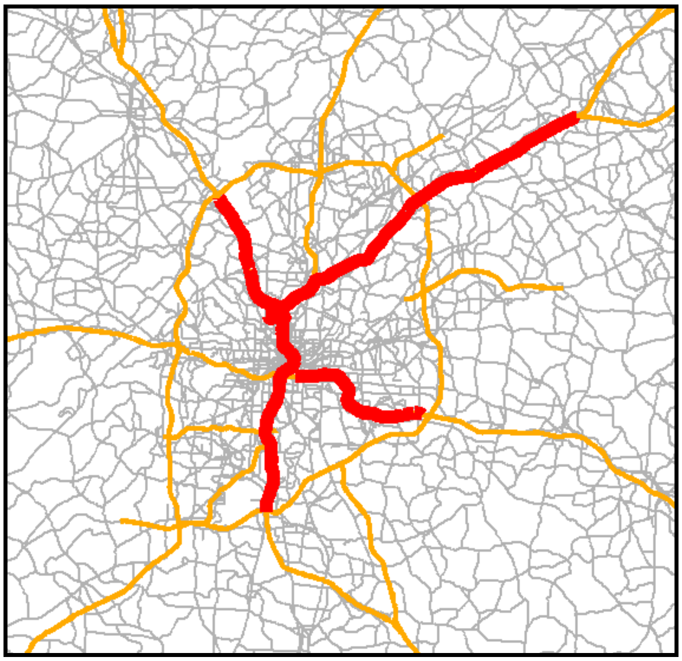


Figure 12: All the HOV facilities in the region shown in red

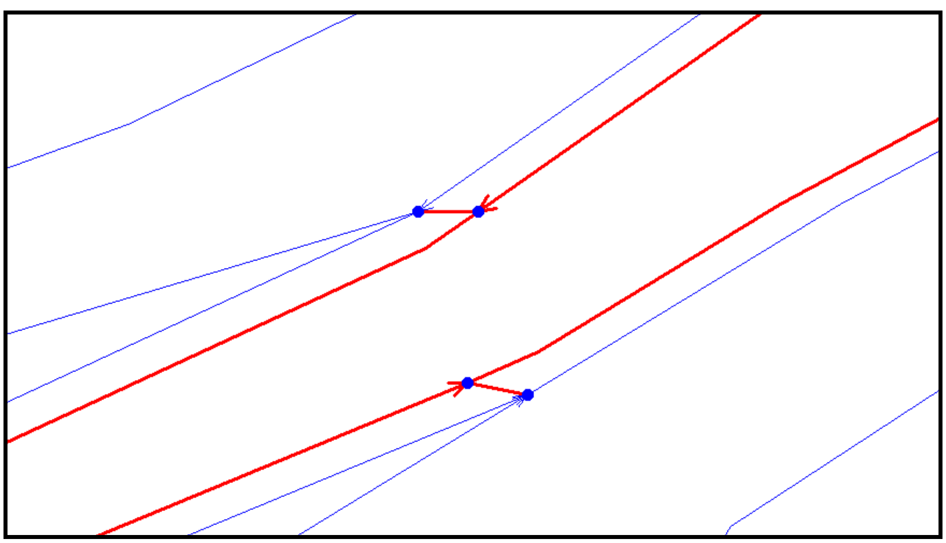


Figure 13: ARC regional TP+ network with HOV links and slip ramps shown in red

The TRANSIMS conversion utilities treat these two-way connection links between the HOV lanes, main lanes, and ramps as a large unsignalized intersection. The angles between each of the entry and exit links and lanes are evaluated to determine if the movement should be permitted and whether it is a thru movement, left turn, right turn, merge or diverge. For these locations many of the movements that would be permitted by TP+ were excluded by TRANSIMS because they were illogical or infeasible. The conversion result shown in Figure 14, caused a number of path building problems and considerable congestion at these intersections.

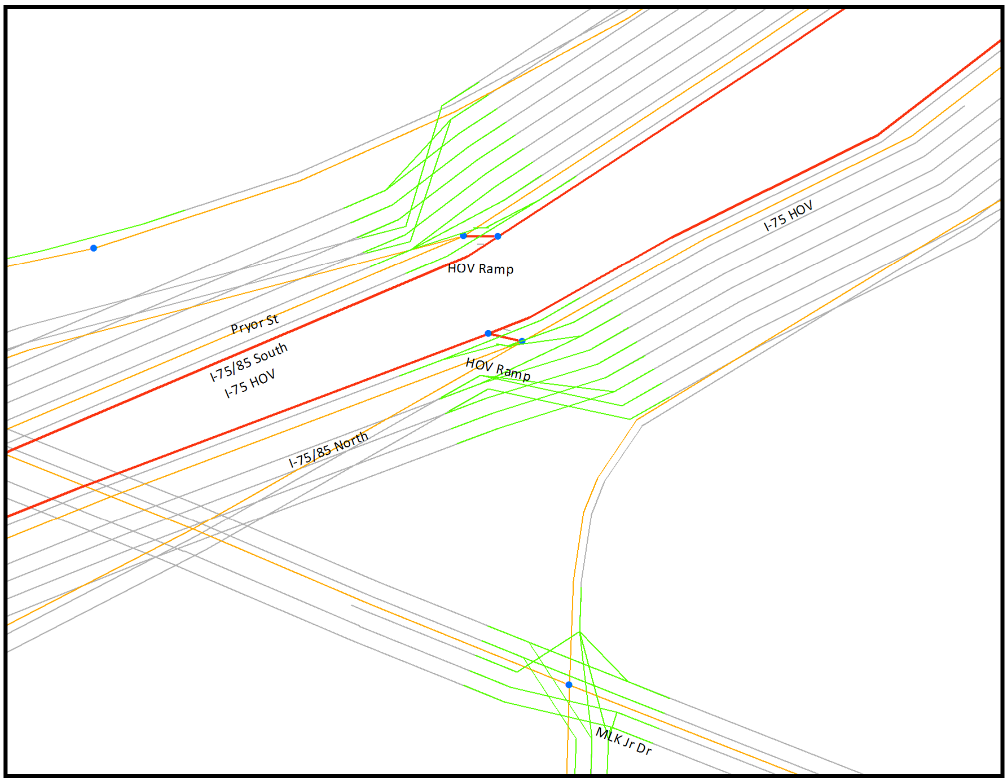


Figure 14: TRANSIMS HOV lanes on separate facilities

The other major problem is that in a TRANSIMS simulation the vehicles must cross each of the freeway lanes to enter a left side HOV lane from a right side entry ramp or visa versa. In TP+ this is a single node and the traffic moves from one link to any other link without consideration of space or traffic. Since the TRANSIMS Router builds paths similar to the way TP+ works, the travel plans generated by the Router were often impossible for the Microsimulator to implement. This generated large numbers of lost vehicles (vehicles pulled out of the simulation because they are stuck in one place for more than two minutes waiting to make a required maneuver) and unrealistic congestion levels.

To address these problems the separate links and two-way connections for HOV lanes were removed from the TRANSIMS network and replaced by an additional left side lane on the mainline freeway. This lane was then added to the Lane Use file as a 24-hour restricted lane for HOV2+ autos and buses. This resolves both the routing problem and the simulation problem by making the decision to use the lane by HOV traffic part of the lane changing and path following logic within the Microsimulator. In other words, the level of traffic in the main lanes determines how quickly the HOV traffic can merge over into the HOV lane and how soon they will leave the HOV lane to move over to their exit ramp. Each of these maneuvers adds delay to the main lane traffic and improves the overall accuracy of the simulation. It also enables the model to demonstrate the benefits of special left side ramps for HOV and bus traffic.

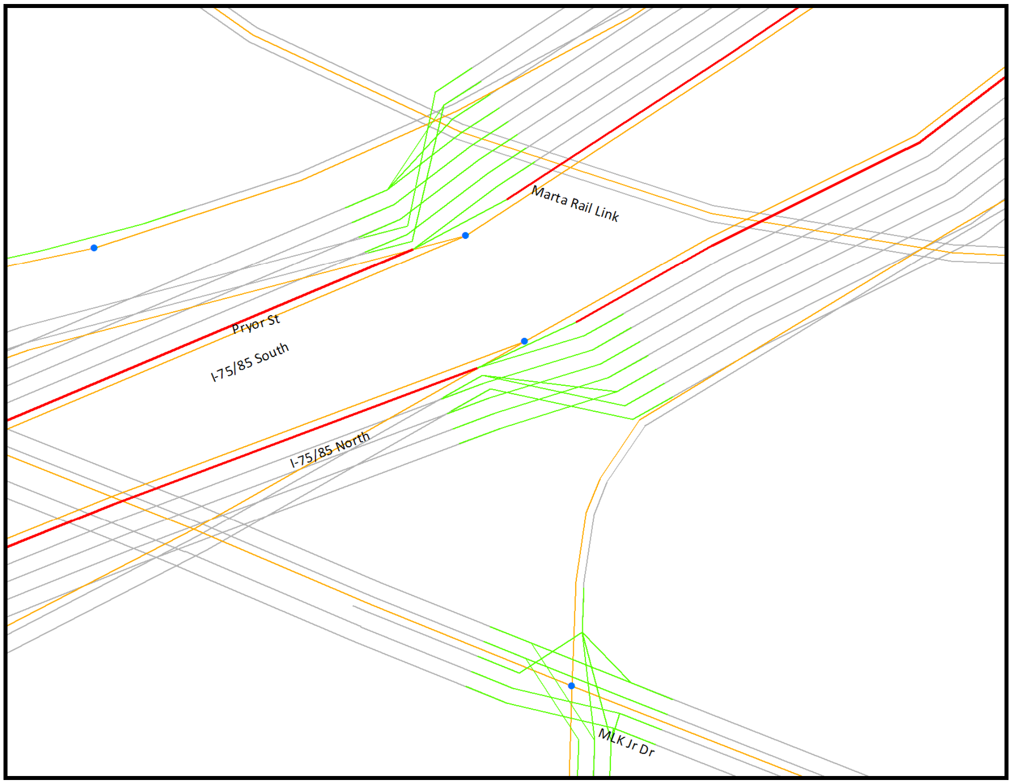


Figure 15: TRANSIMS HOV lanes moved to regular facilities

Airport Network Enhancements

The initial TRANSIMS assignments also showed considerable differences in network volumes and counts in and around Hartsfield-Jackson Atlanta International Airport. In general there were far too many trips on the east side of the airport and not enough traffic on the west side where the main terminal is located. The problem was caused by the way the automated network generation and trip distribution process allocated trips to activity locations within the airport zone (TAZ 1322).

The first step in addressing this problem was to correct the allocation of the main terminal activity locations to the airport traffic analysis zone. Figure 16 shows that the zone boundary for TAZ 1322 and the roadway loop that represents the main terminal were not well aligned. Correcting the zone numbers assigned to the terminal activity locations helped, but it in no way resolved the basic problem. By default, the trip allocation process assigns equal weight to all activity locations within a zone. Since the automatic activity location generation process created a significant number of activity locations on roadways on the east side of the airport (see Figure 16), most of the airport-related trips were assigned to these locations. These activity locations should be used for airport-related business and freight traffic, but not for air passenger traffic. A special air passenger trip weighting factor was added to the activity locations on the main terminal loop to force the trip allocation process to use these locations for the majority of airport-related trips.

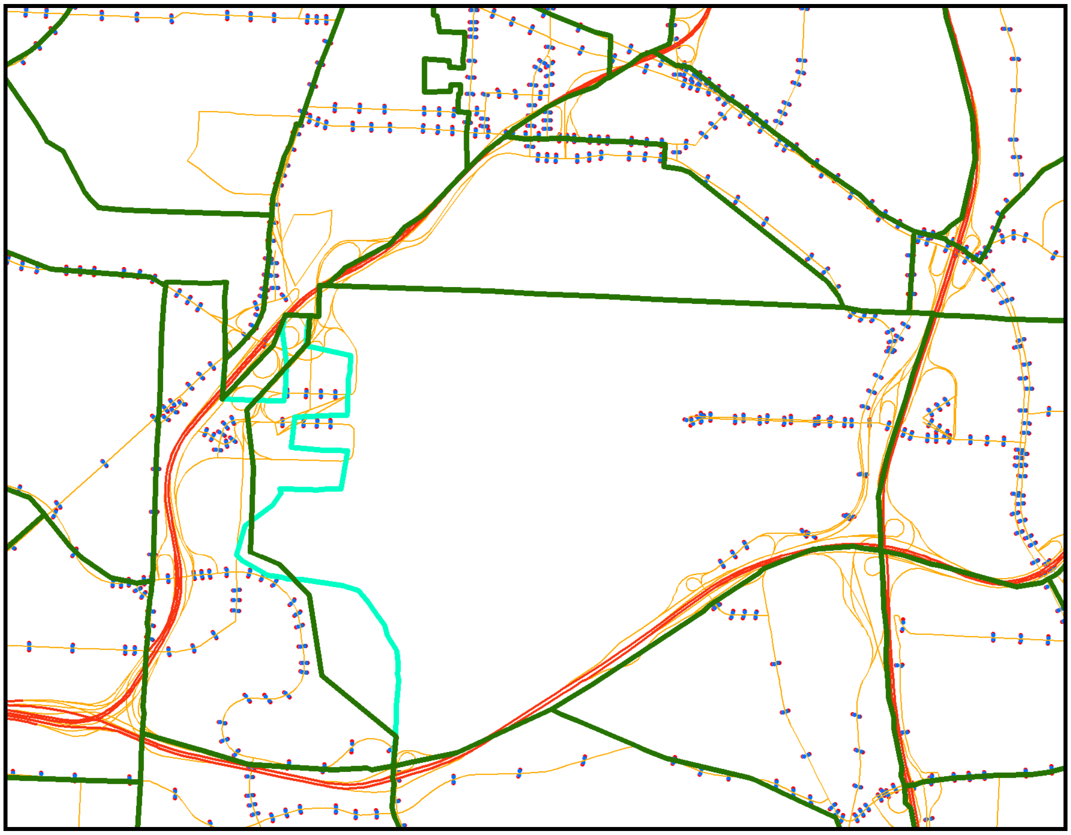


Figure 16: Airport zone boundary refinement

After the general allocation of airport trip ends was addressed, the TRANSIMS assignments matched the observed data much more closely. The heavy concentration of trips on the main terminal access roadways generated additional problems for the Microsimulator. The simulated congestion resulted in cascading queues that spilled back onto the adjacent streets and I-85. This type of congestion affected the assigned volume on I-85 and forced trips to take a more circuitous path. To address this problem, special attention was given to the synthetic network coding in and around the airport. The lanes, lane connectivity and intersection controls were individually reviewed and refined to more accurately reflect the ground conditions and smooth out the traffic flow. The resulting network improvements are shown in Figure 17.

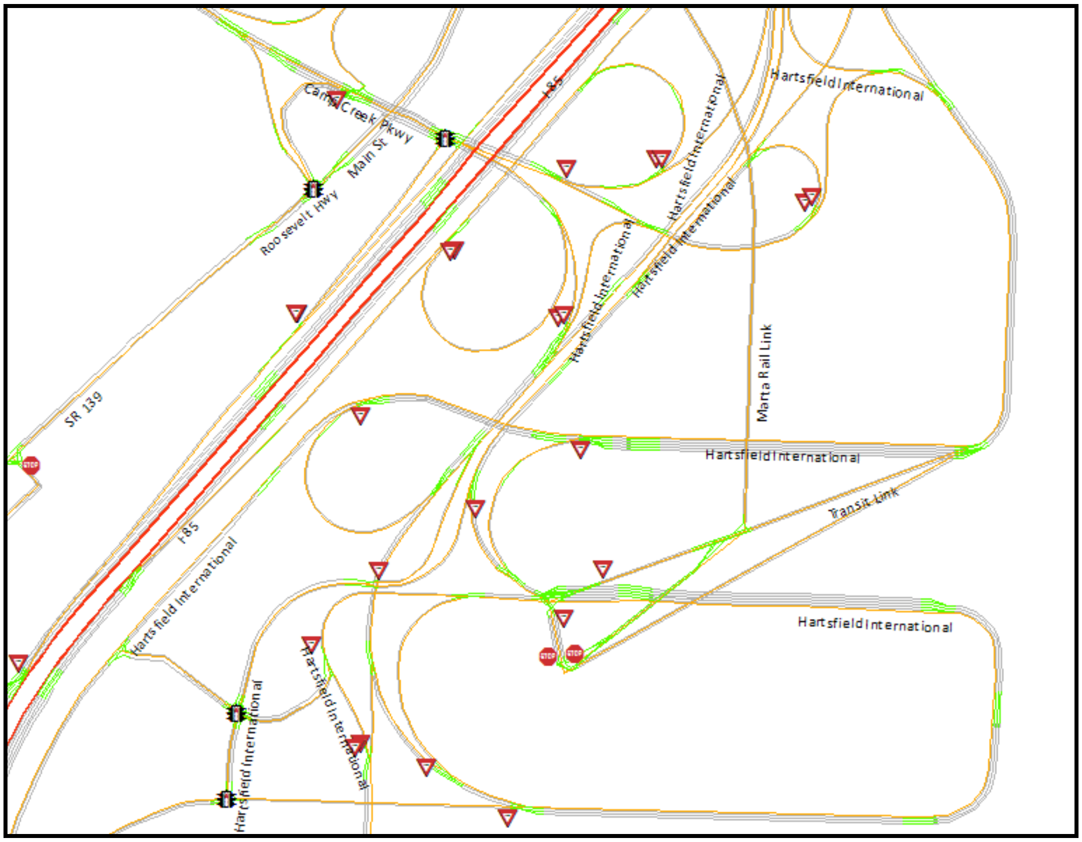


Figure 17: Micro-coding near the Airport for improving traffic flow

Transit Network Routes and Service Levels

Like most regional models, ARC codes transit routes and service levels for the AM peak and off-peak periods. These are used for production-attraction-based mode choice analysis. TRANSIMS, however, assigns riders to transit routes in the same way it assigns autos to the highway network (i.e., in origin-destination format). This means that TRANSIMS needs a daily transit network that includes details about route alignments and schedules by time of day. This detail is typically input into the TRANSIMS conversion utilities using directional route headways for six to eight daily time periods.

In this case, the ARC TP+ transit routes were reviewed, edited, and enhanced using the TP+ network editor and then run through the TRANSIMS conversion utilities iteratively until most of the coding errors and warning messages were resolved. This involved:

Moving routes off of the separate HOV links included in the original TP+ network to the mainline freeway links coded in the TRANSIMS network;

Coding reverse routes for PM Peak services missing from the AM Peak and off-peak route files;

Editing routes that traversed one-way links in the wrong direction in the TP+ formulation;

Modifying routes that make U-turns in the middle of a roadway and re-running the TransimsNet program to add U-turn lane connectivity at transit stations and park-&-ride lots;

Correcting a few network links that were improperly coded as one-way;

Editing the lane connectivity file to correct connectivity problems at three intersections;

Adding rail nodes, links and shapes to the TRANSIMS network to convert the MARTA routes and stations; and

Inserting headways for each time period to each TP+ route to enable TRANSIMS to generate an appropriate run schedule for each route throughout the course of the day.

The resulting TP+ transit routes are shown in Figure 18 and the TRANSIMS MARTA routes and stations are shown in Figure 19.

