

Vissim

(Version 11)

Module 6: Data and Performance Metrics

Georgia Institute of Technology

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Contact:

Michael Hunter

Michael.Hunter@ce.gatech.edu

Disclaimer: The objective of these tutorials is to bring new users sufficiently (and quickly) up to speed so they can use the manual and other resources when they have questions on model development. These tutorials should not be considered as official guidance; users should always refer to official PTV Vissim or project sponsor documentation for the final word on a model feature question. Send any errors, issues, or comments to michael.hunter@ce.gatech.edu so any corrections can be made to the material.

PTV-Vissim (V11) Module 6 Overview

This is the sixth in a series of Vissim modules. [Module 1](#) guides the user through the creation of a corridor which consists of three signalized, pre-time, four-approach intersections. [Module 2](#) adds coordinated-actuated control to the corridor from [Module 1](#). [Module 3](#) adds an unsignalized intersection. [Module 4](#) familiarizes the user with the basics of designing a freeway segment with a diamond interchange. [Module 5](#) introduces additional concepts and tips for building and reviewing a Vissim model, exploring some of the Vissim modeling issues not covered in the first four modules (allowing a user to quickly get up to speed) but critical to model development. [Module 6](#) shows how to collect various performance measures: travel time, speed, delay, queues, etc., including many of the numerous Vissim data elements for each of these metrics. [Module 6](#) assumes the user is familiar with the concepts in the prior five [modules](#) and will build on the final *.inpx* developed in [Module 5](#). The wireframe of this model is seen in Figure 1.

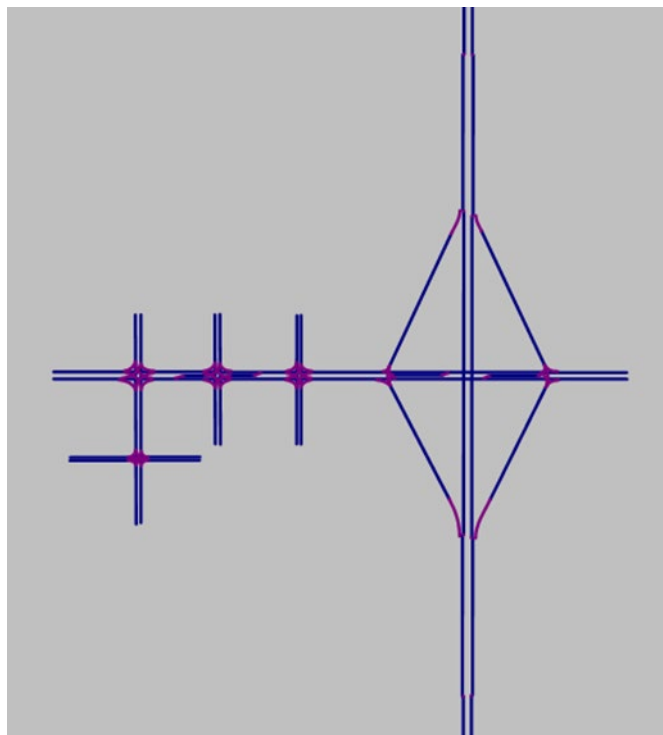


Figure 1: [Module 5](#) Final Network Configuration

Module 6 will step through six primary topics:

1. Travel time,
2. Delay,
3. Volume and speed (*Data Collection Points*),
4. Queues,
5. *Node* and *link* based metrics, and
6. Signal control and detector data.

Base Knowledge

For this module, it is assumed that you have a basic understanding of the concepts covered in Modules 1 through 5, including:

- Starting Vissim and navigating the GUI (Graphical User Interface),
- Links and Connectors,
- Signal Controllers, Signal Groups, and Signal Heads,
- Ring Barrier Control,
- Alternate intersection and ramp link-connector layouts,
- Emergency Stop Distance and Lane Change Distance, and
- Conflict Areas.

IMPORTANT: SAVE FREQUENTLY AS YOU WORK!

Create Module 6 Vissim File

To start open the Module 5 Vissim .inpx file. Save the .inpx under a new name, e.g. Module 6. Let's also update the RBC controllers to:

- RBC_Mod6_Buzz_and_Burdell_v1.rbc,
- RBC_Mod6_Buzz_and_Ramblin_v1.rbc,
- RBC_Mod6_Buzz_and_Pi_v1.rbc,
- Mod 6 Buzz Blvd and Peach Freeway West Int.rbc, and
- Mod 6 Buzz Blvd and Peach Freeway East Int.rbc.

Detailed instructions on opening and saving a Vissim file, as well as renaming RBC controllers, may be found in the prior modules.

Exploring Vissim Data Output and Performance Metrics

Vissim has a multitude of data outputs and performance metrics that are extremely useful for analyzing the performance of a design in simulation. However, these metrics are also highly useful for reviewing, validating, and calibrating a model. In this section you will explore many of the more common data outputs and performance metrics.

There are two options for recording most performance metrics. The first is in a *Results list* that you can view while the model is running. The *results list* data may also be saved to a file if desired. The *results list* data is aggregated by user selected intervals, e.g., the average travel time over a roadway segment every 15 minutes. The second is *Direct Output* of individual vehicle performance metric raw data to a file, e.g., the travel time for every vehicle over a roadway segment. In the first method - *Results List* - Vissim performs many of the various potential data aggregations for you, in the second method - *Direct Output* - the raw performance measure data is written to a file which may then be utilized for post-hoc analysis as desired. We will demonstrate both methods.

Travel Time

We will start with travel time, one of the most commonly utilized performance metrics. To collect travel times, there are several tasks necessary: define the *Travel Time Measurements*, that is, the roadway segments over which travel time data will be collected; define data collection times and intervals for *Results*; select the desired metrics for the *Results List*; and set if *Direct Output* of travel time data to a file is desired. We will set up travel time measurements end-to-end NB and SB on Peach Freeway, end-to-end EB and WB on Buzz Blvd, and over the EB and WB through and left turn movements for Buzz Blvd and Ramblin St. The travel time sections are shown in Figure 2.