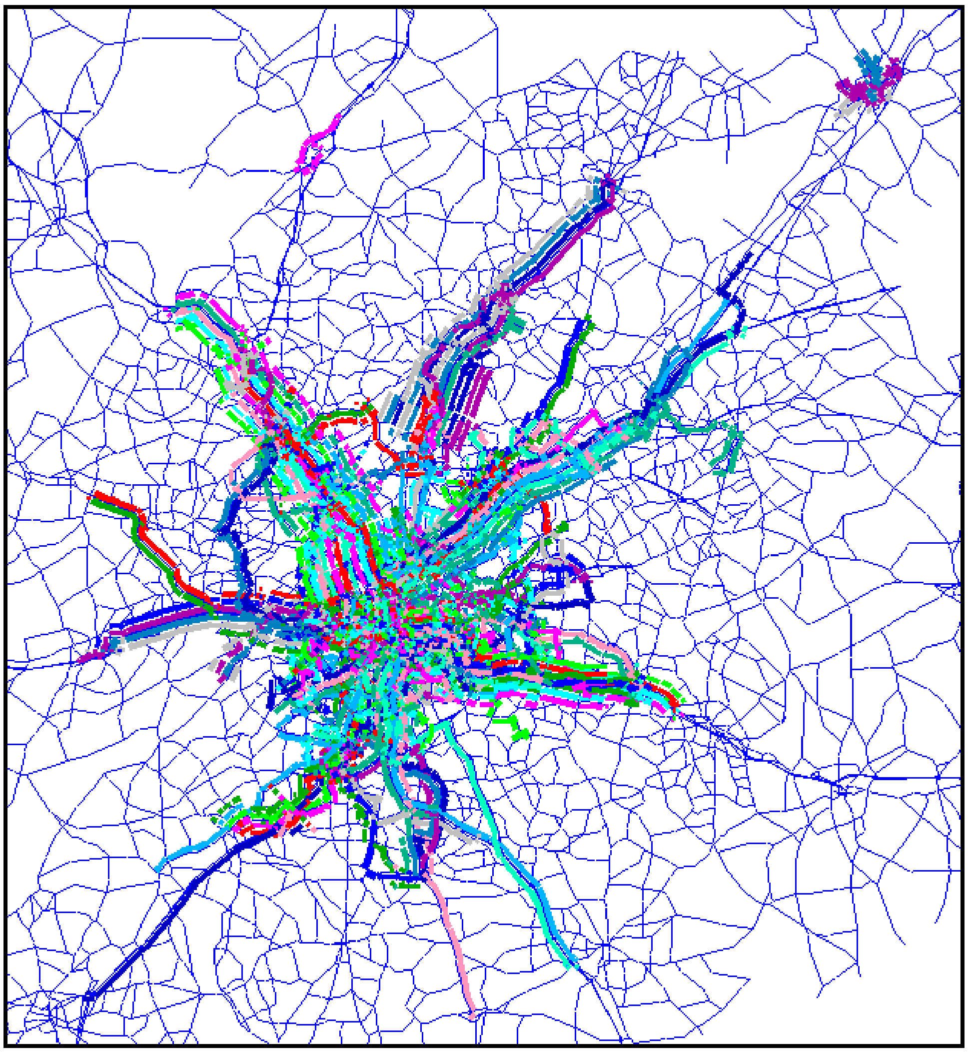


Figure 18: ARC regional transit service

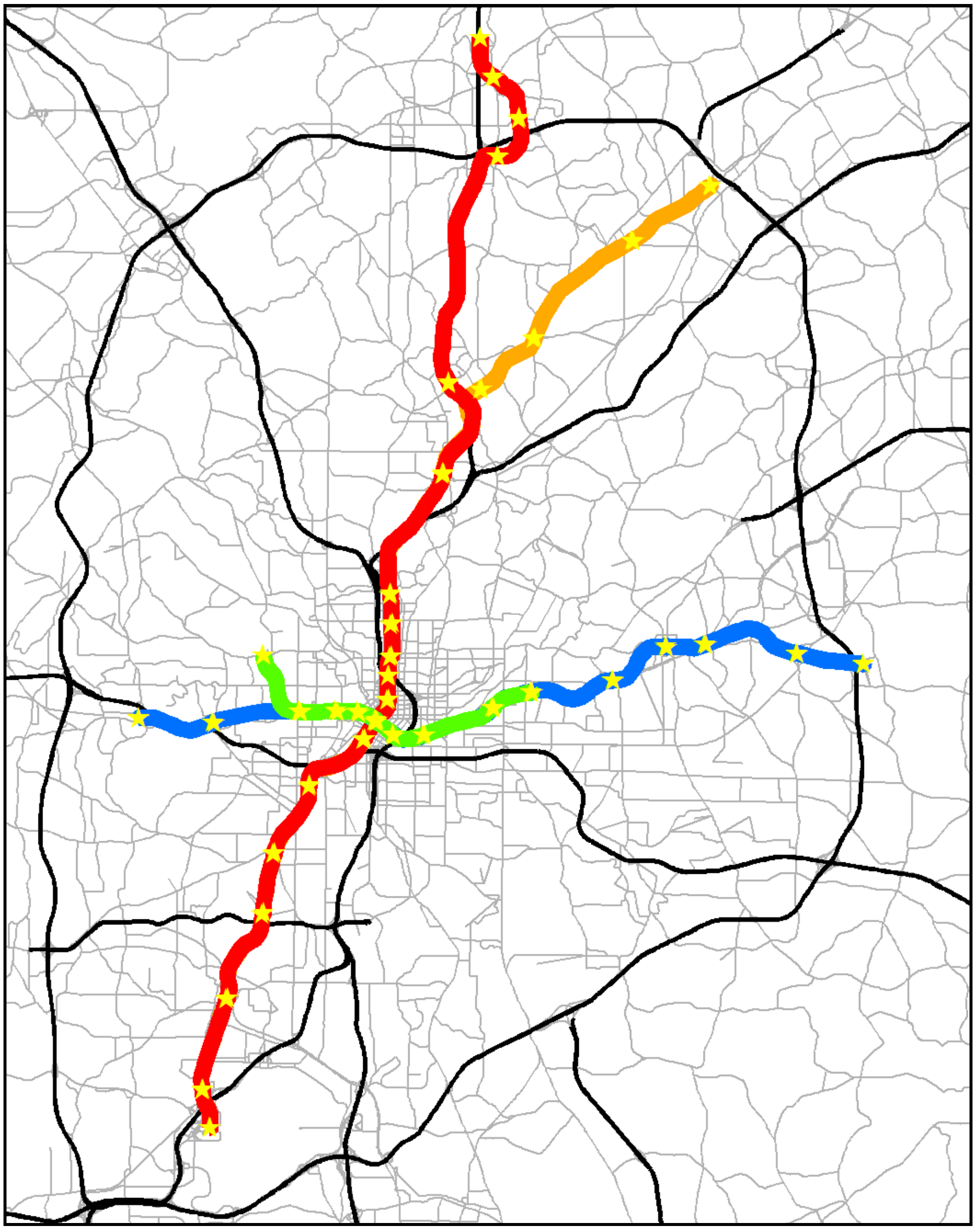


Figure 19: TRANSIMS MARTA rail routes

TRANSIMS Travel Demand Preparation

Trip Table Conversion Process

In addition to a detailed transportation network, TRANSIMS needs travel demand data that defines trips between specific activity locations, at specific times of day, using a specific mode. These trips can be the result of an activity-based travel model or trip tables converted from a traditional modeling process. This study utilizes the second method.

The conversion process begins with a series of trip tables exported from the ARC regional model in I-J-Trips format. Each trip is randomly assigned to a specific time of day using the diurnal distribution curve provided for the trip table. The trips are also randomly assigned to one of the activity locations associated with the origin and destination zone. An origin or destination weighting factor can also be assigned to each activity location to control the allocation of trip ends within the zone. These weights could relate to the distribution of land-use within the zone or special generator locations. The general process is depicted in the following graphic.

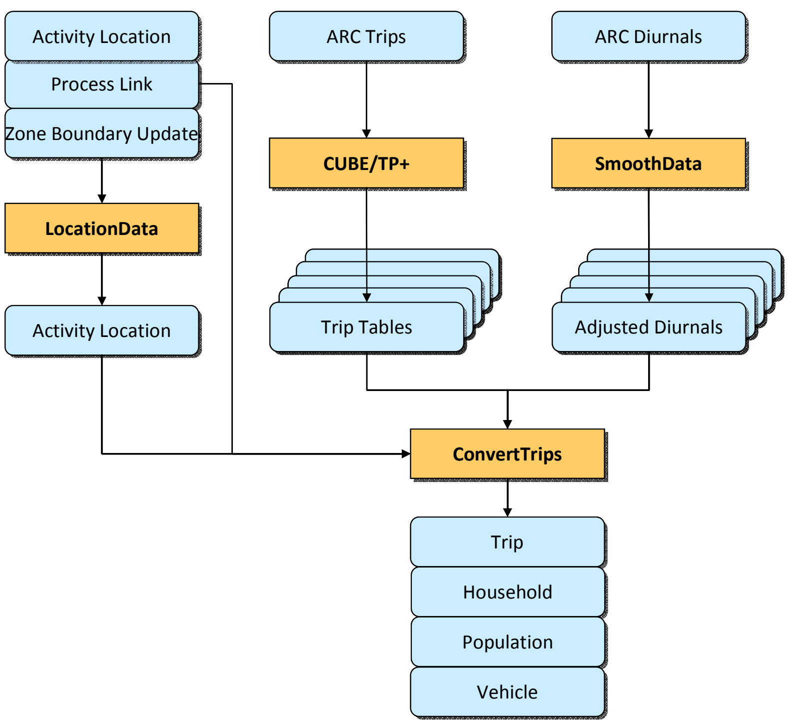


Figure 20: TRANSIMS travel demand preparation

ARC Trip Tables and Diurnal Distribution Curves

The ARC model uses three person trip purposes (home-based-work, home-based-other and non-home-based) that are split into four auto modes (SOV, HOV2, HOV3 and HOV4+) by the mode choice model. These trips are modeled in production-attraction (PA) format and converted to origin-destination format for highway assignment. Each trip table is split in half with one half kept as production-to-attraction

(P→A) trips and the other half transposed to represent attraction-to-production (A→P) trips. This is important for determining the time of day when the trip takes place and which end of the trip controls the travel schedule. For example, the HBW P→A trips are constrained by their attraction end and the HBW A→P are constrained by their production end. Other trip purposes are scheduled by their mid-trip time.

In addition to person trips, the ARC model generates commercial vehicle, air travel and external vehicle trips. Through trips are routed using free flow speeds in ARC's assignment procedure based on the notion that external trips will take the most direct path regardless of network congestion. Special treatment is also required for heavy trucks. By law, heavy trucks with trip ends outside the I-285 perimeter are restricted from using any link inside the perimeter. This restriction was incorporated into TRANSIMS by adding special truck restrictions to links inside the parameter and splitting the heavy truck trip table into trips with origins and destinations outside the parameter from trips with one end within the parameter. Each trip table is then assigned to the appropriate vehicle type to control the links it can use.

The initial diurnal distribution files were prepared from ARC's 30-minute temporal distribution files. These file contain the time of day factors for several trip purpose and mode combinations by trip start, end and mid-trip times. The following two tables depict the various combinations of purpose, mode and time available within each file.

File: "TRPPRO4.TME"

Purpose
HBW
HBU
HBGS
HBO
NHB_JTW
NHB_JAW
NHB_NNW

X

Mode
TRANSIT
AUTODR
AUTOPX
AUTOPS
SOV
HOV
ALLPS

X

Time
Start
End
Mid-Trip

File: "EEIETRK.TME"

Purpose
IEWRK
IENWK
EIWRK
EINWK
EEPC
IIHTK
IIMTK
IEHTK
IEMTK
EETRK

X

Mode
AUTODR

X

Time
Start
End
Mid-Trip

The combinations of trip purpose, mode, location and orientation resulted in the 44 zone-based trip tables and diurnal distribution curves listed in the table below. These data are exported from TP+ for input to the TRANSIMS ConvertTrips program. This program converts these 44 trip tables into TRANSIMS trip, household, population, and vehicle files for use in routing and simulation. In this case, each trip is modeled with its own household, person, and vehicle to simplify the overall modeling process. This results in 13.6 million trips, households, persons, and vehicles in the highway component of the Atlanta TRANSIMS model.

	Trip Table	Diurnal
1	HBW_SOV_PA.Trips	HBW_SOV_PA.txt
2	HBW_SOV_AP.Trips	HBW_SOV_AP.txt
3	HBW_HOV_PA.Trips	HBW_HOV_PA.txt
4	HBW_HOV_AP.Trips	HBW_HOV_AP.txt
5	HBO_SOV_PA.Trips	HBO_SOV_PA.txt
6	HBO_SOV_AP.Trips	HBO_SOV_AP.txt
7	HBO_HOV_PA.Trips	HBO_HOV_PA.txt
8	HBO_HOV_AP.Trips	HBO_HOV_AP.txt
9	NHB_SOV_PA.Trips	NHB_JAW_SOV_PA.txt
10	NHB_SOV_AP.Trips	NHB_JAW_SOV_AP.txt
11	NHB_HOV_PA.Trips	NHB_JAW_HOV_PA.txt
12	NHB_HOV_AP.Trips	NHB_JAW_HOV_AP.txt
13	IEWRKM_PA.Trips	IEWRK_AUTODR_PA.txt
14	IEWRKM_AP.Trips	IEWRK_AUTODR_AP.txt
15	IENWKM_PA.Trips	IENWK_AUTODR_PA.txt
16	IENWKM_AP.Trips	IENWK_AUTODR_AP.txt
17	EEPC_PA.Trips	EEPC_AUTODR_PA.txt
18	EEPC_AP.Trips	EEPC_AUTODR_AP.txt
19	AIRPORT_PA.Trips	HBO_SOV_PA.txt
20	AIRPORT_AP.Trips	HBO_SOV_AP.txt
21	COM_II_PA.Trips	IIMTK_AUTODR_PA.txt
22	COM_II_AP.Trips	IIMTK_AUTODR_AP.txt
23	COM_IE_PA.Trips	IEMTK_AUTODR_PA.txt
24	COM_IE_AP.Trips	IEMTK_AUTODR_AP.txt
25	COM_EE_PA.Trips	EETRK_AUTODR_PA.txt
26	COM_EE_AP.Trips	EETRK_AUTODR_AP.txt
27	MTK_II_PA.Trips	IIMTK_AUTODR_PA.txt
28	MTK_II_AP.Trips	IIMTK_AUTODR_AP.txt
29	MTK_IE_PA.Trips	IEMTK_AUTODR_PA.txt
30	MTK_IE_AP.Trips	IEMTK_AUTODR_AP.txt
31	MTK_EE_PA.Trips	EETRK_AUTODR_PA.txt
32	MTK_EE_AP.Trips	EETRK_AUTODR_AP.txt
33	HTK_II_Inside285_PA.Trips	IIHTK_AUTODR_PA.txt
34	HTK_II_Inside285_AP.Trips	IIHTK_AUTODR_AP.txt
35	HTK_IE_Inside285_PA.Trips	IEHTK_AUTODR_PA.txt
36	HTK_IE_Inside285_AP.Trips	IEHTK_AUTODR_AP.txt
37	HTK_EE_Inside285_PA.Trips	EETRK_AUTODR_PA.txt
38	HTK_EE_Inside285_AP.Trips	EETRK_AUTODR_AP.txt
39	HTK_II_Outside285_PA.Trips	IIHTK_AUTODR_PA.txt
40	HTK_II_Outside285_AP.Trips	IIHTK_AUTODR_AP.txt
41	HTK_IE_Outside285_PA.Trips	IEHTK_AUTODR_PA.txt
42	HTK_IE_Outside285_AP.Trips	IEHTK_AUTODR_AP.txt
43	HTK_EE_Outside285_PA.Trips	EETRK_AUTODR_PA.txt
44	HTK_EE_Outside285_AP.Trips	EETRK_AUTODR_AP.txt

Diurnal Adjustments

After the initial set of TRANSIMS simulation runs, the diurnal distribution of traffic on radial freeways was compared to the detailed 15-minute count data at these same locations. The comparison (Figure 21) showed that the diurnal curves underestimated trips in the early morning and late evening hours and over estimated mid-day trips.

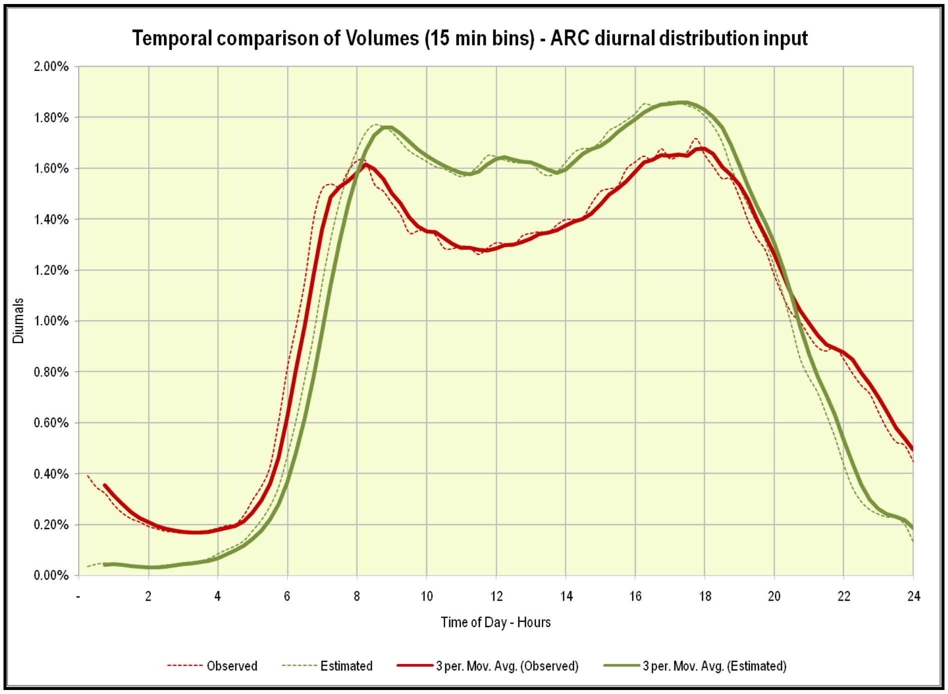


Figure 21: Diurnal distribution of observed and estimate traffic volumes – before adjustment

The distribution was investigated by accumulating the trips by trip purpose and time of day. These results showed spikes by time of day that are typical of reporting bias in household travel surveys. An iterative moving average smoothing process was applied to ARC's diurnal distribution curves and reapplied to the trip tables in the ConvertTrips program. The curves before and after the smoothing process are shown in Figures 22 and 23 and a comparison of the cumulative result is shown in Figure 24. Figure 25 presents a comparison of the diurnal distribution of observed traffic volumes and TRANSIMS estimated volumes on radial freeways after the adjustment.

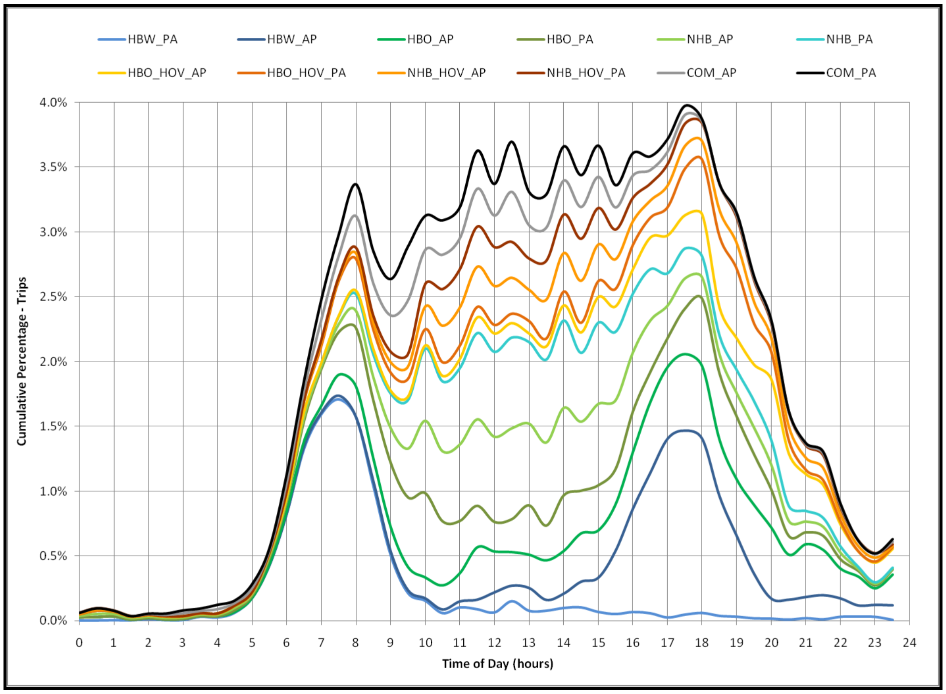


Figure 22: Input diurnal distribution curves by trip purpose – before adjustments

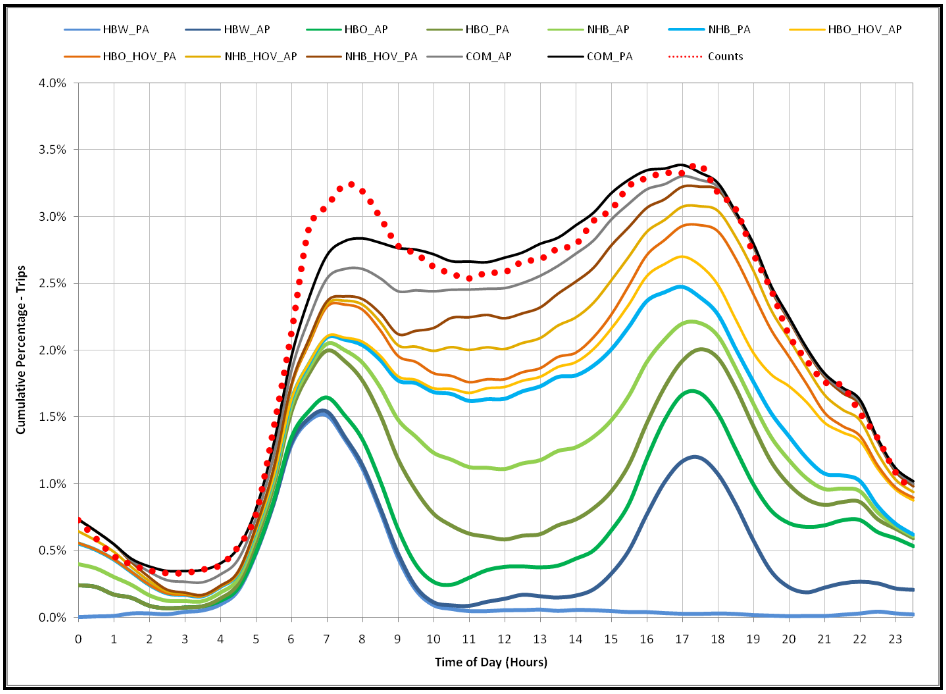


Figure 23: Input diurnal distribution curves by trip purpose – after adjustments

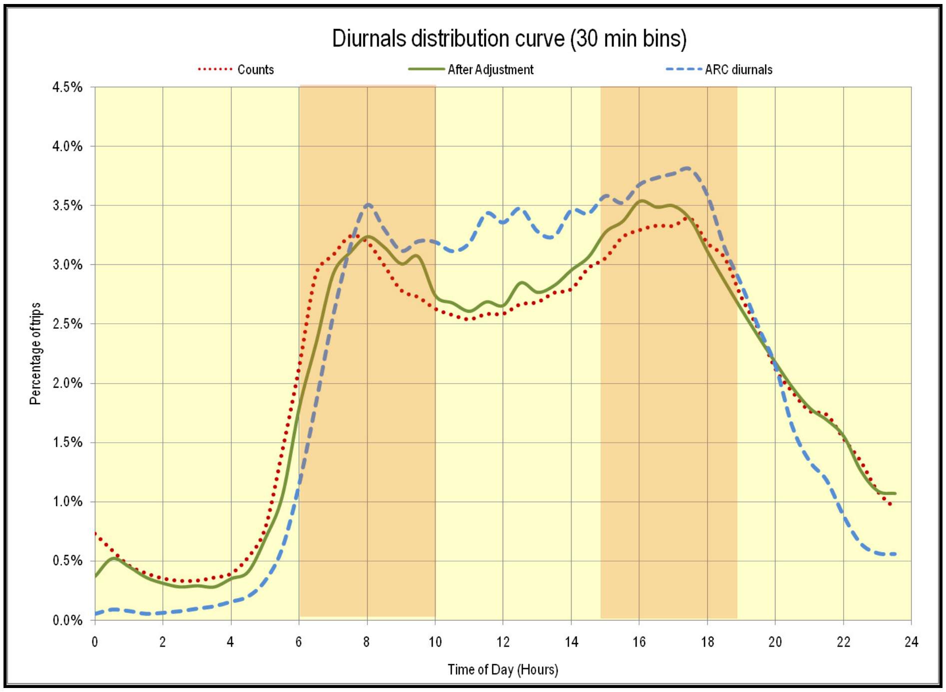


Figure 24: Diurnal distribution curves (output from TRANSIMS ConvertTrips)

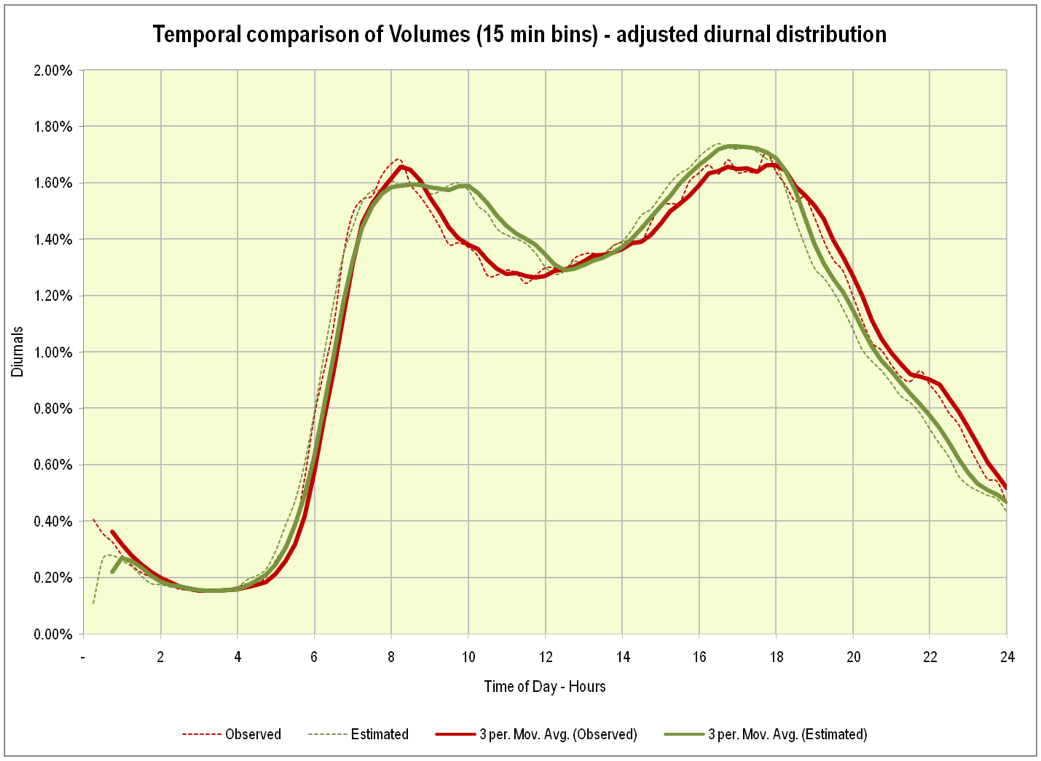


Figure 25: Diurnal distribution of observed and estimate traffic volumes – after adjustment

PBS&J's Matrix Variegator Trip Tables

During the initial TRANSIMS application the Router assigned volumes matched ARC's assigned volumes closely in some time periods (PM & NT) but not in others (AM & MD). Several factors related to the inherent differences in the time of day algorithms could contribute to these differences. The diurnal adjustments discussed in the previous section were one way of addressing the concern. Another approach was to apply a time of day distribution approach developed by PBS&J for the I-285 simulation study. GRTA obtained the "Matrix Variegator" script from PBS&J that slices up the 24-hour SOV, HOV2, HOV3+, commercial truck, medium truck, and heavy truck trip tables into hourly trip tables based on interchange travel times, link demands, and count comparisons. The original script generated tables for just the morning and evening peak periods, so GRTA modified it to produce 24 hourly trips tables to make it compatible with the needs of TRANSIMS. Figure 26 is an example of how the procedure spreads the demand over more hours compared to using the ARC diurnal distribution for SOV trips.