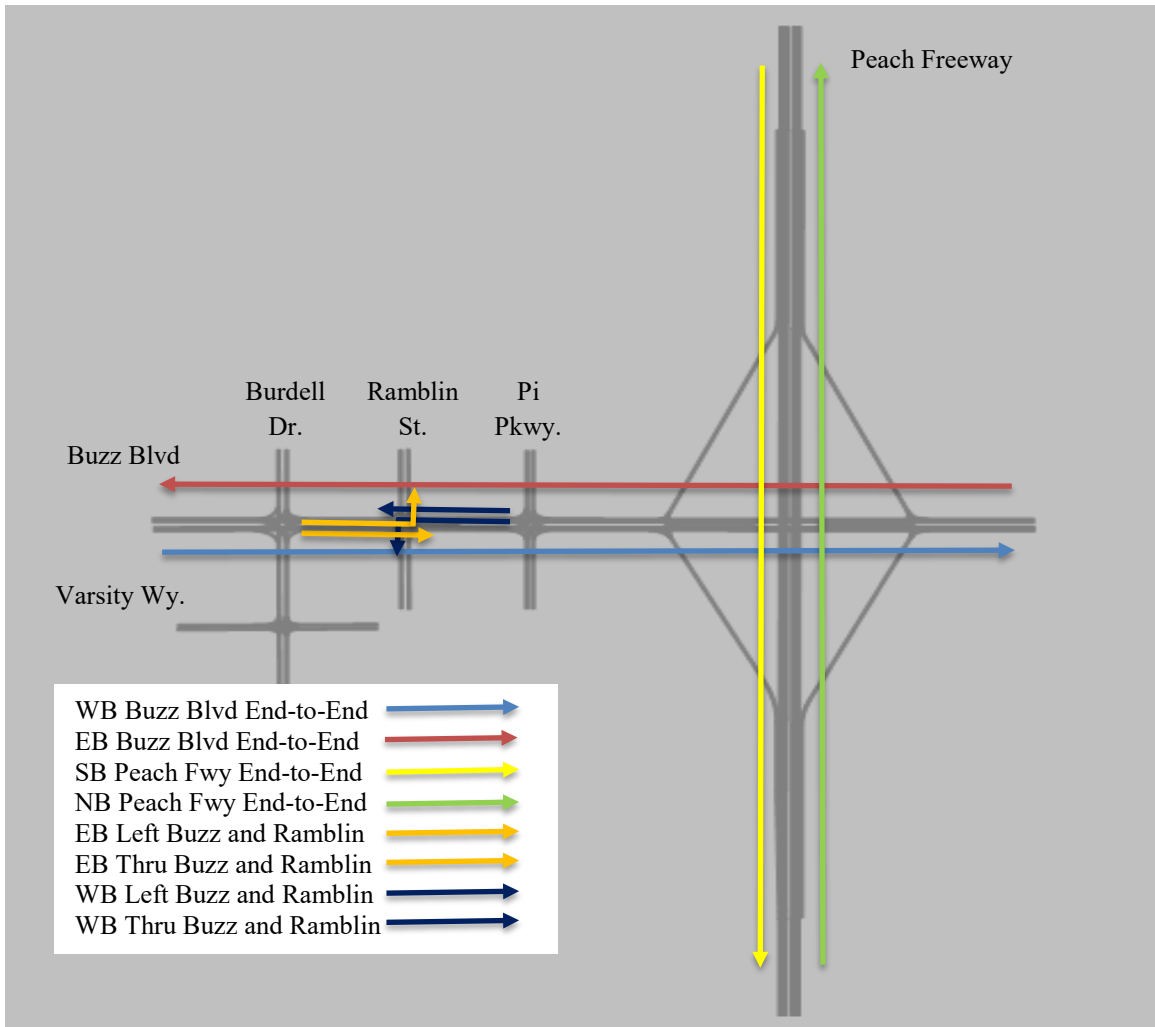


Figure 2: Location of travel Time measurements

Set Travel Time Measurement Sections

To set up the Buzz Blvd EB end-to-end *travel time measurement* use the following steps:

- step i. Select *Vehicle Travel Times* in *Network Objects*.
- step ii. Right-click on the EB *link* just downstream of the *Vehicle Input*, Figure 3.
- step iii. Right-click on Buzz Blvd by the EB exit, Figure 3.
- step iv. The *Travel Time Measurement* pop-up should appear. Set *Name:* as Buzz Blvd EB - End-to-End.
- step v. Select *OK*.

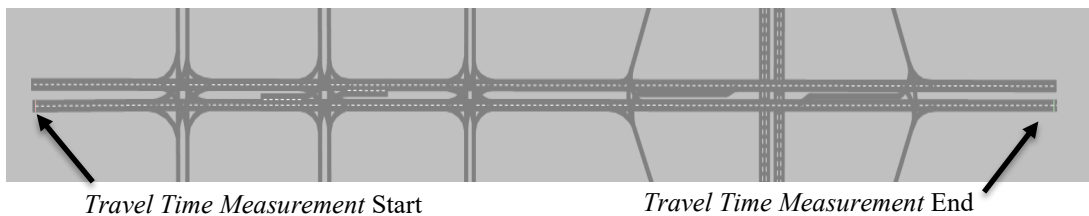


Figure 3: Buzz Blvd EB Travel Time Start and End Points

step vi. Repeat Steps i through v for Buzz Blvd WB end-to-end, Peach Freeway NB and SB end-to-end, and over the Buzz Blvd and Ramblin St. EB and WB through and left turn movements, Figure 2. There should now be eight *travel time measurements*, Figure 4.

Count: 8	No	Name	StartLink	StartPos	EndLink	EndPos	Dist
1	1	Buzz Blvd EB - End-to-End	1: Buzz Blvd EB	9.990	9: Buzz Blvd EB	2462.743	3527.61
2	2	Buzz Blvd WB - End-to-End	2: Buzz Blvd WB	10.352	31: Buzz Blvd WB	447.338	3525.19
3	3	Buzz Blvd & Ramblin St. EB Thru	29: Buzz Blvd EB	23.407	9: Buzz Blvd EB	64.113	520.27
4	4	Buzz Blvd and Ramblin St EB Left	29: Buzz Blvd EB	32.038	34: Ramblin St. NB	46.308	471.52
5	5	Buzz Blvd and Ramblin St WB T...	2: Buzz Blvd WB	2119.314	10: Buzz Blvd WB	10.417	500.53
6	6	Buzz Blvd and Ramblin St. WB...	2: Buzz Blvd WB	2126.713	33: Ramblin St. SB	51.128	495.55
7	7	Peach Freeway NB - End-to-End	14: Peach Freew...	46.386	24: Peach Freewa...	485.569	4938.70
8	8	Peach Freeway SB - End-to-End	13: Peach Freew...	39.979	20: Peach Freewa...	457.210	4927.15

Figure 4: Vehicle Travel Time Measurements List

CRITICAL CONCEPT

For a vehicle's data to be included in a *travel time measurement* it must cross both the start and end point markers of the measurement area. Partial trips are not included in calculated travel time metrics. To be recognized as crossing a travel time marker you must be sure the vehicle is on the link with the travel time marker. That is, where links and connectors meet, or links overlap, a vehicle is only considered to cross the travel time marker if the vehicle is on the same link or connector as the marker.

Also, exercise caution on more complicated models (e.g., larger models, models using dynamic traffic assignment, etc.). ANY vehicle that crosses both the start and end point travel time markers will be included in the travel time data for that measurement section. It is possible that vehicles taking (widely) different paths between the points may be included in the same travel time metrics. To avoid this issue in larger models, instead of using a single very long travel time measurement you may want to break the desired path into several travel time measurement segments, combining the results in your post analysis. This can be particularly necessary for models of grid systems.

Setting Up *Results List*

We will first collect aggregate travel times, using the *Results List*. With a *Results List* you can view aggregate travel times while the model is running and then save the data to a file, if desired.

- step i. Go to *Evaluation* → *Configuration*.
- step ii. Select the *Results Attributes Tab*, Figure 5.
- step iii. For *Vehicle travel times* check the *Collect data* box.
- step iv. Set the *Interval* to 900 (that is 900 seconds, i.e., 15 minutes).
- step v. Leave the *From-time* at 0 and *To-time* at 99999, this means we will collect data for the entire simulation time. (In Module 8 we will discuss the use of a warm-up period.)
- step vi. Select *More...*,
- step vii. Select the *destination section* radio button. This means the reported travel times will be associated with the time the vehicle crosses the travel time exit marker.
- step viii. Select *OK*.
- step ix. Select *OK*.

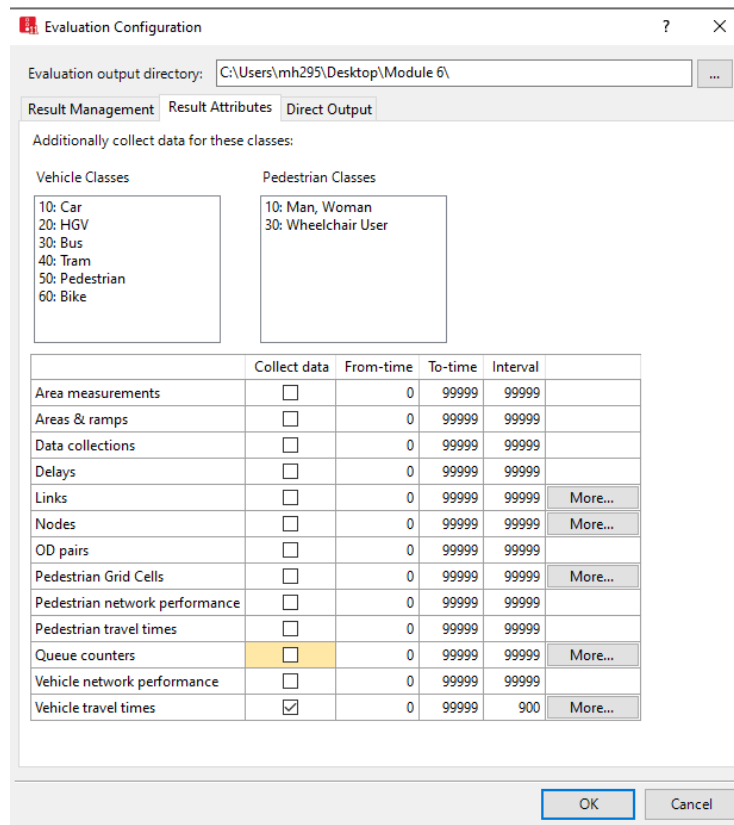


Figure 5: Travel time setting under *Evaluation* → *Configuration* → *Results Attributes*

Select *Travel Time Metrics*


So far, we have set the location of the travel time measurements as well as the data collect time and aggregation interval for the *Results List*. As a last step we need to determine which travel time metrics we would like to collect.

- step i. Go to *Evaluation* → *Results Lists* → *Vehicle Travel Time Results*.
The *Vehicle Travel Time Results* list should open. By default, the following data will be collected:

Vehs(All): The number of vehicles that have crossed the travel time trap,

TravelTm(All): Average travel time of vehicles that have traversed the travel time trap, and

DistTrav(all): The total distance traversed by a vehicle in a travel time trap.

- step ii. While the default travel time metrics are often all you need let's add a few additional travel time metrics so you can see how that is accomplished. Select the wrench icon () in the *Vehicle Travel Time Results* Window. The *Vehicle Travel Time Results: Select Attributes* window should pop-up, Figure 6.