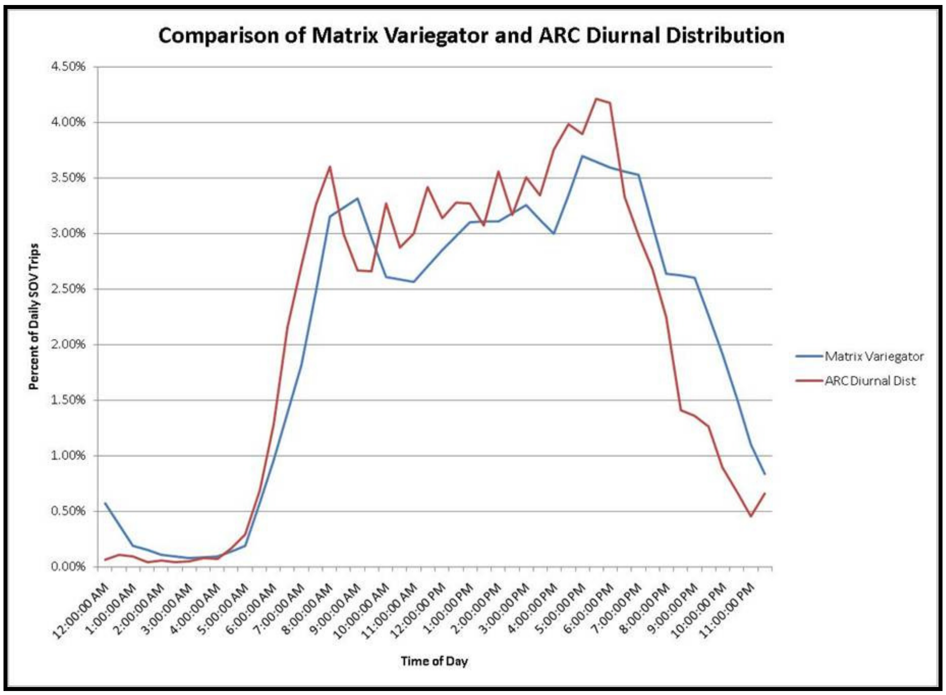


Figure 26: Comparison of Matrix Variegator Diurnal Distribution to ARC Distribution

In order to use this information within TRANSIMS, the TP+ trip tables were processed and reassembled using TP+ scripts to create six trip files (SOV, HOV2, HOV3+, commercial truck, medium truck, and heavy truck trips) with 24 tables corresponding to each of the 24 hours of the day. The six tables were converted to ASCII (text) files with I-J-Hour-Trips format. The ConvertTrips program was modified to process the hourly trip tables and restrict the distribution of specific trip start or end times to the specified hour of the day. An appropriate diurnal distribution curve from the original process was used to subdivide each hour into demand by second within the hour. Since the trip tables generated by this process do not include information about the trip purpose of SOV, HOV2, and HOV3+ trips, a composite curve was used to distribute these trips.

When the results were compared to the original method, a problem was found in the procedures used to generate hourly tables for heavy-duty and medium-duty trucks. Corrections were made by GRTA and PBS&J to limit diurnal distortions. The heavy-duty truck diurnal distributions before and after these corrections are shown in Figure 27.

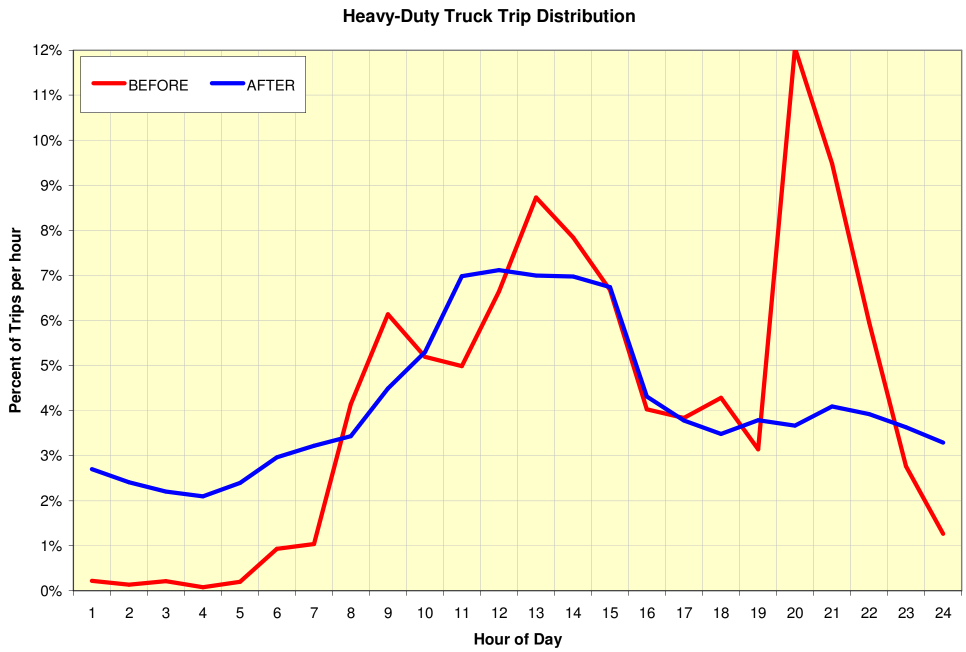


Figure 27: Before and After the Heavy-Duty Truck Correction to the Matrix Variegator Process

The processing methodology behind the Matrix Variegator approach requires sub-dividing the total trips from a time period into its comprising hours for every individual interchange-by-interchange trip separately. This results in many tiny fractional trips. As discussed in the beginning of this section, these fractional trips are bucket-rounded before being integerized for use in TRANSIMS. During the first application of this data in TRANSIMS, a two-decimal precision resulted in a loss of about 200,000 trips (out of 11.8 million trips) due to rounding and truncation. Using a higher precision in the TP+ scripts helped correct this problem.

The TRANSIMS equilibrium simulation process was executed with the demand generated by the diurnal smoothing method and the matrix variegator method. The convergence process using the smoothed diurnal demand was noticeably quicker and experienced less congestion than the matrix variegator runs. In the end, the results were not substantially different.

TRANSIMS Router Applications

Regional Routing and Volume-Delay Equations

In the early stages of implementing a TRANSIMS model, it is helpful to use the Router in much the same way as a traditional iterative highway assignment process to initialize the travel times on the network and the travel paths used by each traveler. This process refrains from executing the Microsimulator until the traffic is reasonably distributed to network links by time of day. Volume-delay equations are used to estimate the link travel times used in building and adjusting the minimum impedance paths.

To support this process, the free flow speeds and link capacities from the ARC model were transferred to the TRANSIMS network. In addition, the volume-delay equations used in the ARC assignment were reviewed and modified as necessary to work within the TRANSIMS Router. As shown in the following charts, the ARC process includes volume-delay equations for five different facilities and four time periods. These curves need to be combined into a single curve for the whole day using the functional forms available in TRANSIMS. The resulting curves are shown on the next page.

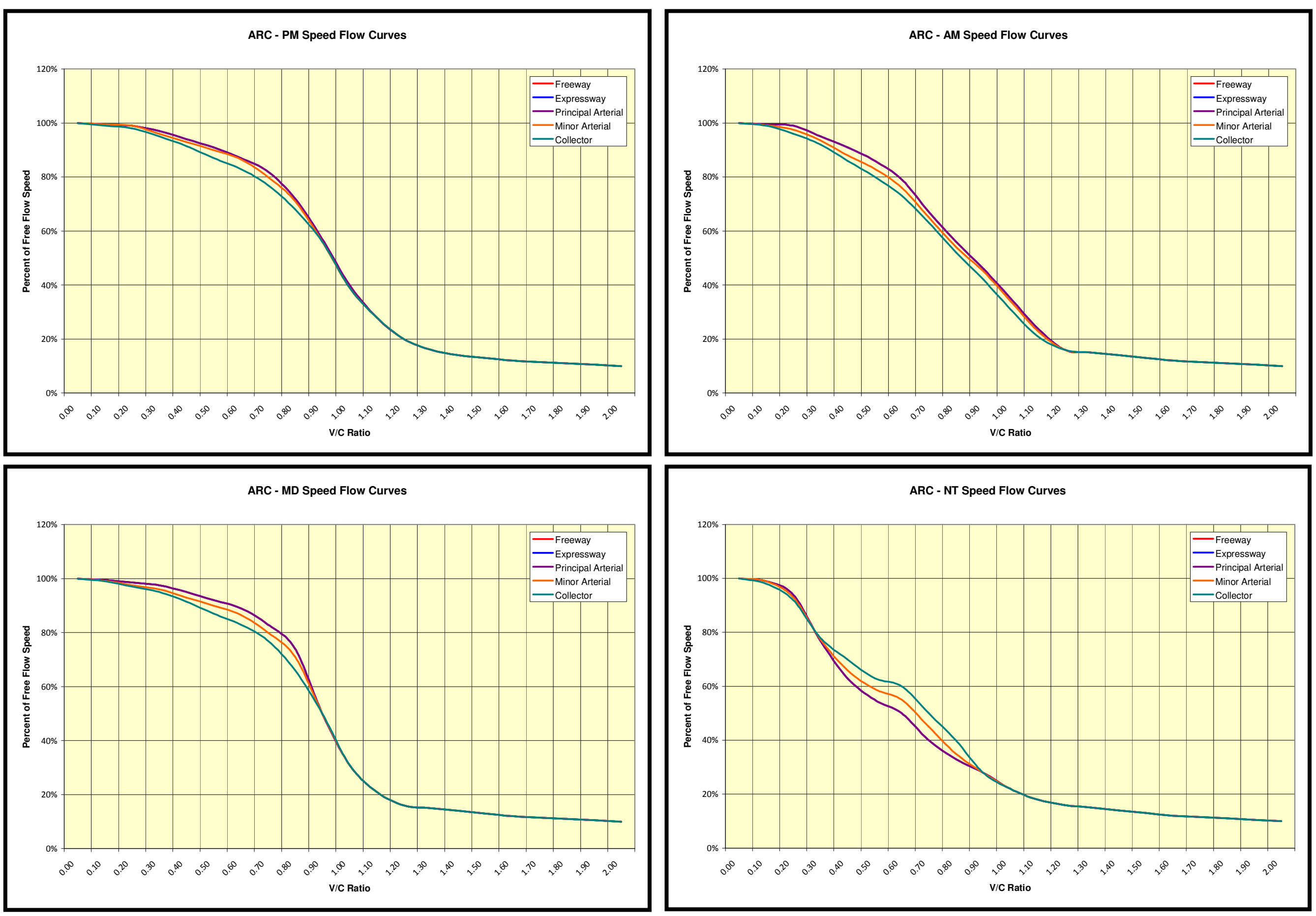


Figure 28: ARC Volume-Delay Equations by Time Period

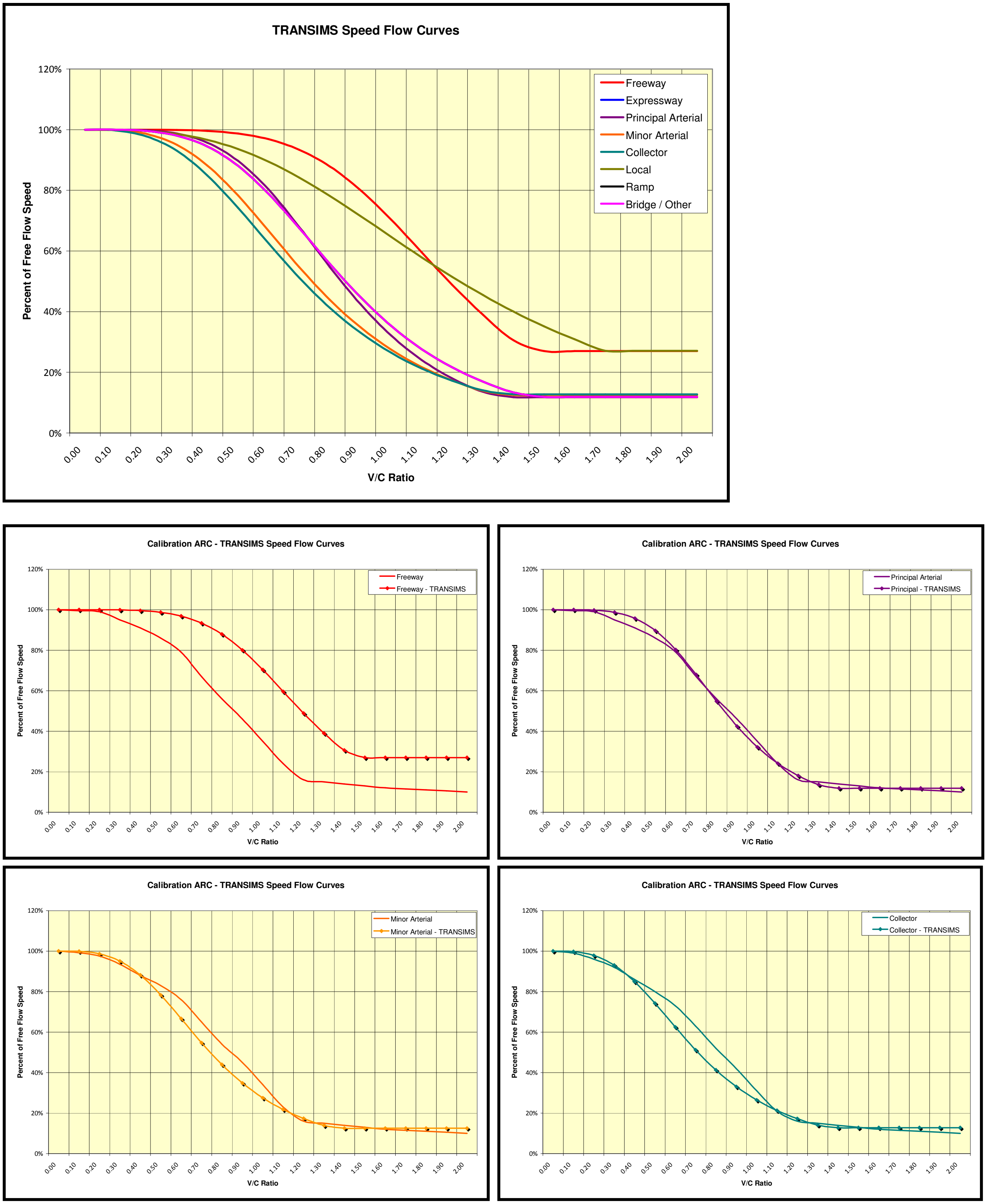


Figure 29: Volume-Delay Equations used in TRANSIMS Assignments

For all facility types except freeways, it was relatively straightforward to calibrate a TRANSIMS volume-delay function that replicates the ARC curve reasonably well. Initially the freeway curve was also replicated with a TRANSIMS function, but the resulting TRANSIMS assignments significantly underestimated the demand for freeway facilities. This is partially due to the fact that TRANSIMS applies these curves to the link demand in every 15-minute time period. This means that the volume-to-capacity ratios generated on a 15-minute basis can be significantly higher than the AM or PM Peak period average volume-to-capacity ratios modeled in the ARC assignment. This results in significantly more punitive travel times in the TRANSIMS Router that ultimately discourages trips from using the freeways. Shifting the ARC curve to higher V/C ratios and increasing the minimum speed helped the TRANSIMS Router load more traffic onto the freeway and validate against traffic counts more effectively.

Router Stabilization Strategies

Previous studies found that Router-based iterations were a valuable precursor to applying the Microsimulator. These iterations provide a quick validation of the demand profile and reasonable estimates of link travel times for improved path building. In this process a time-dependent capacity constrained path is assigned and reviewed for every traveler across iterations. The 15-minute link delays are computed and updated frequently during each Router application. To reduce the processing time, the entire household list is partitioned into eight to sixteen partitions. An independent instance of the Router is applied to each partition given a common regional link delay file. At the end of each iteration, the link volumes are combined and the link travel times are calculated using the volume-delay equations discussed above.

In the process outlined in Figure 30, all the paths are rebuilt and compared with the re-skimmed paths from the previous iteration. The travel time and route differences between the previous path and the new path are used to select a percentage of the new paths to include in the next iteration. The percentage of all such qualifying trips is monitored to determine the general stability of the assignment.

Intra-zonal and Zone Connector Trips

Most traditional models only model demand for motorized trips (i.e., trips that utilize a vehicle such as a car or bus). In other words, they do not consider short walk trips or different activities within the same building. On the other hand, the zone sizes typically used for regional demand models are large enough to make it reasonable and logical for people to make motorized trips that never go beyond the zone boundary. These are called intrazonal trips in a traditional model and are often ignored because they never are loaded to the highway or transit networks.

TRANSIMS networks, however, typically include 30 or more activity locations within each regional zone. As such, intrazonal trips are modeled as trips between activity locations within the same zone and therefore are assigned to the network. In most applications to date this has enhanced the overall comparisons between TRANSIMS simulations and traffic counts. Unfortunately, this was not the case in Atlanta. The ARC trip tables include 1.8 million intrazonal trips or about 13 percent of 13.6 million total regional trips. Most of these trips are in the home-based-other and non-home-based SOV tables. When these trips were included in the TRANSIMS assignment, the estimated volumes were more than 10 percent higher than the observed counts and the ARC assigned volumes.

When the intrazonal trips were removed from the regional trip tables, the TRANSIMS assignment matched the counts and ARC volumes more closely, but was still higher. Further investigation showed that a significant number of interzonal trips were also not being assigned to network links in the ARC model. The TP+ path builder short-circuits the network links by loading trips between two neighboring zones directly from one zone connector to the other zone connector without ever using the network. AECOM identified zone interchanges where this type of connection was possible and removed these trips from the ARC trip tables as well. The resulting TRANSIMS assignments matched the counts and ARC volumes more effectively.

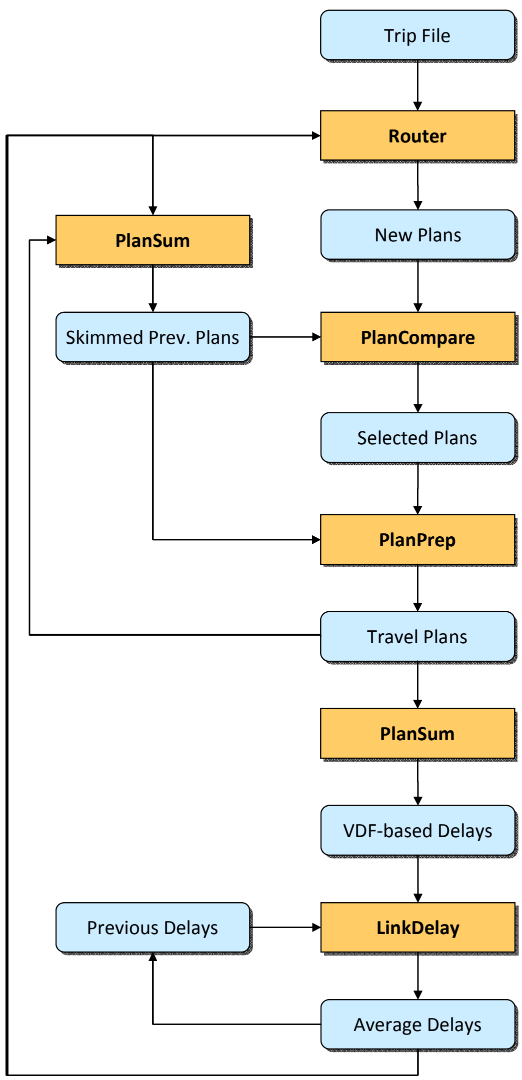


Figure 30: A typical Router-based iteration

TRANSIMS Microsimulator Applications

Subarea Simulation Strategy

The White House Area Transportation Study added the capability of integrating regional routing with subarea microsimulations into the TRANSIMS tool set. Subarea simulations help to reduce the overall processing time and focus the calibration and network refinement efforts on the areas of interest. A subarea simulation approach was designed for this study that divides the entire region into four quadrants and a central core as shown in the image below. This makes the microsimulation effort manageable and helps prioritize the allocation of study resources to the corridors of interest.