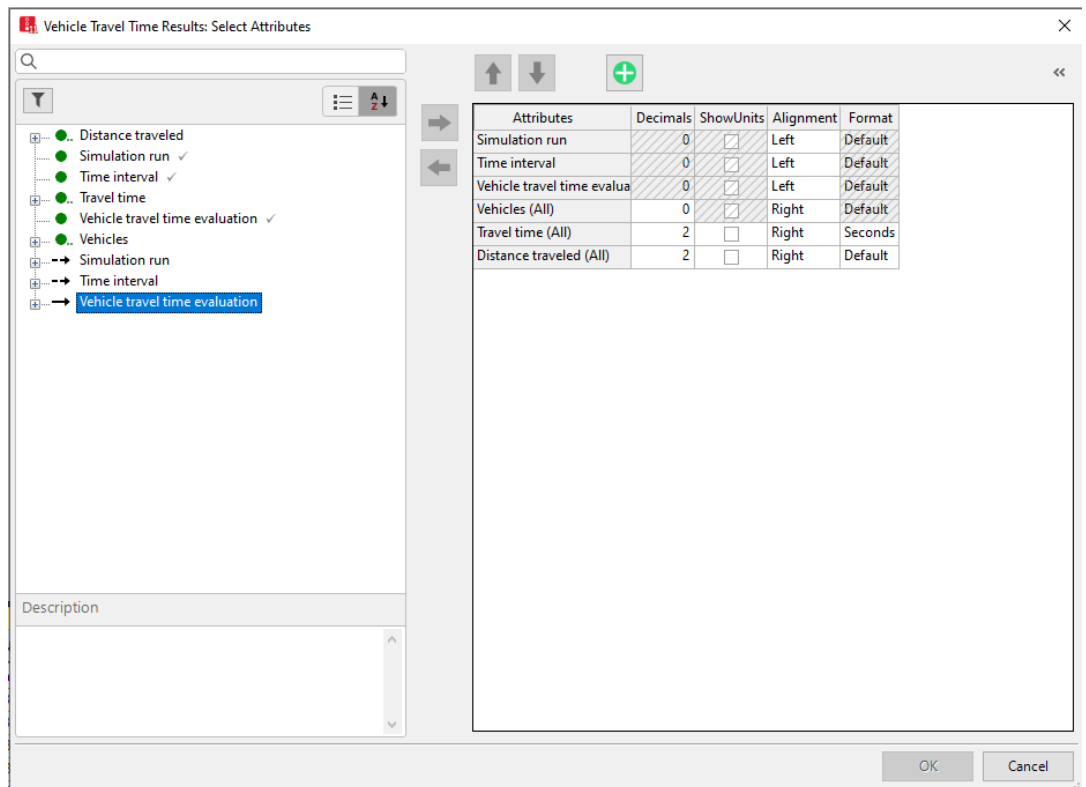


Figure 6: *Vehicle Travel Time Results: Select Attributes* Window

- step iii. Expand *Vehicle travel time evaluation* at the bottom of the list.
- step iv. Expand *Travel time*.
- step v. Select *Current run x Standard deviation x All types*. (This will show the value of the standard deviation of the 15-minute values, i.e., for a two-hour run it would be the standard deviation of the 8, 15-minute interval average values.)
- step vi. Click the green arrow to move the selected attribute to the results list.
- step vii. Select *Current run x Minimum x All types*, move to selected attributes. (This will show the value of the 15-minutes with the lowest value travel time.)
- step viii. Select *Current run x Maximum x All types*, move to selected attributes. (This will show the value of the 15-minutes with the highest travel time.)
- step ix. Expand *Vehicle travel time evaluation* at the bottom of the list. Move the attribute *Name* to the selected attributes list. (This is the name of the *travel time measurement*.)
- step x. Click *OK*.

Save the model. (Hopefully you are doing this often!). Run the model. In the *Vehicle Travel Time Results* window, you will see the travel time results populate for each 15-minute interval as the model runs. Example results may be seen in Figure 7.

Count	SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)	VehicleTravelTi...	VehicleTravelTi...	VehicleTravelTi...	VehicleTravelTi...
1	1	0-900	1: Buzz Llvd EB - End-to-End	36	99.88	3527.61	4.13	91.11	99.88	Buzz Llvd EB - E...
2	1	0-900	2: Buzz Blvd WB - End-to-End	41	115.19	3525.19	2.48	115.19	120.44	Buzz Blvd WB -...
3	1	0-900	3: Buzz Blvd & Ramblin St. EB...	76	20.96	520.27	1.84	20.96	25.35	Buzz Blvd & Ra...
4	1	0-900	4: Buzz Blvd and Ramblin St E...	6	49.48	471.52	6.66	46.44	60.45	Buzz Blvd and...
5	1	0-900	5: Buzz Blvd and Ramblin St...	109	22.02	500.53	1.54	19.65	23.34	Buzz Blvd and...
6	1	0-900	6: Buzz Blvd and Ramblin St...	16	56.36	495.55	11.50	56.36	82.77	Buzz Blvd and...
7	1	0-900	7: Peach Freeway NB - End-to...	276	48.73	4938.70	0.15	48.38	48.73	Peach Freeway...
8	1	0-900	8: Peach Freeway SB - End-to...	307	51.88	4940.88	0.27	51.45	52.11	Peach Freeway...
9	1	900-18...	1: Buzz Llvd EB - End-to-End	20	91.11	3527.61	4.13	91.11	99.88	Buzz Llvd EB - E...
10	1	900-18...	2: Buzz Blvd WB - End-to-End	47	117.80	3525.19	2.48	115.19	120.44	Buzz Blvd WB -...
11	1	900-18...	3: Buzz Blvd & Ramblin St. EB...	84	25.35	520.27	1.84	20.96	25.35	Buzz Blvd & Ra...
12	1	900-18...	4: Buzz Blvd and Ramblin St E...	7	46.44	471.52	6.66	46.44	60.45	Buzz Blvd and...
13	1	900-18...	5: Buzz Blvd and Ramblin St...	116	23.34	500.53	1.54	19.65	23.34	Buzz Blvd and...

Figure 7: Example Vehicle Travel Time Results

Aside: feel free to explore some of the other attributes. You may notice that *Delay measurements* may be found under the *Vehicle travel time evaluation* list. If you add the delay attributes to the results list you will notice when you run the model that they do not populate with values. This is because there are a few additional steps needed to set up the delay measurements. These will be demonstrated in the next section.

If you wish to perform some post-hoc analysis of the travel time results click on the disk icon (📁) in the *Vehicle Travel Time Results* list. The file save window will pop-up, select *Save*. The file will save as an *.att* file in the same folder as the *.inpx*; however, you can confirm (or change) this when you save the file. If you select the disk icon with the red arrow (📁➔) the travel time file will automatically be saved at the end of each run.

You can now open the travel time file in Excel (or the analysis software of your choice). Remember, the file has an *.att* extension, so you will need select *All Files *.** in Excel to open the file. Open the file as *Delimited*, with *Semicolon Delimiters*, and *General Column data format*. In the Excel file you will see some header data (file name and location, date, Vissim version, etc.), a list of the data collected, and the raw data. You may now plot and analyze the data as you wish. For example, Figure 8 is the recorded travel time for each 15-minute period, for all 8 travel time segments.

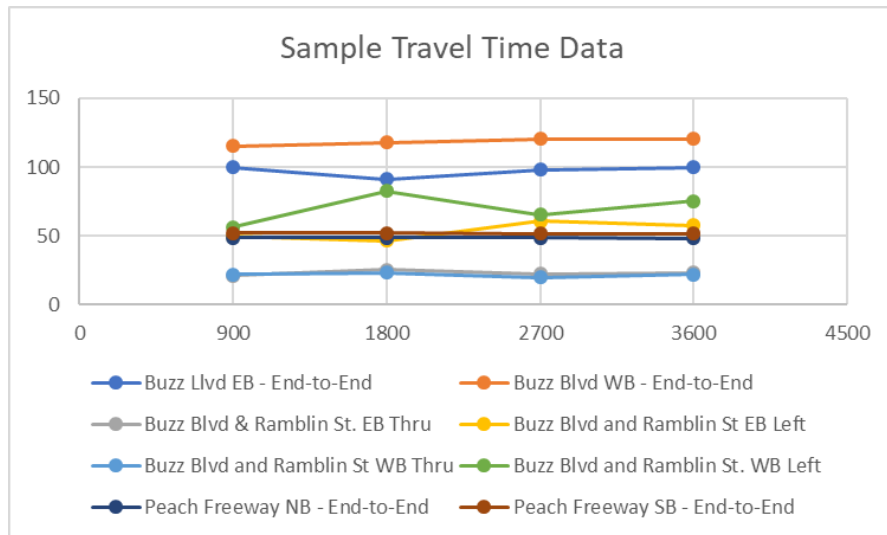


Figure 8: Travel time data per 15-minute interval for each travel time segment

Save Direct Output File

Next, we will see how to output the raw travel time data; that is, the individual vehicle travel times over each travel time measurement zone. To output the raw travel time data to a file we use *Direct Output*:

- step i. Go to *Evaluation* → *Configuration* → *Direct Output*.
- step ii. Check *Write to file* for *Vehicle Travel times (raw data)*.