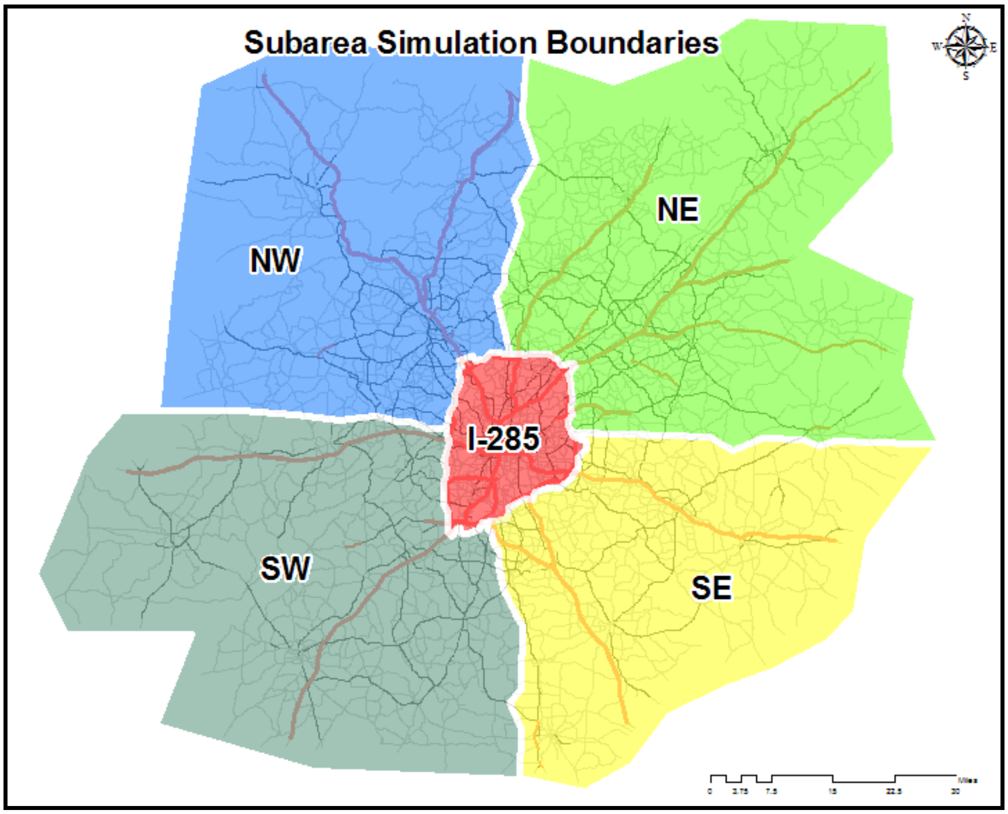


Figure 31: Subarea boundaries

The following is a list of subarea regions in order of priority for this particular study:

I-285 Subarea	6,128 links	4,663 nodes	5.3 million subarea trips
NW quadrant	2,910 links	2,337 nodes	4.4 million subarea trips
NE quadrant	4,757 links	3,839 nodes	7.7 million subarea trips
SE quadrant	2,817 links	2,250 nodes	3.4 million subarea trips
SW quadrant	2,559 links	2,054 nodes	2.9 million subarea trips

In this approach routing is done at the regional level and only the portion of the paths that traverse the subarea of interest are kept and simulated. The start and end times of trips that cross the simulation boundary are adjusted based on link travel time estimates from previous simulation iterations. At the end of a subarea simulation the subarea link delays are merged back into the regional link delays to be utilized in the path building process for other subarea simulations.

The following image outlines the different steps involved in a typical subarea simulation process.

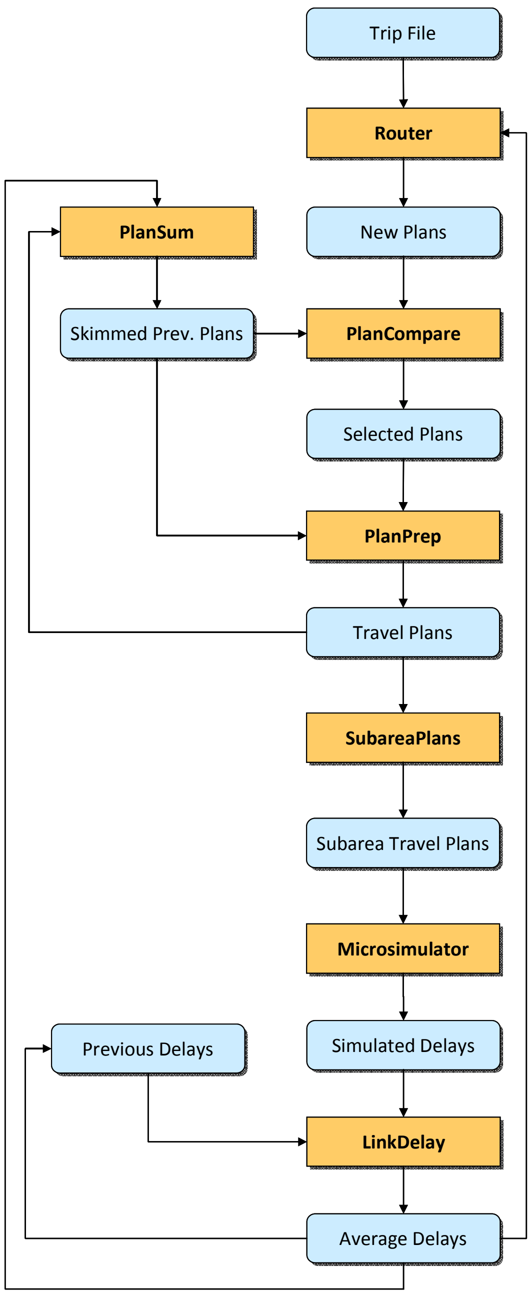


Figure 32: A typical subarea simulation iteration

To increase the fidelity in evaluation of a planned project, additional network detail can be added to any new or existing subarea region from the detailed NAVTEQ® street network used in ARC's network conflation process. The existing TRANSIMS demand can be disaggregated to include the new activity locations introduced by this process. Figure 33 shows an example of how the network would appear with this process. The additional detailed network is shown in grey inside the blue subarea boundary.

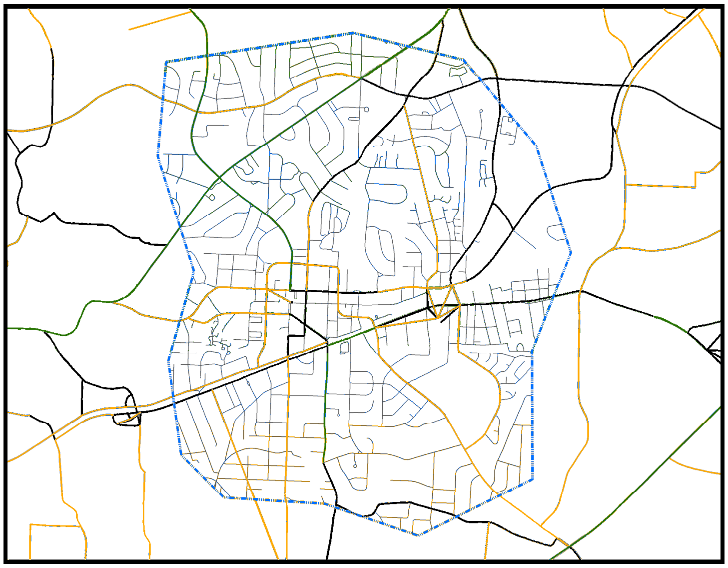


Figure 33: Example showing how "all-streets" data can be added

Signal Timing Adjustments

Most signal systems in urban areas maintain different timing plans for different times of the day. This variation helps in catering to the directionally biased traffic in the peak periods while reducing the overall delay during off peak periods. ARC provided the time periods for the traffic signals in the downtown based on the data gathered for the VISSIM simulation of downtown Atlanta. The data suggested three sets of timing plans corresponding to AM peak, Mid-day and PM peak periods. The time period breaks were incorporated in TRANSIMS as following:

Midnight – 6:30am

6:30am-9:30am

9:30am-3:30pm

3:30pm-6:30pm

6:30pm-Midnight

Each set of timing and phasing plans was initially synthesized with the IntControl program based on the intersection capacity. After several Microsimulator iterations, the splits corresponding to each of the above timing plans was individually updated based on the 15-minute simulated turning movements. Since the simulation is quite sensitive to signal timings, this had a noticeable impact on the results.

Travel paths adapt to a given signal timing plan, but the signal timing plans must also adapt to demand where imbalances exist. Iterative adjustments were made to the timing splits as required to stabilize the traffic and minimize excessive queues. Since TRANSIMS requires several equilibrium simulation iterations to assimilate any signal change, the signal timing updates are performed several times early in the process and then held constant for the simulation convergence steps.

Speed Adjustments

The Router and the Microsimulator speeds were calibrated using 15-minute radial freeway speed and volume counts collected by roadside detectors. The data were available for about 325 freeway locations and aggregated and assigned to TRANSIMS links by GRTA. Figure 34 shows the freeway locations where 15 minute count and speed data are available.

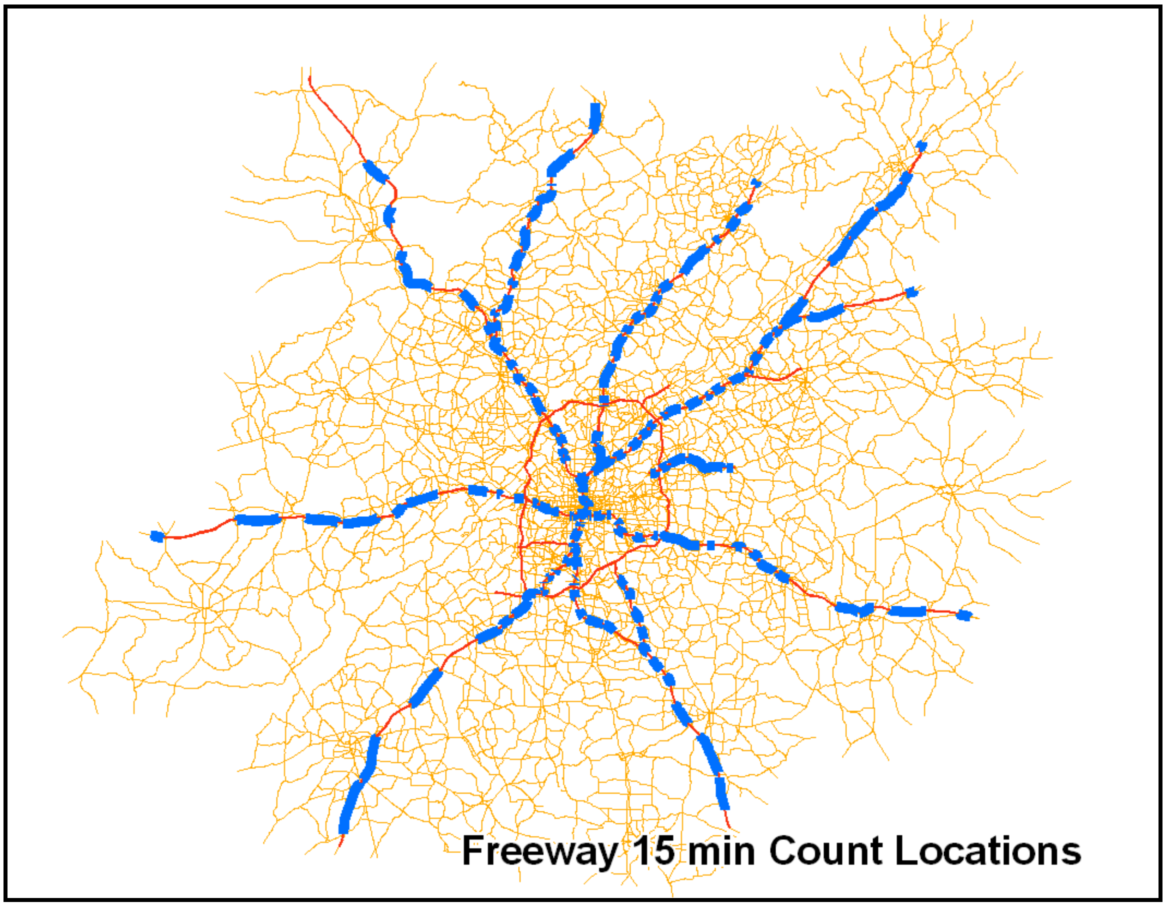


Figure 34: Freeway count locations

The initial analysis of this data indicated that free-flow speeds included in the ARC network and converted to TRANSIMS were lower than the observed speeds at most locations. The average of the highest three observed 15 minute speeds for each link was used to adjust the free-flow speeds in the TRANSIMS network. TRANSIMS uses this speed in the Router as the maximum speed for volume-delay equations. The new free-flow speed was then rounded up to the nearest Microsimulator cell speed (i.e., 6 meters / second increment). This value is coded as the maximum speed for the link. Since each vehicle type also has a maximum speed limit, it was necessary to also increase the maximum speeds in the vehicle type file to enable the Microsimulator to model the higher speeds (80+ mph) observed in the 15 minute count data. On average the increase was about 5 percent per link. In some cases the increase was more significant. Figure 35 below shows the before and after speed profiles for one of the links that were significantly affected. In this case the free-flow and maximum speed values were increased by 35 percent.

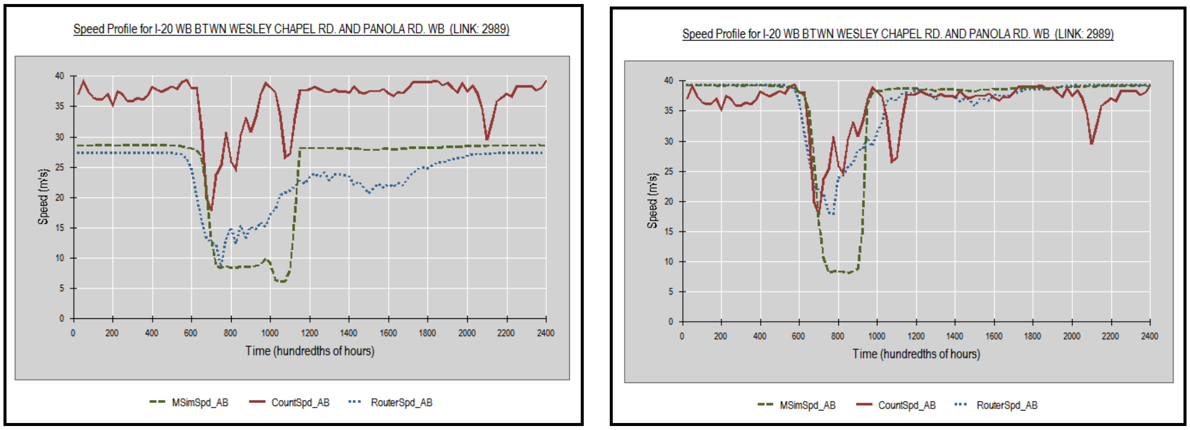


Figure 35: Speed Profile Before and After Adjusting the Free-Flow and Maximum Speeds

User-Equilibrium and Convergence Methods

The user-equilibrium process is begun with Router-based V/C ratio iterations. Here, a given percentage of travelers using links with high 15-minute V/C ratios are iteratively re-routed until the highest estimated V/C ratio is below a threshold level. These iterations help set the stage for microsimulation by reducing the initial congestion levels. The user-equilibrium process is started after this step where-in all the travelers are rerouted and the travel times and routes are compared to the previous paths to evaluate convergence and select trips to included in the next simulation.

An equivalent of MSA (method of successive averages) is used to average the latest simulated link and turning movement delays with the results from previous simulations. The weighting factors used in combining the current results with previous results increases with the number of iterations. This averaged link delay file is then used for building new paths and for re-skimming the previous paths before the plans are compared. The number of travelers with significant differences (percent qualified), the total vehicle hours of travel, and the number of simulation problems (percent wait time problems) are the primary performance measures used to determine user-equilibrium and system convergence. An ideally converged simulation will have no path fluctuations. However, in a microsimulation environment this is impossible to achieve when dynamic traffic interactions are simulated with random driving behavior at the individual level.

The following image shows how these statistics vary over the course of the last 50 iterations in the Northwest quadrant simulation.

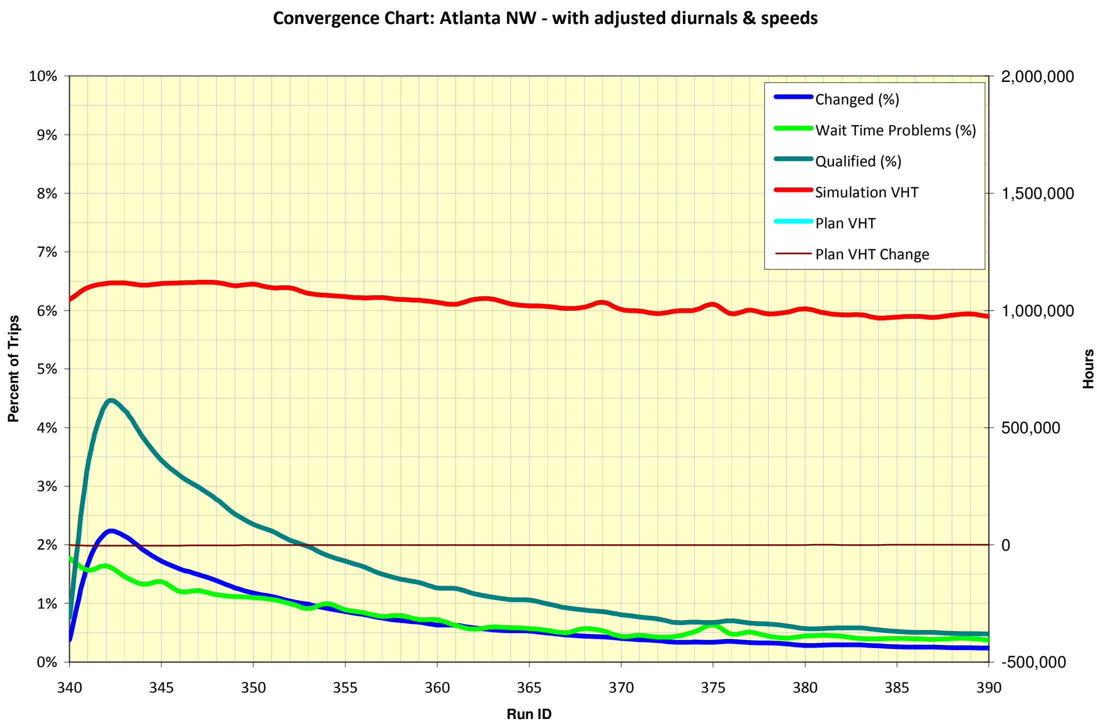


Figure 36: Example run convergence statistics

Regional Simulation Attempt

In addition to subarea simulations, an experiment was conducted based on a full regional simulation. The conflated Atlanta network contains about 18,000 links, 15,000 nodes and around 11.8 million regional highway trips. This is the largest TRANSIMS simulation that has been attempted to date. The processing times and computing resource utilization are extremely large compared to any of the subarea simulations. This process is currently underway and AECOM hopes to share the simulation validation results during the Peer Review meeting. If successful, this method would be more accurate in terms of traveler paths and simulation delays than composite subarea simulations. One drawback in this method is that the turn-around time for any planned project scenario could easily become unrealistic. However, the stabilized regional paths obtained from this method could be used to adjust the demand profile at the boundaries for any subareas.

TRANSIMS Assignment Validation

Screenline Locations and Available Count Data

GRTA and ARC gathered observed data from a number of sources for use in this study. This includes data used by ARC to validate their 2005 model plus volume and speed data by time-of-day derived from other sources to assist in the TRANSIMS validation:

1. Directional Counts ("DIRCNT05") -- 2005 AADT (daily counts) available for 5,600 directional links. Source: ARC.
2. I-285 Counts – peak periods by hour and daily counts available for around 250 directional links. Source: NAVIGATOR®, "Revive I-285" & "I-285 strategic implementation plan".
3. Radial Freeway Counts – 15 minute counts, speeds, and vehicles per mile on Tuesdays and Wednesdays during the spring months of 2008 and 2009 for about 400 directional freeway links. Source: GDOT Radial Freeway study data.

Directional Counts and ARC assignment volumes were easily formatted to match the TRANSIMS link numbers. The I-285 Counts were linked to ARC's pre-conflation network and therefore needed to be mapped to a corresponding TRANSIMS link by GRTA. GRTA also processed and prepared the Radial Freeway Counts by translating the description of the recording station location to a TRANSIMS link number. In many cases this required aggregating the information from multiple stations into a single data record.

After the HOV lane coding was modified (see the TRANSIMS network preparation section), the Radial Freeway Counts, Directional Counts and the ARC's TP+ assignment volumes for the affected links were merged with the corresponding freeway facility.

ARC also provided a listing of the links included in the 23 screenlines used during the 2005 model calibration process. These links were defined for the pre-conflation network and therefore needed to be converted to the new numbering system. AECOM converted these data to TRANSIMS link equivalence records for use by the Validate program. Figure 37 shows the location of these screenlines and Figure 38 shows the locations of other count data.