This will output to a *.rsr* file. For each vehicle that crosses a travel time measurement zone the file includes: time stamp, travel time measurement number, vehicle number, vehicle type, travel time, delay, and distance traveled.

Caution: As raw data files contain individual vehicle data they can become rather large (particularly for large models or long run times) and they tend to slow down model run time.

The *.rsr* file will be stored by default in the same file as the *.inpx* file. You can open this file in Excel using *Semicolon Delimitation*. In the file you will see the travel time for every vehicle that crosses one of the defined *Travel Time Measurement* zones. For instance, Figure 9 shows the end-to-end EB Buzz Blvd vehicle travel times. In the figure the raw data was used to calculate the 15-minute averages as well, these are also plotted. A comparison of the 15-minute averages calculated using the raw data and that from the *Results List* show the same aggregate values, as it should be!

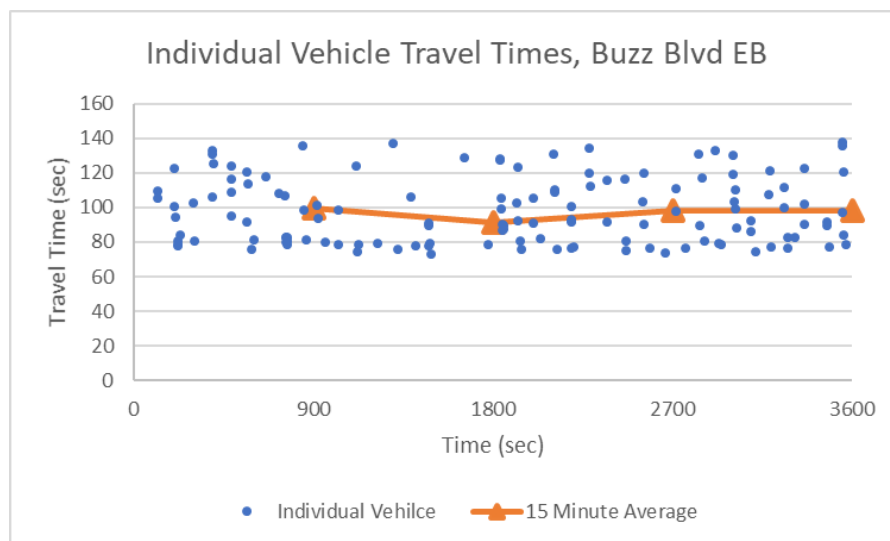


Figure 9: Individual vehicle Buzz Blvd EB travel times

By default, all vehicle types are included in the *Results List*. However, you can set the *Results List* to combinations of vehicle types, different data intervals, etc. In addition, using the *Direct Output* you can perform your own post-hoc analysis for combinations of vehicle types, different intervals, etc. The raw data provides nearly limitless analysis alternatives.


Delay

The steps to collect delay performance metrics in Vissim are similar to those used to collect travel time. The following demonstrates collecting delay data. Recall, in Vissim a vehicle's delay is defined as the difference in travel time over a segment at the vehicle's desired speed versus the actual travel time. Thus, two vehicles with the same travel time could have different delays.

Vissim uses *travel time measurement* zones for delay calculations. We will use the same *travel time measurement* zones as defined earlier, so we do not need create new zones; however, a user may certainly create *travel time measurement* zones that are of specific

interest for delay. (Later we will also see how to use *Vissim Nodes* to obtain delay measures.) First, we need to select the *travel time measurement* zone(s) for which we want to collect delay data.