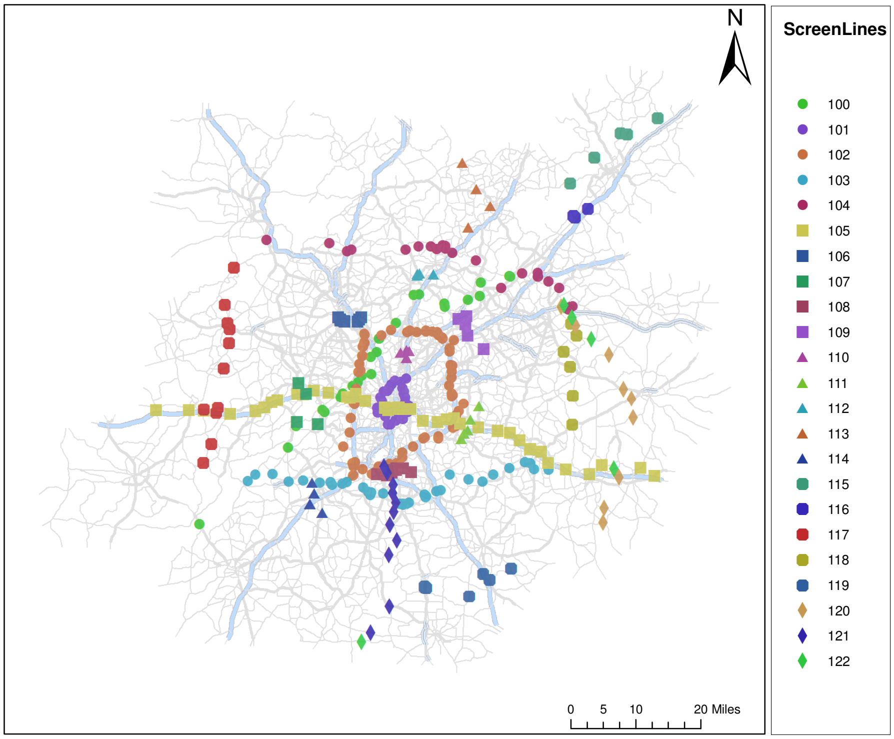


Figure 37: Screenline locations

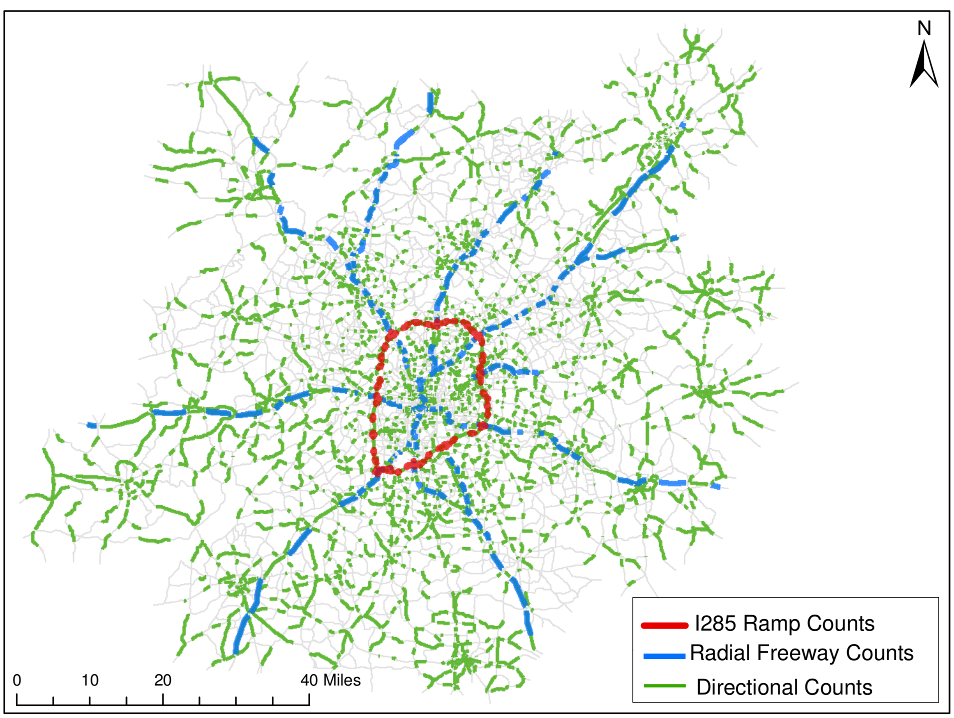


Figure 38: Count locations by source

SkyComp Data

GRTA also gathered 2005 "Skycomp" data from GDOT for select freeways and arterial highways in the Atlanta region. The following figure shows a summary of this information for the morning and evening peaks. The data also include aerial photography from which traffic volumes, densities, and speeds can be deduced. These data are being used in addition to the count and speed data for validating the 2005 TRANSIMS model.

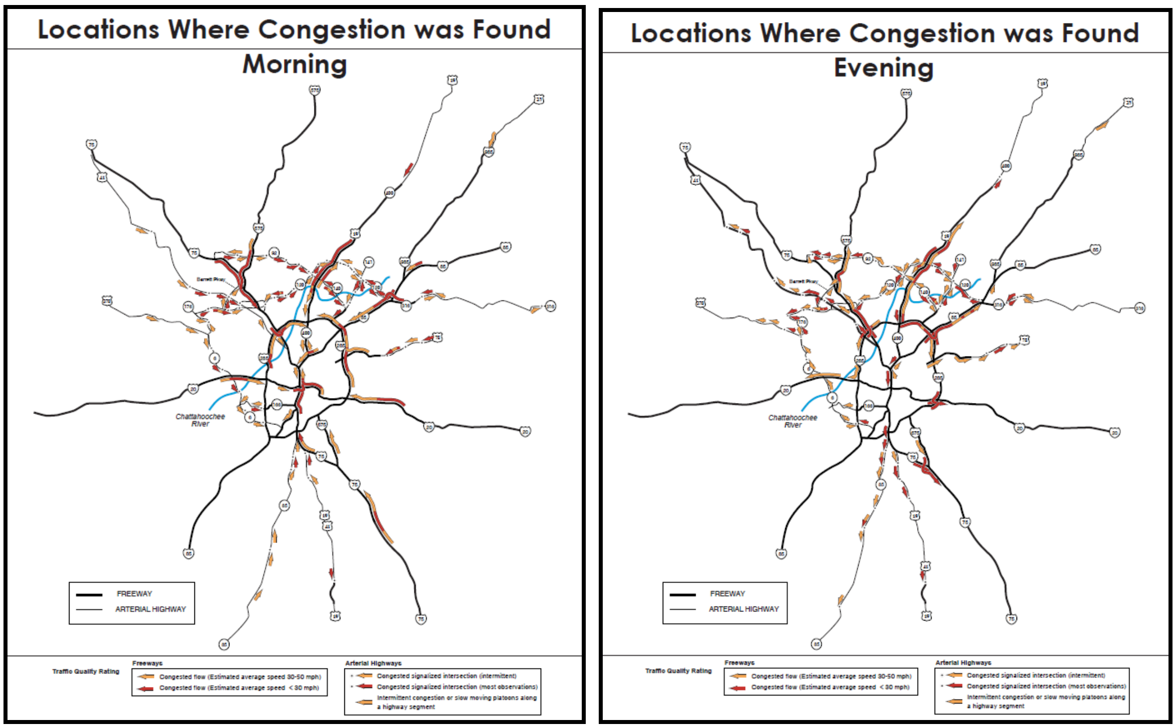


Figure 39: SkyComp data for AM peak and PM peak periods

Count Comparison

The TRANSIMS Validate program was used to compare the assigned volumes to traffic counts by volume level, facility type, area types, screenline, and summary district. The percent difference and root mean squared error (RMSE) are two of the validation statistics of primary concern. Comparisons were also made between the TRANSIMS volume estimates and the TP+ assignment results to provide a general assessment of the model differences. The following figures show the validation statistics across several combinations of count sources and assignments by time of day, facility type and screenline. This includes the results from two subarea simulations (I-285 and Northwest) plus comparisons based on Router demand and Microsimulator volumes. Router demand reflects the expected volume on the link based on the travel plans and estimated travel times. If the Microsimulator is unable to load all of the demand to the network in the specified time period due to congestion and other issues, the simulated volumes will be less than the demand estimates. This is one way of assessing the overall stability and convergence of the simulation.

ARC Regional Model Assignment Volumes vs Counts

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**ARC**	**DirCount**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
Freeway	455	31,361,806	31,399,126	-37,320	-0.1	8,523	12.4	8,112	17.0
Expressway	63	1,398,730	1,110,875	287,855	25.9	6,080	34.5	4,153	41.7
Principal Arterial	1,568	21,872,609	18,319,366	3,553,243	19.4	3,690	31.6	3,451	43.2
Minor Arterial	2,311	11,105,356	10,965,925	139,431	1.3	1,762	37.1	1,717	51.9
Collector	1,045	4,031,000	4,670,535	-639,535	-13.7	1,850	41.4	1,888	59.1
Local Street	102	253,656	271,310	-17,654	-6.5	1,439	54.1	1,341	73.8
TOTAL	**5,544**	**70,023,157**	**66,737,137**	**3,286,020**	**4.9**	**2,922**	**24.3**	**3,815**	**39.9**

	Num.	Volume		Difference		Abs.Error		Std.	
Screenline ID	**Obs.**	**ARC**	**DirCount**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
Chattaoochee River	21	762,535	673,235	89,300	13.3	5,789	18.1	6,888	27.7
Inner Rail Ring	16	611,723	576,845	34,878	6.0	5,396	15.0	4,297	18.9
Outside of I-285	53	1,767,046	1,714,050	52,996	3.1	5,947	18.4	10,270	36.4
South Atlanta - East/West	31	556,334	495,925	60,409	12.2	3,570	22.3	3,890	32.7
North Atlanta - East / West	14	355,876	375,465	-19,589	-5.2	5,764	21.5	5,711	29.7
Central Atlanta - north of I-20	43	950,380	913,315	37,065	4.1	3,270	15.4	2,569	19.5
Corridor south of Marietta	2	12,219	14,590	-2,371	-16.3	1,186	16.3	187	16.4
I-20 Corridor east of Douglasville	3	83,987	66,115	17,872	27.0	5,957	27.0	61	27.0
I-75 Corridor north of Jonesboro	6	158,680	157,860	820	0.5	2,130	8.1	936	8.7
I-85 Corridor north of Norcross	3	185,422	150,169	35,253	23.5	11,751	23.5	15,327	34.3
GA 400 Corridor north of Buckhead	4	86,303	92,550	-6,247	-6.7	5,182	22.4	1,445	23.0
I-20 Corridor east of I-285	6	184,256	202,160	-17,904	-8.9	5,319	15.8	5,624	21.9
GA 400 Corridor in Roswell	4	147,006	149,895	-2,889	-1.9	2,005	5.3	2,299	7.5
SR 20 Corridor west of Cumming	1	4,651	3,825	826	21.6	826	21.6	-	21.6
I-85 Corridor south of Fairburn	4	131,202	119,040	12,162	10.2	3,041	10.2	1,762	11.4
Lake Lanier	4	14,607	9,200	5,407	58.8	1,352	58.8	275	59.7
I-985 South of Gainsville	5	55,886	34,825	21,061	60.5	5,777	82.9	6,001	113.2
West Region N/S	18	124,742	119,865	4,877	4.1	1,874	28.1	1,360	34.4
East Region N/S	7	64,405	64,065	340	0.5	1,552	17.0	760	18.6
I-75 South of Locust Grove	7	102,993	82,025	20,968	25.6	3,045	26.0	1,988	30.4
Alcovy River	8	30,037	22,930	7,107	31.0	888	31.0	562	36.0
Flint River	13	135,397	130,620	4,777	3.7	1,301	12.9	690	14.5
TOTAL	**273**	**6,525,687**	**6,168,569**	**357,118**	**5.8**	**4,107**	**18.2**	**5,981**	**32.1**

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**ARC**	**I-285 Count**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
TOTAL	**209**	**2,556,895**	**2,616,524**	**-59,629**	**-2.3**	**4,928**	**39.4**	**5,991**	**61.9**

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**ARC**	**RadFwy Count**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
TOTAL	**323**	**22,667,214**	**21,638,815**	**1,028,399**	**4.8**	**9,799**	**14.6**	**14,502**	**26.1**
AM									
TOTAL	**323**	**5,271,743**	**4,980,559**	**291,184**	**5.8**	**2,892**	**18.8**	**3,761**	**30.7**
MD									
TOTAL	**323**	**6,446,089**	**5,796,285**	**649,804**	**11.2**	**3,339**	**18.6**	**4,171**	**29.7**
PM									
TOTAL	**323**	**6,662,060**	**5,601,554**	**1,060,506**	**18.9**	**4,285**	**24.7**	**4,672**	**36.5**
NT									
TOTAL	**644**	**4,271,137**	**5,260,417**	**-989,280**	**-18.8**	**2,129**	**26.1**	**2,367**	**39.0**

TRANSIMS Regional Router Volumes vs Counts

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**ARC**	**DirCount**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
Freeway	455	33,541,496	31,399,126	2,142,370	6.8	11,788	17.1	13,128	25.6
Expressway	63	1,249,905	1,110,875	139,030	12.5	5,350	30.3	4,762	40.5
Principal Arterial	1,568	22,058,525	18,319,366	3,739,159	20.4	4,058	34.7	3,520	46.0
Minor Arterial	2,311	15,171,977	10,965,925	4,206,052	38.4	2,538	53.5	2,312	72.3
Collector	1,045	6,625,831	4,670,535	1,955,296	41.9	2,830	63.3	2,575	85.6
Local Street	102	254,374	271,310	-16,936	-6.2	1,378	51.8	1,081	65.7
TOTAL	**5,544**	**78,902,108**	**66,737,137**	**12,164,971**	**18.2**	**3,793**	**31.5**	**5,254**	**53.8**

	Num.	Volume		Difference		Abs.Error		Std.	
Screenline ID	**Obs.**	**Router**	**DirCount**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
Chattaoochee River	21	775,035	673,235	101,800	15.1	6,954	21.7	6,187	28.7
Inner Rail Ring	16	674,665	576,845	97,820	17.0	9,056	25.1	13,679	44.5
Outside of I-285	53	1,887,690	1,714,050	173,640	10.1	6,977	21.6	9,206	35.5
South Atlanta - East/West	31	576,813	495,925	80,888	16.3	4,471	27.9	4,098	37.6
North Atlanta - East / West	14	408,473	375,465	33,008	8.8	5,505	20.5	4,779	26.8
Central Atlanta - north of I-20	43	1,080,905	913,315	167,590	18.3	4,822	22.7	10,293	53.0
Corridor south of Marietta	2	24,674	14,590	10,084	69.1	5,042	69.1	4,077	79.6
I-20 Corridor east of Douglasville	3	82,277	66,115	16,162	24.4	8,039	36.5	7,336	45.5
I-75 Corridor north of Jonesboro	6	163,500	157,860	5,640	3.6	4,525	17.2	4,583	23.4
I-85 Corridor north of Norcross	3	211,601	150,169	61,432	40.9	20,931	41.8	35,664	71.6
GA 400 Corridor north of Buckhead	4	88,034	92,550	-4,516	-4.9	2,765	11.9	1,681	13.5
I-20 Corridor east of I-285	6	229,033	202,160	26,873	13.3	5,000	14.8	3,774	18.0
GA 400 Corridor in Roswell	4	141,796	149,895	-8,099	-5.4	6,540	17.5	3,593	19.3
SR 20 Corridor west of Cumming	1	9,069	3,825	5,244	137.1	5,244	137.1	-	137.1
I-85 Corridor south of Fairburn	4	131,000	119,040	11,960	10.0	3,970	13.3	2,963	15.9
Lake Lanier	4	18,466	9,200	9,266	100.7	2,317	100.7	1,891	123.4
I-985 South of Gainsville	5	66,300	34,825	31,475	90.4	6,295	90.4	4,740	109.0
West Region N/S	18	166,764	119,865	46,899	39.1	3,405	51.1	3,018	67.5
East Region N/S	7	77,787	64,065	13,722	21.4	2,774	30.3	1,407	33.5
I-75 South of Locust Grove	7	110,469	82,025	28,444	34.7	5,052	43.1	3,446	51.0
Alcovy River	8	38,263	22,930	15,333	66.9	1,917	66.9	1,271	78.7
Flint River	13	152,377	130,620	21,757	16.7	2,309	23.0	1,556	27.4
TOTAL	**273**	**7,114,991**	**6,168,569**	**946,422**	**15.3**	**5,489**	**24.3**	**8,166**	**43.5**

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**ARC**	**I-285 Count**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
TOTAL	**209**	**2,688,443**	**2,616,524**	**71,919**	**2.7**	**4,490**	**35.9**	**5,525**	**56.8**
AM									
TOTAL	**234**	**548,755**	**542,671**	**6,084**	**1.1**	**847**	**36.5**	**1,108**	**60.1**
PM									
TOTAL	**234**	**560,570**	**584,474**	**-23,904**	**-4.1**	**1,051**	**42.1**	**1,143**	**62.1**
Facility Type	**Obs.**	**ARC**	**RadFwy Count**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
TOTAL	**323**	**24,706,527**	**21,638,815**	**3,067,712**	**14.2**	**15,265**	**22.8**	**20,543**	**38.2**
AM									
TOTAL	**323**	**5,707,849**	**4,980,559**	**727,290**	**14.6**	**4,059**	**26.3**	**5,263**	**43.1**
MD									
TOTAL	**323**	**6,924,036**	**5,796,285**	**1,127,751**	**19.5**	**5,313**	**29.6**	**6,609**	**47.2**
PM									
TOTAL	**323**	**6,150,040**	**5,601,554**	**548,486**	**9.8**	**4,554**	**26.3**	**5,620**	**41.7**
NT									
TOTAL	**644**	**5,906,089**	**5,260,417**	**645,672**	**12.3**	**2,177**	**26.7**	**2,888**	**44.3**

TRANSIMS Regional Router Volumess vs ARC Regional Model Assignment Volumes

Facility Type	Num. Obs.	Volume TRANSIMS	Volume ARC	Difference Volume	Difference %	Abs.Error Avg.	Abs.Error %	Std. Dev.	% RMSE
DAILY									
Freeway	1,392	101,235,528	91,507,996	9,727,532	10.6	8,446	12.8	9,806	19.7
Expressway	280	6,008,558	6,273,684	-265,126	-4.2	2,942	13.1	4,109	22.5
Principal Arterial	6,829	109,764,914	103,519,965	6,244,949	6.0	3,100	20.5	2,847	27.8
Minor Arterial	11,911	74,702,326	62,888,042	11,814,284	18.8	1,774	33.6	1,809	48.0
Collector	7,720	39,247,645	28,471,236	10,776,409	37.9	1,950	52.9	1,867	73.2
Local Street	1,524	3,466,632	3,554,987	-88,355	-2.5	1,432	61.4	1,693	95.0
Ramp	1,714	20,097,449	19,672,547	424,902	2.2	3,532	30.8	3,839	45.4
External	182	869,331	871,498	-2,167	-0.2	68	1.4	230	5.0
TOTAL	**31,552**	**355,392,383**	**316,759,955**	**38,632,428**	**12.2**	**2,478**	**24.7**	**3,351**	**41.5**
AM									
Freeway	1,390	25,189,813	21,459,082	3,730,731	17.4	3,046	19.7	3,322	29.2
Expressway	280	1,456,638	1,502,250	-45,612	-3.0	725	13.5	930	22.0
Principal Arterial	6,829	26,300,243	25,175,295	1,124,948	4.5	767	20.8	761	29.3
Minor Arterial	11,862	17,955,580	15,451,540	2,504,040	16.2	425	32.6	451	47.6
Collector	7,638	9,146,195	6,880,270	2,265,925	32.9	470	52.2	483	74.8
Local Street	1,453	718,929	854,109	-135,180	-15.8	357	60.8	411	92.6
Ramp	1,697	4,787,516	4,629,366	158,150	3.4	962	35.3	1,118	54.1
External	182	192,058	205,570	-13,512	-6.6	102	9.1	149	15.9
TOTAL	**31,331**	**85,746,972**	**76,157,482**	**9,589,490**	**12.6**	**653**	**26.9**	**1,062**	**51.3**
MD									
Freeway	1,390	27,524,963	26,038,560	1,486,403	5.7	2,038	10.9	2,363	16.7
Expressway	280	1,605,635	1,740,507	-134,872	-7.7	990	15.9	1,374	27.2
Principal Arterial	6,829	29,774,867	28,893,184	881,683	3.1	888	21.0	914	30.1
Minor Arterial	11,793	19,939,809	16,637,783	3,302,026	19.8	528	37.4	567	54.9
Collector	7,518	10,766,494	7,499,342	3,267,152	43.6	608	61.0	607	86.2
Local Street	1,383	960,346	917,715	42,631	4.6	469	70.7	583	112.8
Ramp	1,688	5,592,762	5,650,952	-58,190	-1.0	1,072	32.0	1,102	45.9
External	182	244,921	243,376	1,545	0.6	128	9.6	156	15.0
TOTAL	**31,063**	**96,409,797**	**87,621,419**	**8,788,378**	**10.0**	**723**	**25.6**	**925**	**41.6**
PM									
Freeway	1,392	27,108,064	26,898,979	209,085	0.8	2,409	12.5	2,542	18.1
Expressway	280	1,622,488	1,993,059	-370,571	-18.6	1,480	20.8	1,578	30.4
Principal Arterial	6,829	29,047,515	34,646,061	-5,598,546	-16.2	1,136	22.4	1,223	32.9
Minor Arterial	11,880	19,703,220	21,908,566	-2,205,346	-10.1	525	28.4	618	43.9
Collector	7,692	10,500,328	10,370,343	129,985	1.3	507	37.6	495	52.6
Local Street	1,499	982,591	1,341,258	-358,667	-26.7	520	58.1	550	84.6
Ramp	1,706	5,407,858	6,022,204	-614,346	-10.2	1,190	33.7	1,300	49.9
External	182	225,688	251,502	-25,814	-10.3	175	12.6	277	23.7
TOTAL	**31,460**	**94,597,752**	**103,431,972**	**-8,834,220**	**-8.5**	**779**	**23.7**	**1,072**	**40.3**
NT									
Freeway	2,780	21,381,601	17,111,375	4,270,226	25.0	1,792	29.1	1,952	43.0
Expressway	560	1,323,797	1,037,868	285,929	27.5	690	37.2	702	53.1
Principal Arterial	13,652	24,640,630	14,805,425	9,835,205	66.4	755	69.6	681	93.7
Minor Arterial	23,382	16,881,988	8,890,153	7,991,835	89.9	368	96.9	406	144.1
Collector	14,616	8,427,007	3,721,281	4,705,726	126.5	344	135.2	377	200.5
Local Street	2,482	625,138	441,905	183,233	41.5	159	89.3	243	163.1
Ramp	3,290	4,222,523	3,370,025	852,498	25.3	503	49.1	674	82.1
External	364	206,664	171,050	35,614	20.8	142	30.3	334	77.2
TOTAL	**61,126**	**77,709,348**	**49,549,082**	**28,160,266**	**56.8**	**514**	**63.4**	**717**	**108.8**

I-285 Subarea TRANSIMS Simulation Volumes vs ARC Regional Model Assignments

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	Obs.	TRANSIMS	ARC	Volume	%	Avg.	%	Dev.	% RMSE
DAILY									
Freeway	574	47,560,072	45,313,825	2,246,247	5.0	8,127	10.3	8,505	14.9
Expressway	72	1,504,979	1,787,343	-282,364	-15.8	5,687	22.9	6,618	35.0
Principal Arterial	1,808	28,304,829	30,781,198	-2,476,369	-8.0	4,036	23.7	3,586	31.7
Minor Arterial	2,383	17,312,772	15,585,637	1,727,135	11.1	2,254	34.5	2,226	48.4
Collector	3,165	17,387,405	12,089,562	5,297,843	43.8	2,326	60.9	2,150	82.9
Local Street	723	1,798,181	1,673,319	124,862	7.5	1,457	63.0	1,666	95.6
Ramp	677	8,116,791	8,415,707	-298,916	-3.6	4,192	33.7	4,328	48.5
TOTAL	**9,402**	**121,985,029**	**115,646,591**	**6,338,438**	**5.5**	**3,084**	**25.1**	**3,744**	**39.4**
AM									
Freeway	574	11,542,806	10,636,903	905,903	8.5	2,628	14.2	2,411	19.2
Expressway	72	363,217	419,792	-56,575	-13.5	1,248	21.4	1,525	33.6
Principal Arterial	1,808	6,720,289	7,489,878	-769,589	-10.3	1,041	25.1	1,018	35.2
Minor Arterial	2,370	4,157,137	3,819,110	338,027	8.9	560	34.8	577	49.9
Collector	3,138	3,976,626	2,899,881	1,076,745	37.1	571	61.8	563	86.8
Local Street	687	358,027	397,233	-39,206	-9.9	363	62.7	410	94.6
Ramp	669	1,893,098	2,006,745	-113,647	-5.7	1,149	38.3	1,286	57.5
TOTAL	**9,318**	**29,011,200**	**27,669,542**	**1,341,658**	**4.8**	**818**	**27.5**	**1,083**	**45.7**
PM									
Freeway	574	12,447,732	13,259,987	-812,255	-6.1	3,305	14.3	3,064	19.5
Expressway	72	406,700	580,376	-173,676	-29.9	2,502	31.0	2,295	42.0
Principal Arterial	1,808	7,556,906	10,782,094	-3,225,188	-29.9	1,998	33.5	1,639	43.3
Minor Arterial	2,372	4,560,437	5,571,150	-1,010,713	-18.1	793	33.7	891	50.8
Collector	3,155	4,705,569	4,550,929	154,640	3.4	618	42.8	575	58.5
Local Street	709	517,282	644,761	-127,479	-19.8	516	56.7	534	81.6
Ramp	671	2,173,716	2,586,005	-412,289	-15.9	1,492	38.7	1,442	53.8
TOTAL	**9,361**	**32,368,342**	**37,975,302**	**-5,606,960**	**-14.8**	**1,163**	**28.7**	**1,490**	**46.6**

	Num.	Volume		Difference		Abs.Error		Std.	
Screenline ID	Obs.	TRANSIMS	ARC	Volume	%	Avg.	%	Dev.	% RMSE
DAILY									
100	11	467,839	455,532	12,307	2.7	5,359	12.9	6,738	20.2
101	38	1,046,538	1,088,844	(42,306)	(3.9)	4,844	16.9	5,039	24.2
102	52	1,191,991	1,137,374	54,617	4.8	4,369	20.0	4,502	28.5
103	15	119,497	95,688	23,809	24.9	1,810	28.4	1,357	35.0
104	2	22,140	13,193	8,947	67.8	4,474	67.8	169	67.8
105	28	802,439	778,867	23,572	3.0	4,529	16.3	5,831	26.2
106	3	43,239	36,132	7,107	19.7	2,369	19.7	1,313	21.6
108	4	248,025	226,323	21,702	9.6	5,426	9.6	1,993	10.1
110	5	46,832	33,388	13,444	40.3	3,279	49.1	2,541	59.7
111	6	156,826	130,737	26,089	20.0	5,368	24.6	7,185	38.9
112	1	73,489	61,488	12,001	19.5	12,001	19.5	-	19.5
114	1	2,912	1,291	1,621	125.6	1,621	125.6	-	125.6
115	2	13,121	9,086	4,035	44.4	2,018	44.4	408	44.9
116	1	45,892	41,954	3,938	9.4	3,938	9.4	-	9.4
117	2	26,765	24,028	2,737	11.4	1,369	11.4	473	11.7
121	5	80,233	76,652	3,581	4.7	1,789	11.7	708	12.4
125	2	4,620	10,054	(5,434)	(54.0)	2,717	54.0	130	54.1
TOTAL	**178**	**4,392,398**	**4,220,631**	**171,767**	**4.1**	**4,209**	**17.8**	**4,723**	**26.6**

I-285 Subarea TRANSIMS Simulation Volumes vs Counts

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**TRANSIMS**	**Count**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
Radial Freeway Counts - DAILY									
Freeway	109	2,485,079	2,134,046	351,033	16.4	4,601	23.5	6,346	39.9
Ramp	2	4,892	32,474	-27,582	-84.9	13,791	84.9	5,373	88.1
TOTAL	**111**	**2,489,971**	**2,166,520**	**323,451**	**14.9**	**4,766**	**24.4**	**6,427**	**40.9**
Radial Freeway Counts - AM									
Freeway	109	2,715,299	2,397,053	318,246	13.3	4,836	22.0	5,449	33.0
Ramp	2	2,136	42,116	-39,980	-94.9	19,990	94.9	8,152	98.8
TOTAL	**111**	**2,717,435**	**2,439,169**	**278,266**	**11.4**	**5,109**	**23.3**	**5,818**	**35.1**
Radial Freeway Counts - PM									
Freeway	109	10,430,606	9,319,680	1,110,926	11.9	15,356	18.0	21,388	30.7
Ramp	2	12,083	152,078	-139,995	-92.1	69,998	92.1	6,150	92.2
TOTAL	**111**	**10,442,689**	**9,471,758**	**970,931**	**10.3**	**16,341**	**19.1**	**22,423**	**32.4**

	Num.	Volume		Difference		Abs.Error		Std.	
Screenline ID	**Obs.**	**TRANSIMS**	**Count**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
Radial Freeway Counts - DAILY									
100	11	467,839	455,532	12,307	2.7	5,359	12.9	6,738	20.2
101	38	1,046,538	1,088,844	-42,306	-3.9	4,844	16.9	5,039	24.2
102	52	1,191,991	1,137,374	54,617	4.8	4,369	20.0	4,502	28.5
103	15	119,497	95,688	23,809	24.9	1,810	28.4	1,357	35.0
105	28	802,439	778,867	23,572	3.0	4,529	16.3	5,831	26.2
111	6	156,826	130,737	26,089	20.0	5,368	24.6	7,185	38.9
112	1	73,489	61,488	12,001	19.5	12,001	19.5	-	19.5
116	1	45,892	41,954	3,938	9.4	3,938	9.4	-	9.4
TOTAL	**178**	**4,392,398**	**4,220,631**	**171,767**	**4.1**	**4,209**	**17.8**	**4,723**	**26.6**

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**TRANSIMS**	**Count**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
Directional Counts - DAILY									
Freeway	172	14,692,538	13,921,386	771,152	5.5	12,949	16.0	12,471	22.2
Expressway	13	290,936	259,640	31,296	12.1	7,195	36.0	6,422	47.5
Principal Arterial	298	4,480,401	3,632,960	847,441	23.3	4,394	36.0	3,836	47.8
Minor Arterial	371	2,622,250	2,181,730	440,520	20.2	2,501	42.5	2,035	54.8
Collector	376	2,289,951	1,985,235	304,716	15.3	2,637	49.9	2,589	69.9
Local Street	26	53,391	64,730	(11,339)	(17.5)	1,248	50.1	767	58.5
TOTAL	**1,256**	**24,429,467**	**22,045,681**	**2,383,786**	**10.8**	**4,444**	**25.3**	**6,372**	**44.2**
I-285 Counts - DAILY									
Freeway	2	91,149	34,344	56,805	165.4	28,403	165.4	24,628	194.0
Ramp	232	3,154,606	3,709,325	-554,719	-15.0	7,049	44.1	6,753	61.0
TOTAL	**234**	**3,245,755**	**3,743,669**	**-497,914**	**-13.3**	**7,232**	**45.2**	**7,190**	**63.7**
I-285 Counts - AM									
Freeway	109	2,485,079	2,134,046	351,033	16.4	4,601	23.5	6,346	39.9
Ramp	2	4,892	32,474	-27,582	-84.9	13,791	84.9	5,373	88.1
TOTAL	**111**	**2,489,971**	**2,166,520**	**323,451**	**14.9**	**4,766**	**24.4**	**6,427**	**40.9**
I-285 Counts - PM									
Freeway	2	14,970	5,368	9,602	178.9	4,801	178.9	4,435	213.7
Ramp	232	635,053	579,106	55,947	9.7	1,014	40.6	964	56.0
TOTAL	**234**	**650,023**	**584,474**	**65,549**	**11.2**	**1,046**	**41.9**	**1,062**	**59.6**

NW Subarea TRANSIMS Simulation Volumes vs ARC Regional Model Assignments

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	**Obs.**	**TRANSIMS**	**ARC**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
Freeway	194	12,466,092	11,137,032	1,329,060	11.9	7,914	13.8	7,665	19.2
Expressway	58	1,231,671	1,323,608	-91,937	-6.9	3,329	14.6	2,909	19.3
Principal Arterial	1,190	19,547,606	19,130,999	416,607	2.2	2,974	18.5	2,607	24.6
Minor Arterial	1,814	11,535,212	9,331,130	2,204,082	23.6	1,835	35.7	1,707	48.7
Collector	1,226	6,943,286	4,979,848	1,963,438	39.4	2,070	51.0	1,742	66.6
Local Street	173	415,589	444,041	-28,452	-6.4	1,498	58.4	1,821	91.7
Ramp	233	2,828,334	2,637,616	190,718	7.2	2,619	23.1	2,628	32.7
External	31	190,329	193,362	-3,033	-1.6	161	2.6	348	6.1
TOTAL	**4,919**	**55,158,119**	**49,177,636**	**5,980,483**	**12.2**	**2,441**	**24.4**	**2,795**	**37.1**
AM									
Freeway	194	3,179,457	2,615,828	563,629	21.5	3,204	23.8	3,677	36.1
Expressway	58	283,433	315,704	-32,271	-10.2	1,035	19.0	930	25.5
Principal Arterial	1,190	4,536,550	4,649,875	-113,325	-2.4	849	21.7	768	29.3
Minor Arterial	1,797	2,734,681	2,307,214	427,467	18.5	445	34.7	420	47.6
Collector	1,221	1,608,642	1,220,774	387,868	31.8	470	47.0	422	63.1
Local Street	171	89,714	106,768	-17,054	-16.0	371	59.5	427	90.5
Ramp	232	687,457	609,325	78,132	12.8	825	31.4	974	48.5
External	31	41,494	45,022	-3,528	-7.8	165	11.3	190	17.2
TOTAL	**4,894**	**13,161,428**	**11,870,510**	**1,290,918**	**10.9**	**680**	**28.0**	**1,070**	**52.3**
PM									
Freeway	194	3,249,104	3,217,593	31,511	1.0	1,652	10.0	1,485	13.4
Expressway	58	325,466	427,122	-101,656	-23.8	1,898	25.8	1,523	32.9
Principal Arterial	1,190	5,081,250	6,333,713	-1,252,463	-19.8	1,311	24.6	1,172	33.0
Minor Arterial	1,801	3,052,628	3,275,610	-222,982	-6.8	490	26.9	509	38.8
Collector	1,224	1,882,229	1,769,304	112,925	6.4	500	34.6	476	47.8
Local Street	172	113,965	168,158	-54,193	-32.2	566	57.9	506	77.6
Ramp	233	753,822	802,916	-49,094	-6.1	763	22.1	832	32.7
External	31	48,557	56,208	-7,651	-13.6	266	14.7	419	27.1
TOTAL	**4,903**	**14,507,021**	**16,050,624**	**-1,543,603**	**-9.6**	**769**	**23.5**	**899**	**36.1**

	Num.	Volume		Difference		Abs.Error		Std.	
Screenline ID	**Obs.**	**TRANSIMS**	**ARC**	**Volume**	**%**	**Avg.**	**%**	**Dev.**	**% RMSE**
DAILY									
100	8	379,556	350,452	29,104	8.3	5,468	12.5	6,122	18.1
102	10	765,405	671,996	93,409	13.9	11,311	16.8	8,112	20.4
103	1	32,271	33,303	-1,032	-3.1	1,032	3.1	-	3.1
104	2	32,789	18,354	14,435	78.6	7,218	78.6	1,488	79.5
105	14	141,376	127,207	14,169	11.1	1,652	18.2	2,249	30.0
106	7	262,485	228,892	33,593	14.7	5,916	18.1	8,699	30.6
107	2	31,828	27,153	4,675	17.2	2,338	17.2	64	17.2
109	5	234,737	207,076	27,661	13.4	7,145	17.3	9,933	27.5
112	1	13,965	10,522	3,443	32.7	3,443	32.7	-	32.7
117	8	48,701	35,265	13,436	38.1	1,726	39.2	1,367	48.7
119	11	125,813	121,123	4,690	3.9	919	8.3	929	11.6
120	6	48,918	52,056	-3,138	-6.0	888	10.2	832	13.5
TOTAL	**75**	**2,117,844**	**1,883,399**	**234,445**	**12.4**	**4,133**	**16.5**	**6,083**	**29.2**

NW Subarea TRANSIMS Simulation Volumes vs Counts

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	Obs.	TRANSIMS	Count	Volume	%	Avg.	%	Dev.	% RMSE
Radial Freeway Counts - DAILY									
Freeway	58	4,233,545	3,588,013	645,532	18.0	13,743	22.2	16,084	34.0
Radial Freeway Counts - AM									
Freeway	58	1,076,947	815,689	261,258	32.0	4,993	35.5	5,185	51.0
Radial Freeway Counts - PM									
Freeway	58	1,094,308	919,509	174,799	19.0	3,981	25.1	4,734	38.8

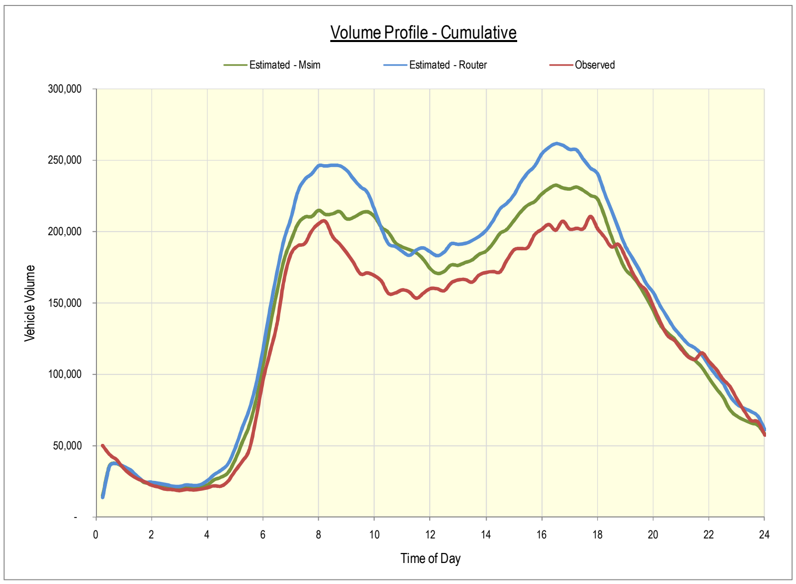
	Num.	Volume		Difference		Abs.Error		Std.	
Screenline ID	Obs.	TRANSIMS	Count	Volume	%	Avg.	%	Dev.	% RMSE
Radial Freeway Counts - DAILY									
102	5	657,738	462,071	195,667	42.3	39,133	42.3	31,130	52.0
103	1	32,271	28,012	4,259	15.2	4,259	15.2	-	15.2
119	1	50,166	45,536	4,630	10.2	4,630	10.2	-	10.2
120	2	37,555	41,339	(3,784)	(9.2)	1,892	9.2	583	9.4
TOTAL	**9**	**777,730**	**576,958**	**200,772**	**34.8**	**23,149**	**36.1**	**29,064**	**56.0**

	Num.	Volume		Difference		Abs.Error		Std.	
Facility Type	Obs.	TRANSIMS	Count	Volume	%	Avg.	%	Dev.	% RMSE
Directional Counts - DAILY									
Freeway	71	5,076,770	4,797,712	279,058	5.8	9,948	14.7	10,094	20.9
Expressway	14	350,196	262,005	88,191	33.7	7,441	39.8	4,423	45.8
Principal Arterial	262	4,223,394	3,202,295	1,021,099	31.9	4,735	38.7	4,120	51.3
Minor Arterial	342	1,936,917	1,534,305	402,612	26.2	1,901	42.4	1,786	58.1
Collector	163	941,218	708,240	232,978	32.9	2,170	49.9	1,668	62.9
Local Street	4	6,575	8,130	-1,555	-19.1	397	19.5	335	24.2
TOTAL	**856**	**12,535,070**	**10,512,687**	**2,022,383**	**19.2**	**3,571**	**29.1**	**4,604**	**47.4**

15 Minute Speed and Volume Comparison

In addition to comparing the totals for any given time-period, the distributions of the speeds and volumes were compared with observed data wherever available. The following charts compare the Router (estimated demand by time of day), Microsimulator volumes and observed data in 15-minute increments throughout the day.

Figure 40 presents a cumulative temporal volume and speed profile for all radial freeway sections with observed data inside the I-285 perimeter. This is followed by several pages of comparisons at individual locations.



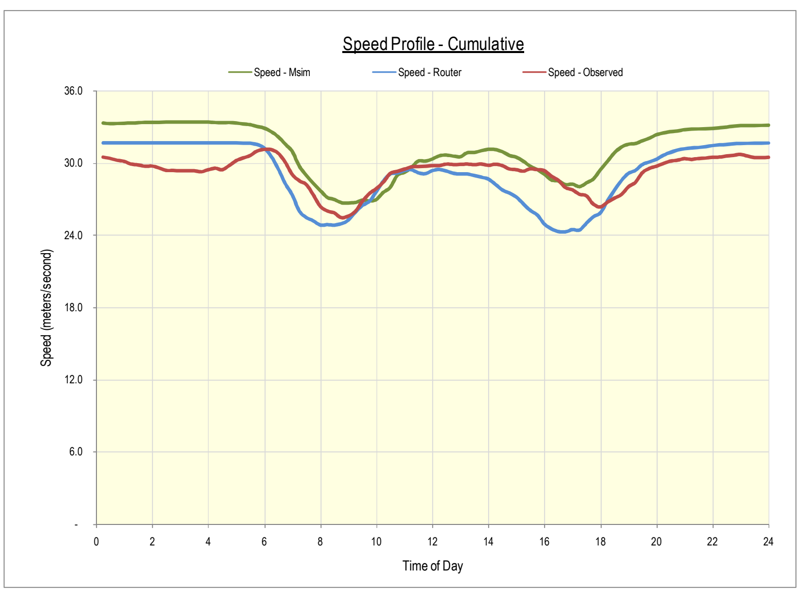
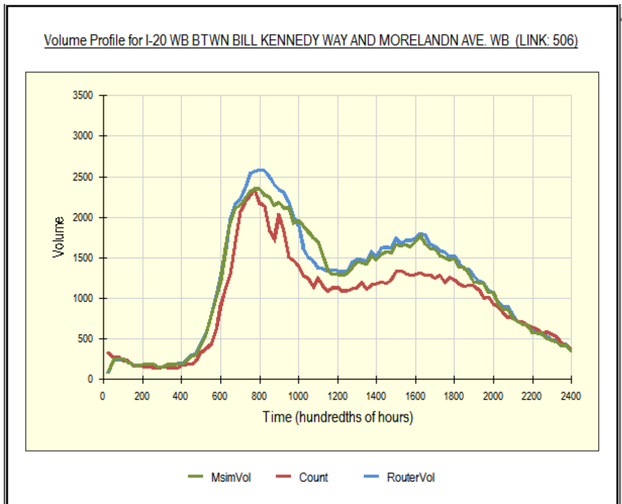
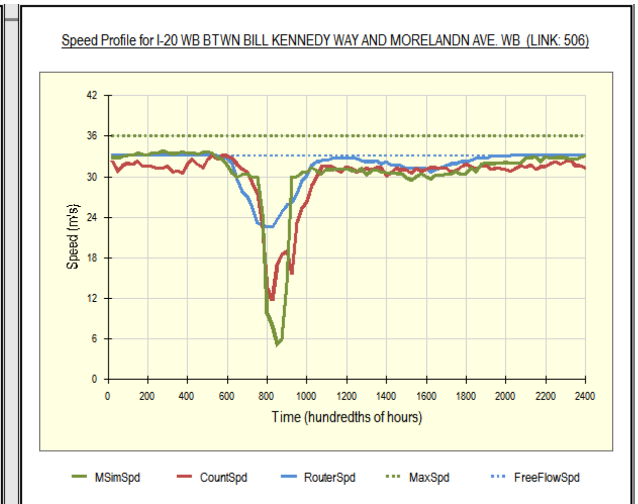


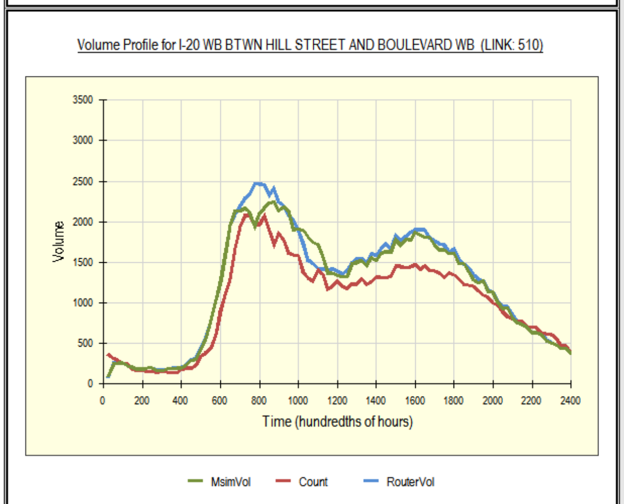
Figure 40: Cumulative volume and speed profiles Estimated - Observed (285 Sub Area Run 368)



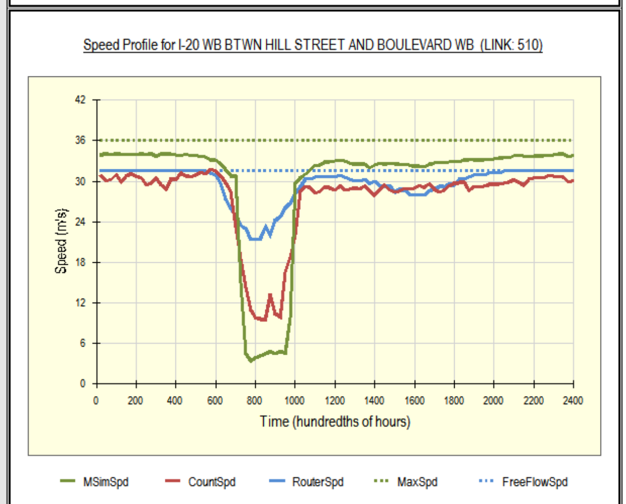
Volume Profile for I-20 WB BTWN BILL KENNEDY WAY AND MORELANDN AVE. WB (LINK: 506)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol



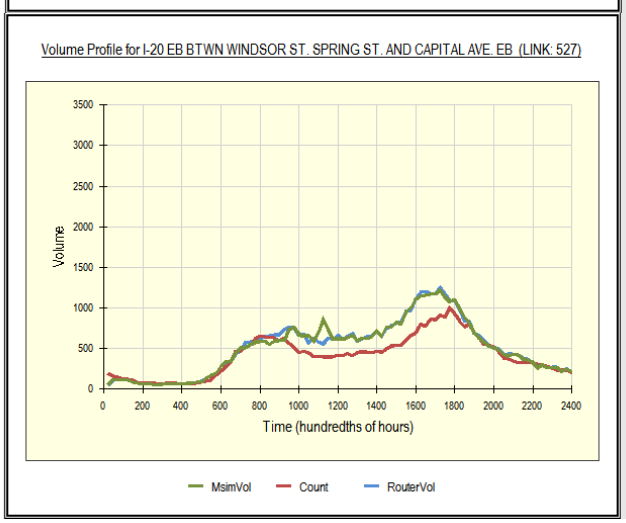
Speed Profile for I-20 WB BTWN BILL KENNEDY WAY AND MORELANDN AVE. WB (LINK: 506)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd



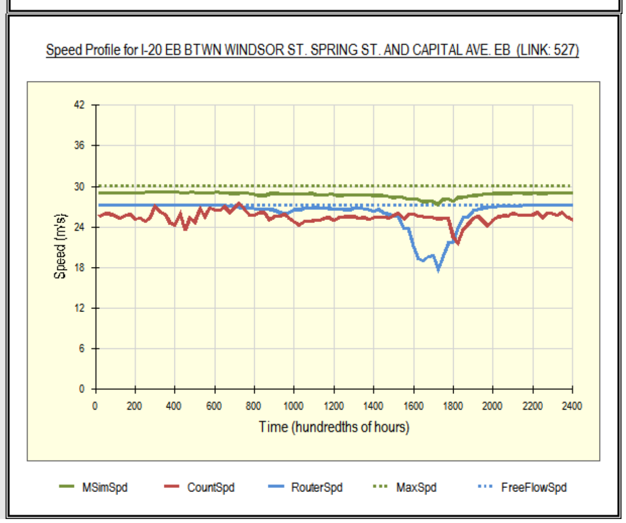
Volume Profile for I-20 WB BTWN HILL STREET AND BOULEVARD WB (LINK: 510)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol



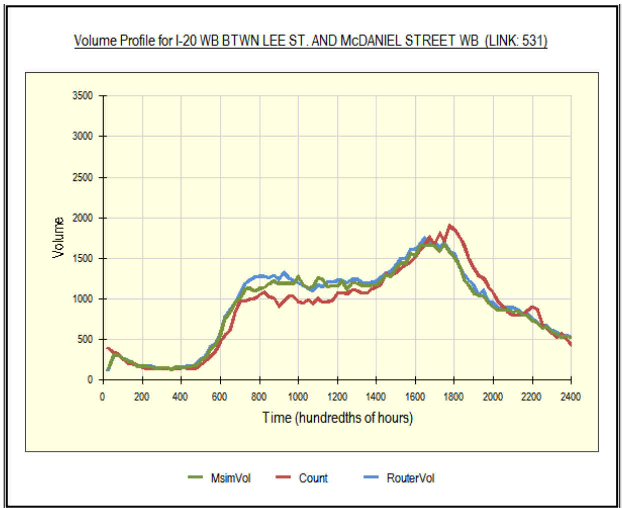
Speed Profile for I-20 WB BTWN HILL STREET AND BOULEVARD WB (LINK: 510)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

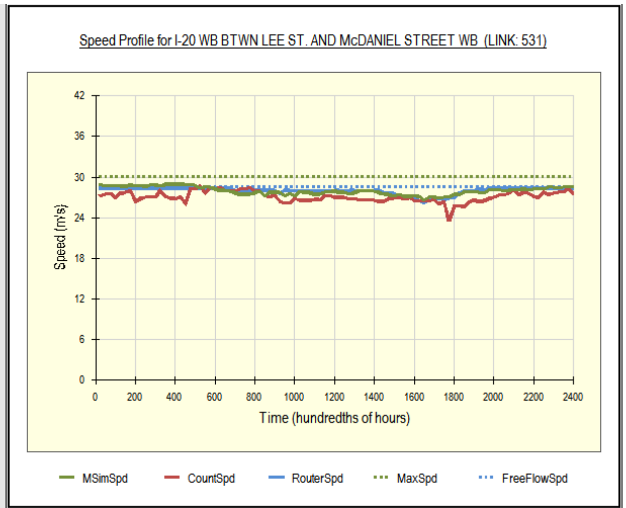


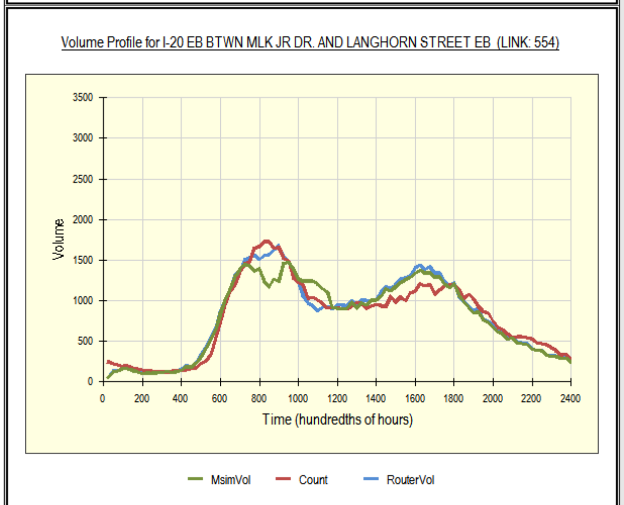
Volume Profile for I-20 EB BTWN WINDSOR ST. SPRING ST. AND CAPITAL AVE. EB (LINK: 527)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol

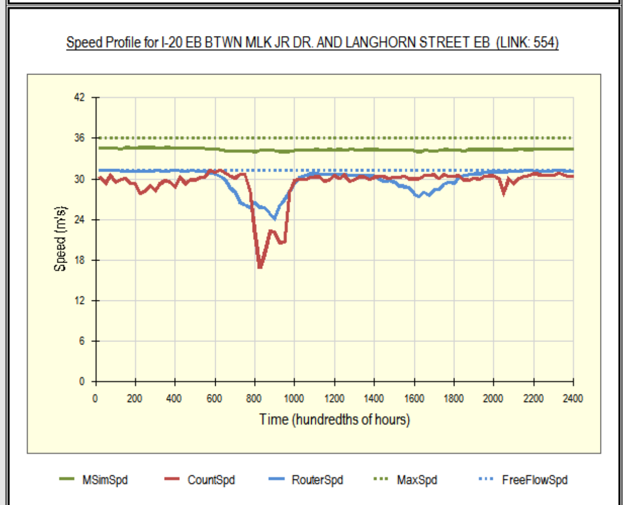


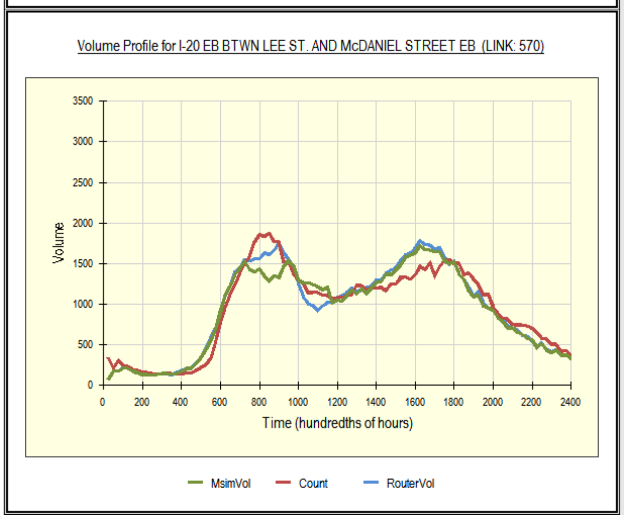
Speed Profile for I-20 EB BTWN WINDSOR ST. SPRING ST. AND CAPITAL AVE. EB (LINK: 527)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

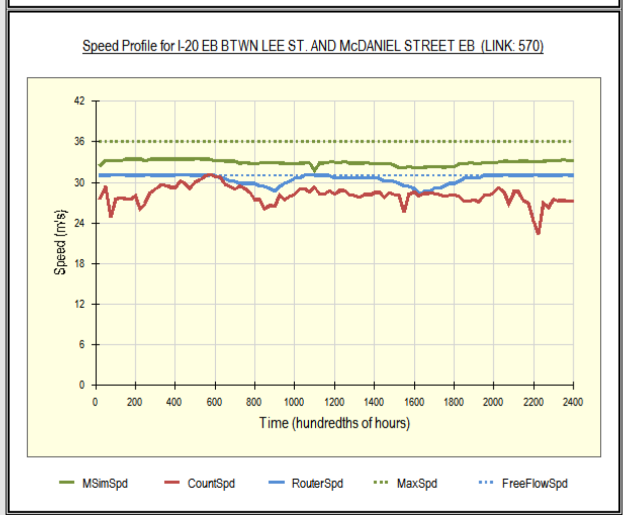

Volume Profile for I-20 WB BTWN LEE ST. AND McDANIEL STREET WB (LINK: 531)
Volume
0
500
1000
1500
2000
2500
3000
3500
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
Time (hundredths of hours)
MsimVol
Count
RouterVol

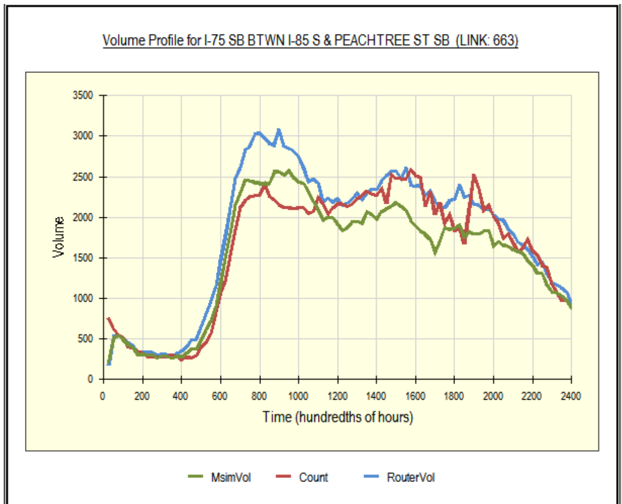

Speed Profile for I-20 WB BTWN LEE ST. AND McDANIEL STREET WB (LINK: 531)
Speed (m/s)
0
6
12
18
24
30
36
42
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

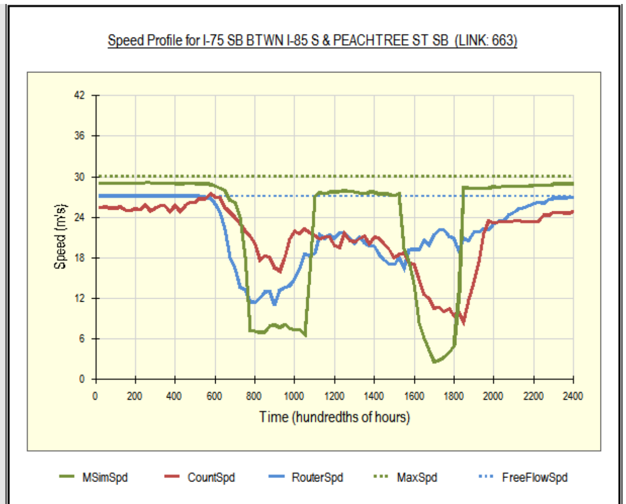

Volume Profile for I-20 EB BTWN MLK JR DR. AND LANGHORN STREET EB (LINK: 554)
Volume
0
500
1000
1500
2000
2500
3000
3500
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
Time (hundredths of hours)
MsimVol
Count
RouterVol

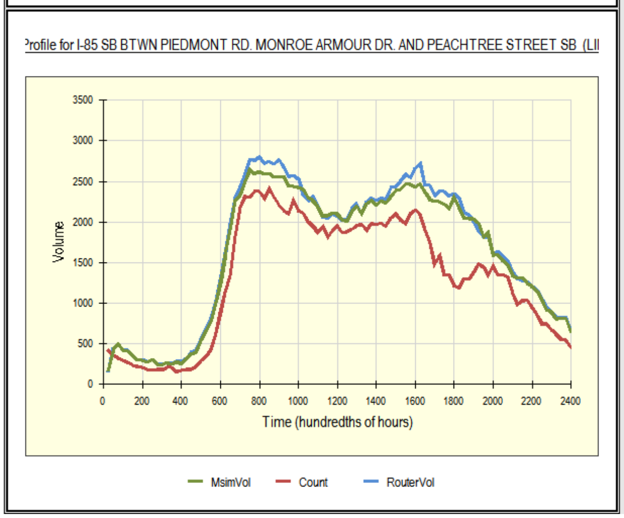

Speed Profile for I-20 EB BTWN MLK JR DR. AND LANGHORN STREET EB (LINK: 554)
Speed (m/s)
0
6
12
18
24
30
36
42
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

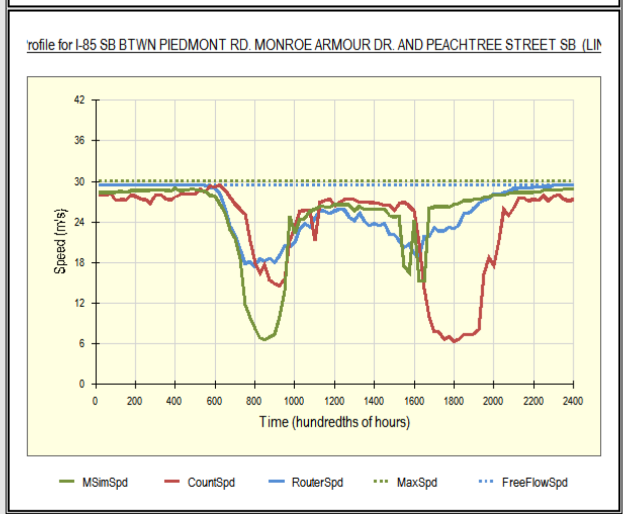

Volume Profile for I-20 EB BTWN LEE ST. AND McDANIEL STREET EB (LINK: 570)
Volume
0
500
1000
1500
2000
2500
3000
3500
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
Time (hundredths of hours)
MsimVol
Count
RouterVol

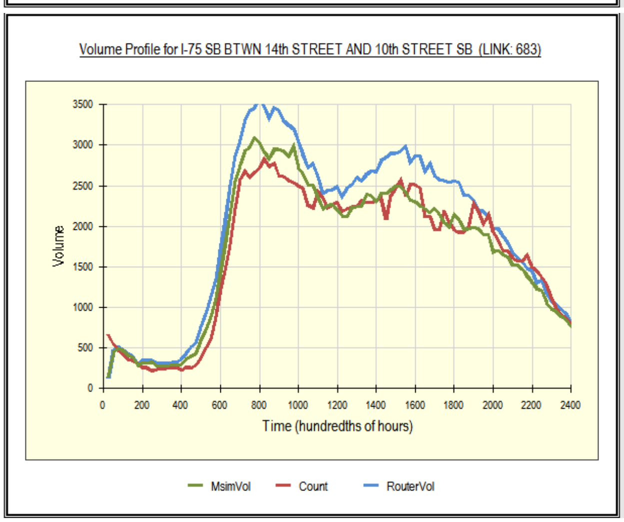

Speed Profile for I-20 EB BTWN LEE ST. AND McDANIEL STREET EB (LINK: 570)
Speed (m/s)
0
6
12
18
24
30
36
42
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

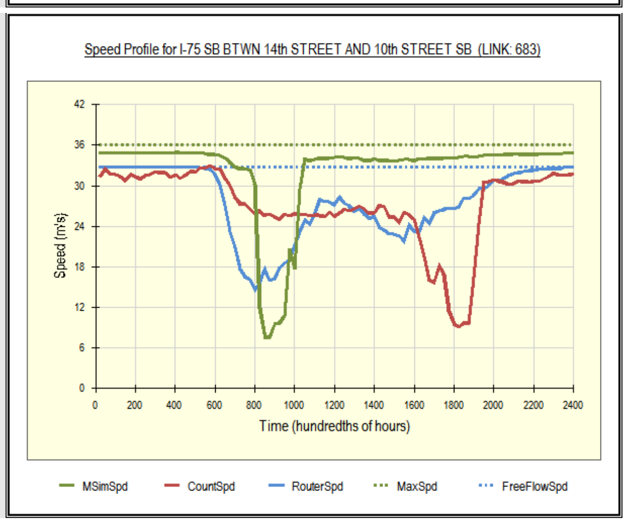

Volume Profile for I-75 SB BTWN I-85 S & PEACHTREE ST SB (LINK: 663)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol

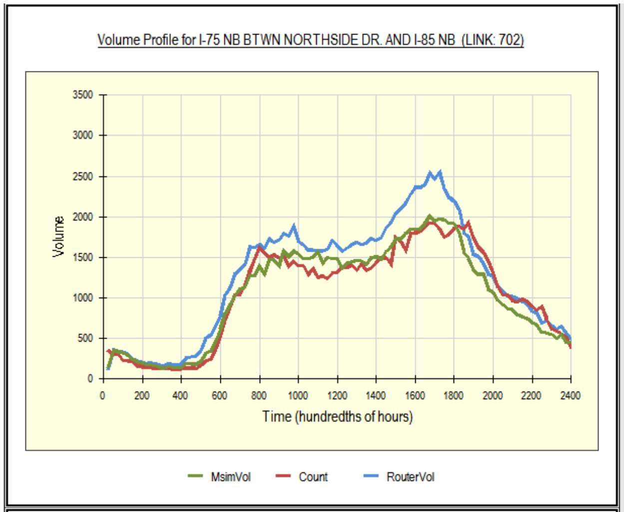

Speed Profile for I-75 SB BTWN I-85 S & PEACHTREE ST SB (LINK: 663)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

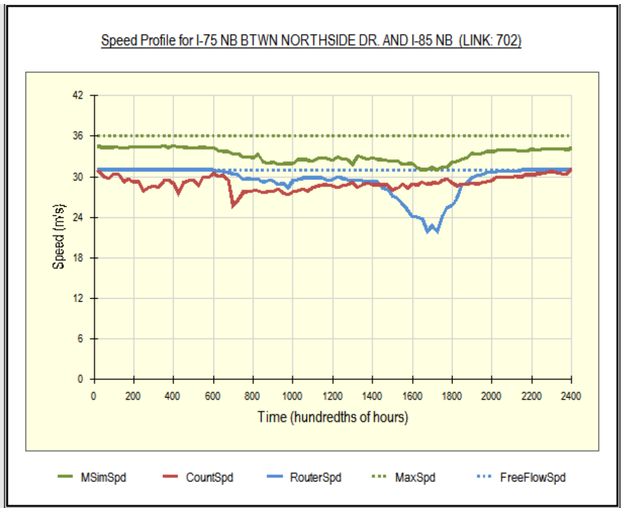

Profile for I-85 SB BTWN PIEDMONT RD. MONROE ARMOUR DR. AND PEACHTREE STREET SB (LI
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol

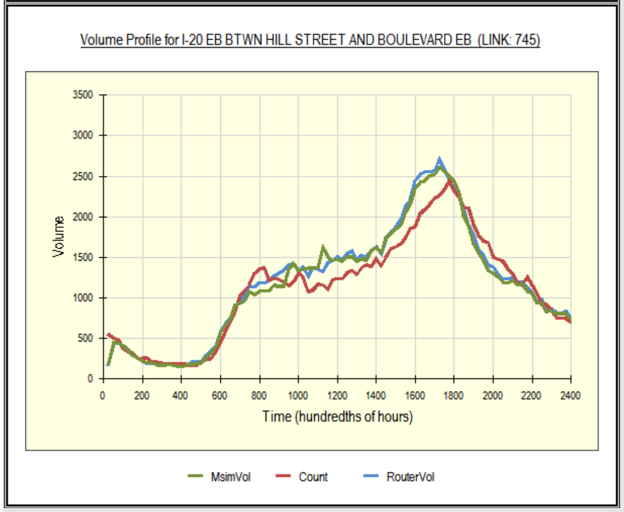

rofile for I-85 SB BTWN PIEDMONT RD. MONROE ARMOUR DR. AND PEACHTREE STREET SB (LIN
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

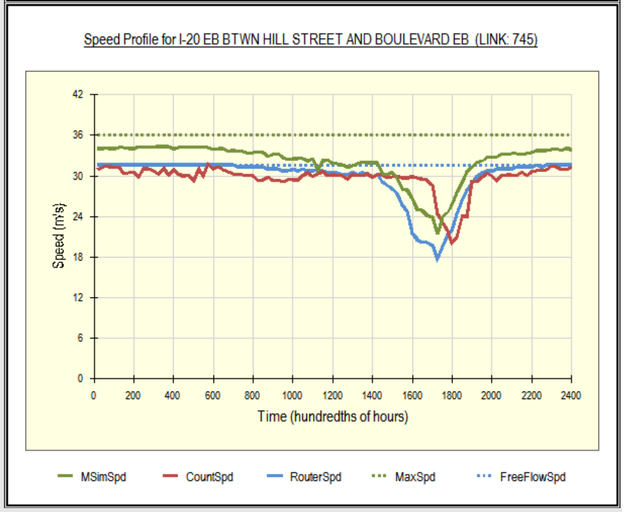

Volume Profile for I-75 SB BTWN 14th STREET AND 10th STREET SB (LINK: 683)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol

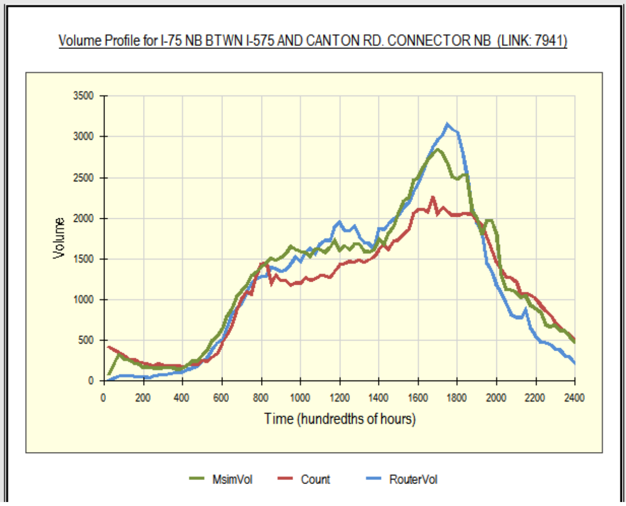

Speed Profile for I-75 SB BTWN 14th STREET AND 10th STREET SB (LINK: 683)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

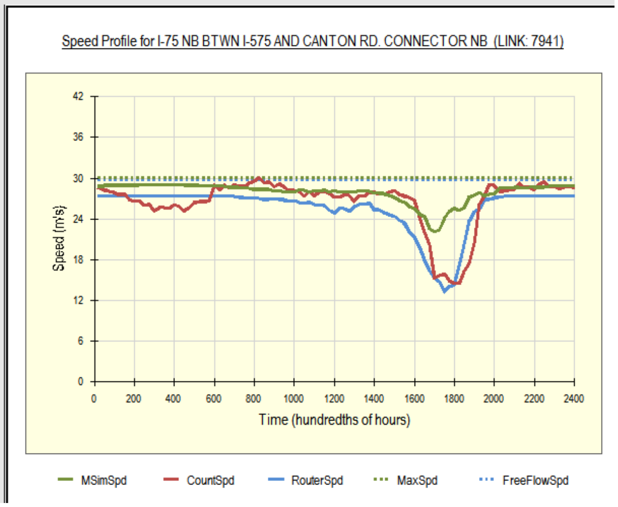

Volume Profile for I-75 NB BTWN NORTHSIDE DR. AND I-85 NB (LINK: 702)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol

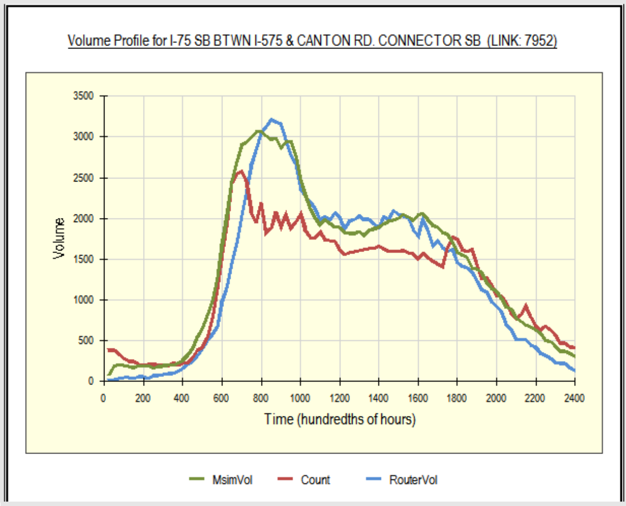

Speed Profile for I-75 NB BTWN NORTHSIDE DR. AND I-85 NB (LINK: 702)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

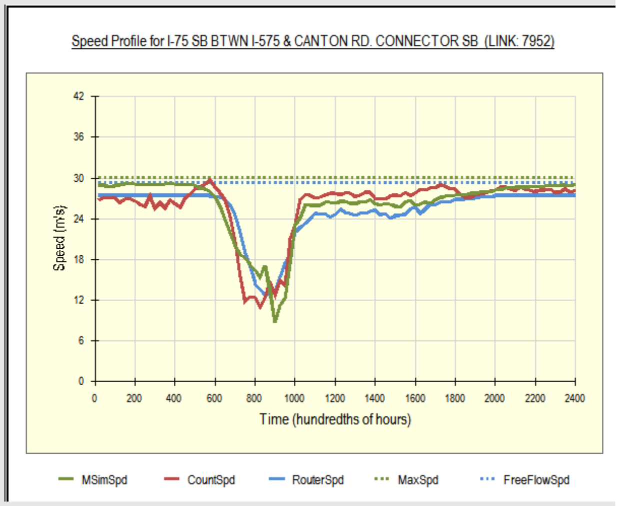

Volume Profile for I-20 EB BTWN HILL STREET AND BOULEVARD EB (LINK: 745)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol

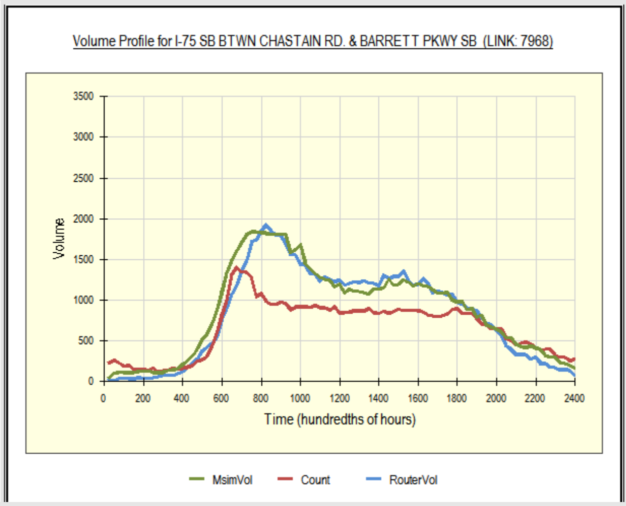

Speed Profile for I-20 EB BTWN HILL STREET AND BOULEVARD EB (LINK: 745)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

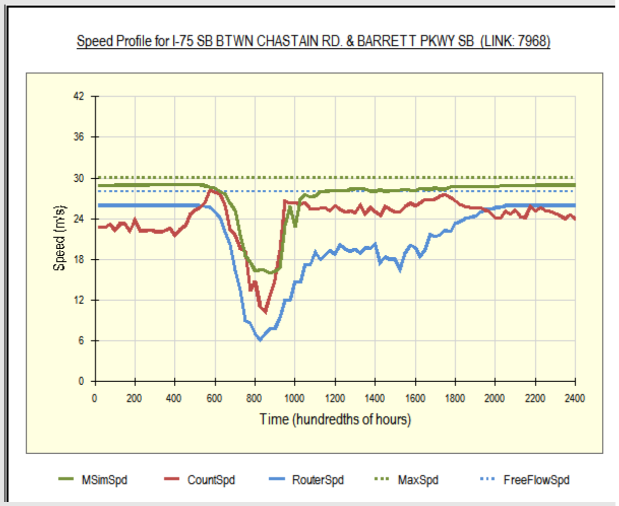

Volume Profile for I-75 NB BTWN I-575 AND CANTON RD. CONNECTOR NB (LINK: 7941)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol

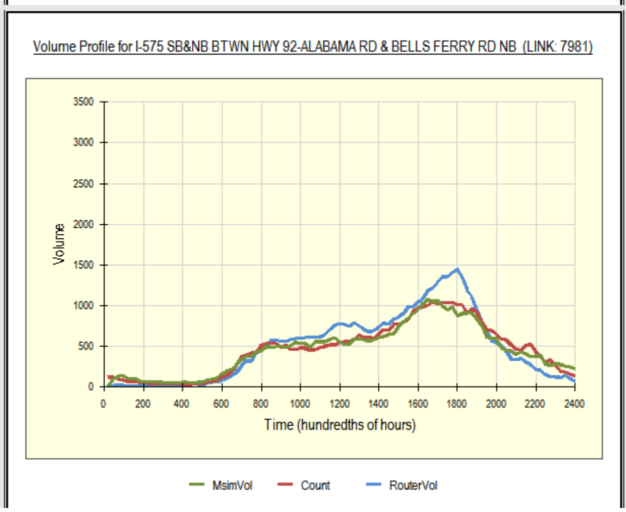

Speed Profile for I-75 NB BTWN I-575 AND CANTON RD. CONNECTOR NB (LINK: 7941)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

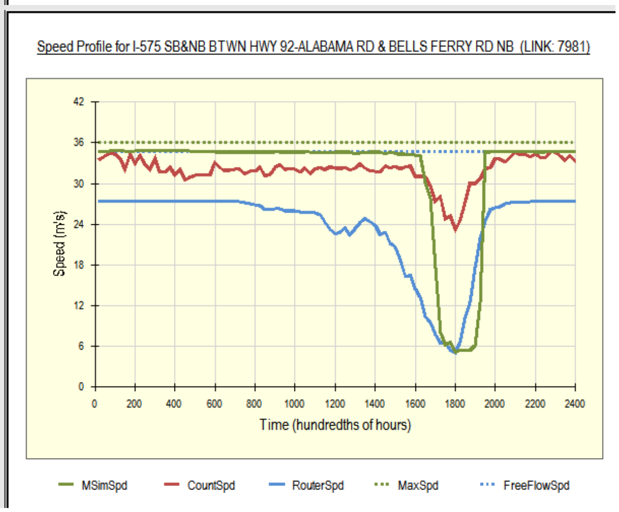

Volume Profile for I-75 SB BTWN I-575 & CANTON RD. CONNECTOR SB (LINK: 7952)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol


Speed Profile for I-75 SB BTWN I-575 & CANTON RD. CONNECTOR SB (LINK: 7952)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

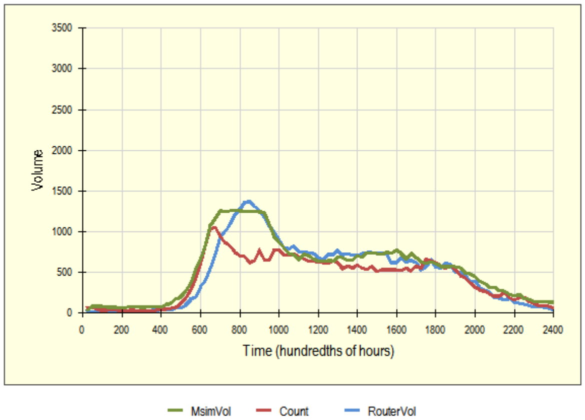

Volume Profile for I-75 SB BTWN CHASTAIN RD. & BARRETT PKWY SB (LINK: 7968)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol


Speed Profile for I-75 SB BTWN CHASTAIN RD. & BARRETT PKWY SB (LINK: 7968)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

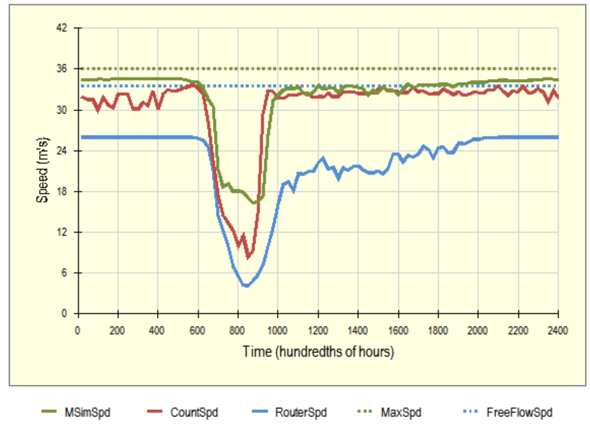

Volume Profile for I-575 SB&NB BTWN HWY 92-ALABAMA RD & BELLS FERRY RD NB (LINK: 7981)
Volume
Time (hundredths of hours)
MsimVol
Count
RouterVol


Speed Profile for I-575 SB&NB BTWN HWY 92-ALABAMA RD & BELLS FERRY RD NB (LINK: 7981)
Speed (m/s)
Time (hundredths of hours)
MSimSpd
CountSpd
RouterSpd
MaxSpd
FreeFlowSpd

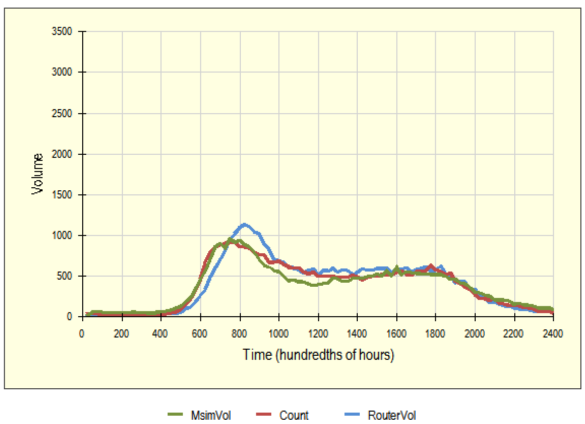
Volume Profile for I-575 SB&NB BTWN CHASTAIN RD & BARRETT PKWY SB (LINK: 7998)



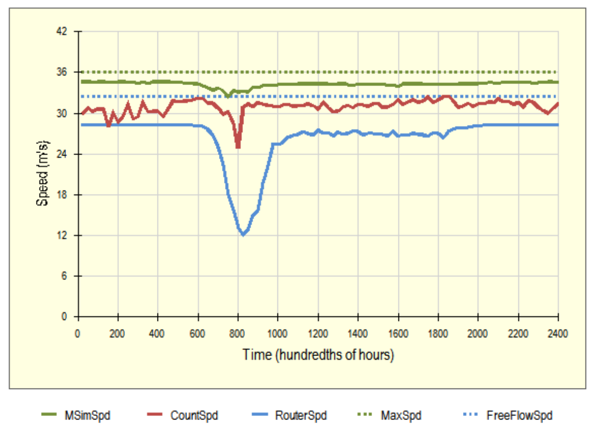
Speed Profile for I-575 SB&NB BTWN CHASTAIN RD & BARRETT PKWY SB (LINK: 7998)



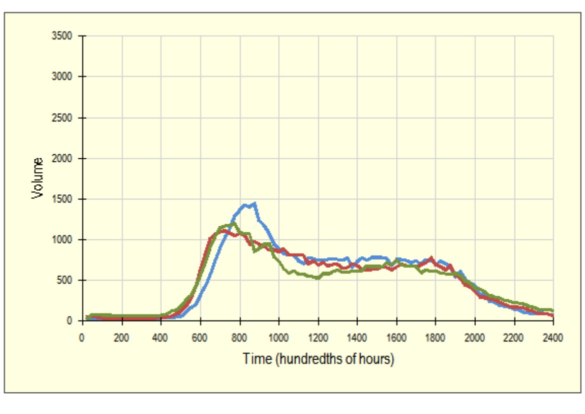
Volume Profile for I-575 SB&NB BTWN SIXES RD & TOWNE LAKE PKWY SB (LINK: 8417)



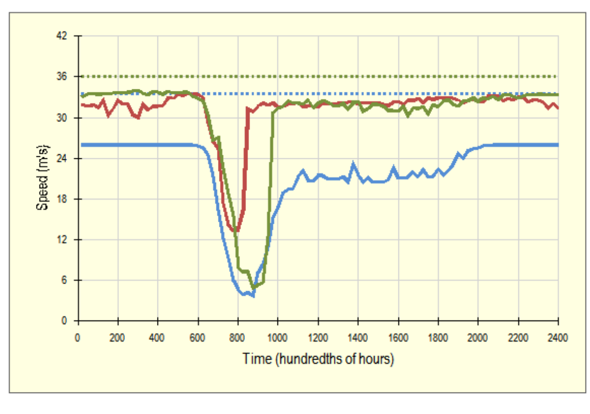
Speed Profile for I-575 SB&NB BTWN SIXES RD & TOWNE LAKE PKWY SB (LINK: 8417)



Volume Profile for I-575 SB&NB BTWN TOWNE LAKE PKWY & HWY 92-ALABAMA RD SB (LINK: 9761)



Speed Profile for I-575 SB&NB BTWN TOWNE LAKE PKWY & HWY 92-ALABAMA RD SB (LINK: 9761)



MOVES Application Options

One of the objectives of this study is to estimate the air quality impacts of each of the application alternatives. In April of 2009 EPA released the Draft version of their new emissions inventory software called MOVES. After a one year review period, EPA will finalize MOVES and begin requiring local and state agencies to use MOVES for statutory air quality analysis.

MOVES supports two primary methods for county / regional level analysis. In the "Lookup Method", MOVES generates a table of emissions rates by vehicle type, facility type, speed bin, and various other classifications. This table can then be used by custom software to calculate and aggregate emissions from individual links. In the "Inventory Method", the transportation data are processed to generate a series of tables and distribution factors that MOVES importers can read for a MOVES emissions inventory application.

The TRANSIMS Emissions program is capable of supporting both MOVES application options. Figure 41 shows the TRANSIMS interface using MOVES lookup tables. In this approach, MOVES is applied once with appropriate local county specific data to generate one or more lookup tables. The TRANSIMS Microsimulator is executed to generate speed bin files for each vehicle type. These files contain the number of seconds over each 15 minute period that each 30 meter segment of roadway has vehicles of the specified type traveling in each of six speed bins. The TRANSIMS Emission program is then executed with various parameters to aggregate some values and disaggregate other values in the MOVES lookup table and output the resulting composite rates. These rates could then replace the MOVES lookup table for subsequent applications. In addition, the Emissions program applies the composite rates to each record and aggregates the resulting emissions by facility type, vehicle type, and/or summary district.

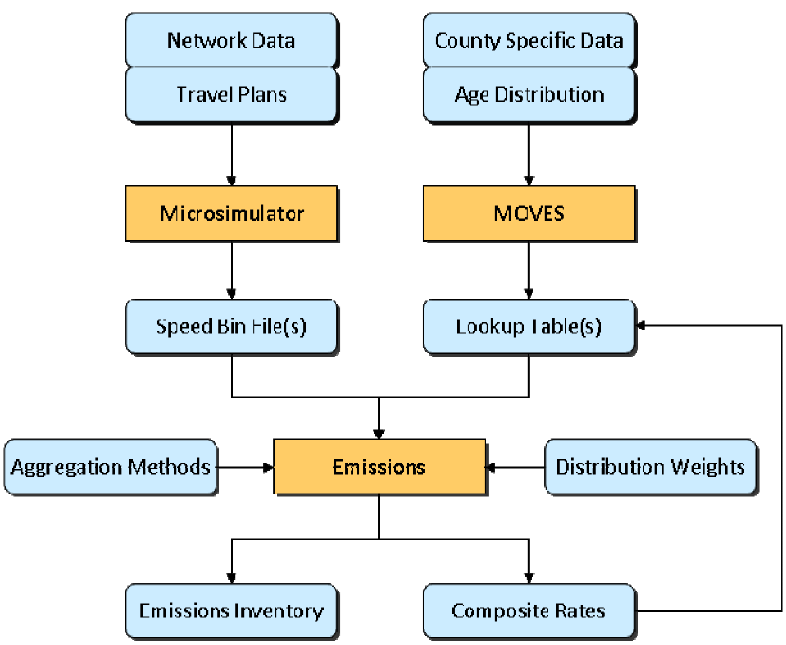


Figure 41: Lookup Table Interface to MOVES

For MOVES inventory applications, the process shown in Figure 42 is used. In this case the TRANSIMS Microsimulator generates the speed bin files plus a link delay file. The link delay file contains the volumes and speed on each link in 15 minute increments. The LinkSum program aggregates this information to generate the VMT by HPMS vehicle types and the distribution of VMT by MOVES facility types. The Emissions program in this case is configured to output VMT distributions and average speed bin distributions by hour of the day. These tables are generated in the format required by MOVES importers that insert the data into the MOVES MySQL database for emissions inventory processing.

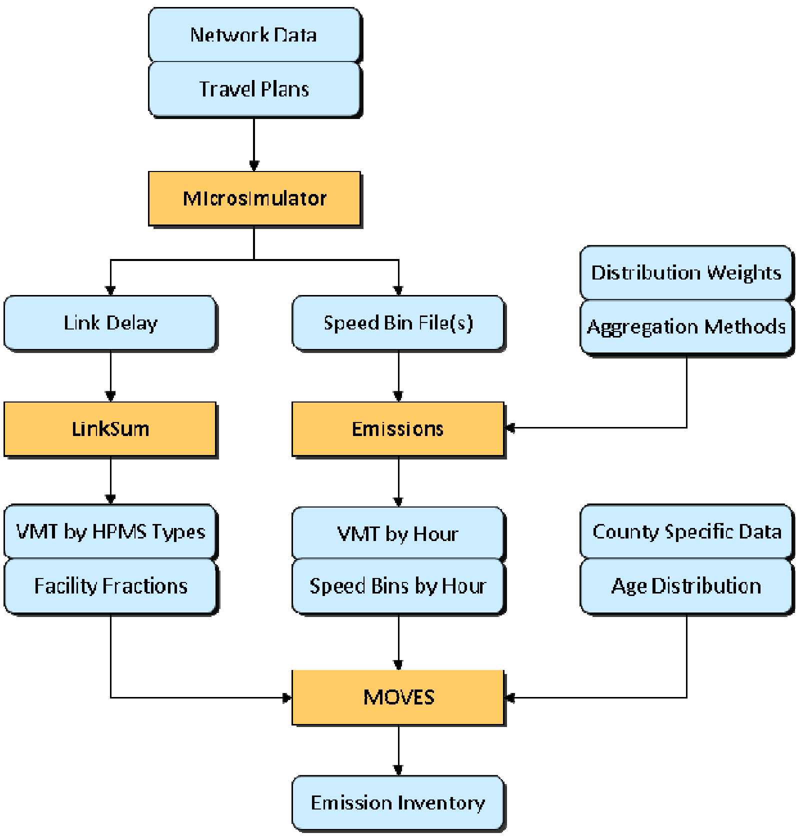


Figure 42: Inventory Interface to MOVES

In addition to county level analysis, MOVES is designed to implement project level conformity and NEPA analysis. This process is intended for Hot-Spot analysis of small area microsimulations of vehicle drive cycles. AECOM is investigating the feasibility of interfacing this process with TRANSIMS data. It is not clear at this point if this approach will be appropriate for any of the alternatives proposed by this study.