- step i. Go to *Evaluation* → *Measurement Definitions* → *Delay Measurements*.
- step ii. Currently there are no zones identified. Right-click in the *Delay Measurements* window, select *Generate all (1:1)*. This will create a *Delay Measurement* for each *Travel Time Measurement* zone.
- step iii. You may also create *Delay Measurements* that are combinations of *Travel Time Measurement* zones. To do this right-click in the *Delay Measurements* window, select *Add*.
- step iv. In the *VehTravTmMeas* column select the arrow. Select the Buzz Blvd EB and WB boxes. This will set the *delay measurement* to use the vehicle data from both *Travel Time Measurement Zones*.
- step v. Set *Name* to: Buzz Blvd EB and WB End-to-End.
- step vi. Next, we need to select delay performance metrics that should be collected.

Click on the wrench icon  and select the following from the *Delay Measurements Attributes*:

- a. *Stopped delay (average)* → *Current run x Current Interval x All Types*
- b. *Vehicle delay (average)* → *Current run x Current Interval x All Types*
- c. *Stops* → *Current run x Current Interval x All Types*
- d. *Vehicles* → *Current run x Current Interval x All Types*

There are numerous other metrics you could add. Feel free to explore the different metrics.

- step vii. Select *OK*.

In the preceding steps the *delay measurement* zones, along with delay performance metrics to be collected, were set. If you run the model now you will see these attributes populate in the *delay measurements* window as the model is running. However, you will only see the data for the current interval, you will not see a record of the data for each interval. (Although, you could have, if you selected each interval individually from the attributes list.) As with the travel time data, for delay results aggregated over the intervals we will use a *Results List*.

- step i. Go to *Evaluation* → *Configuration* → *Results Attributes*.
- step ii. For *Delays*:
 - a. Check the *Collect data* box
 - b. Leave the *From-time* and *To-time* at 0 and 99999
 - c. Set the *Interval* to 900.
- step iii. Go to *Evaluation* → *Results Lists* → *Delay Results*.

step iv. Next, let's select the delay attributes we would like to capture. Click on the wrench icon (🔧) and select the following from the *Delay Measurements Attributes*:

- a. *Delay measurement* → *Name*
- b. *Stopped delay (average)* → *All Types*
- c. *Stops* → *All Types*
- d. *Vehicle delay (average)* → *All Types*
- e. *Vehicles* → *All Types*

step v. Select *OK*.

Save and run the model. In the *delay results* window you will see the selected performance metrics populate for each time interval, Figure 10. As with travel time, in the *delays results* window you can save the results by clicking on the disk icon (💾). If you select the disk icon with the red arrow (🔴) the results file will be automatically saved at the end of each run. The file extension will be *.att*, with the term “*Delay Results*” in the file name.

Count	SimRun	TimeInt	DelayMeasurement	DelayMeasure...	StopDelay(All)	Stops(All)	VehDelay(All)	Vehs(All)
1	1	0-900	1: Buzz Llvd EB - End-to-End	Buzz Llvd EB - E...	10.22	0.89	20.13	36
2	1	0-900	2: Buzz Blvd WB - End-to-End	Buzz Blvd WB - ...	21.02	1.59	37.43	41
3	1	0-900	3: Buzz Blvd & Ramblin St. EB Thru	Buzz Blvd & Ra...	4.86	0.45	9.29	76
4	1	0-900	4: Buzz Blvd and Ramblin St EB Left	Buzz Blvd and...	31.03	0.83	39.14	6
5	1	0-900	5: Buzz Blvd and Ramblin St WB Thru	Buzz Blvd and...	6.94	0.39	10.80	109
6	1	0-900	6: Buzz Blvd and Ramblin St. WB Left	Buzz Blvd and...	35.49	1.13	45.44	16
7	1	0-900	7: Peach Freeway NB - End-to-End	Peach Freeway...	0.00	0.00	0.34	276
8	1	0-900	8: Peach Freeway SB - End-to-End	Peach Freeway...	1.94	0.06	2.77	307
9	1	0-900	9: Buzz Blvd EB and WB End-to-End De...	Buzz Blvd EB an...	15.97	1.26	29.34	77
10	1	900-1800	1: Buzz Llvd EB - End-to-End	Buzz Llvd EB - E...	6.34	0.55	12.76	20
11	1	900-1800	2: Buzz Blvd WB - End-to-End	Buzz Blvd WB - ...	23.68	1.66	38.88	47
12	1	900-1800	3: Buzz Blvd & Ramblin St. EB Thru	Buzz Blvd & Ra...	8.66	0.57	13.80	84
13	1	900-1800	4: Buzz Blvd and Ramblin St EB Left	Buzz Blvd and...	28.29	0.71	36.19	7
14	1	900-1800	5: Buzz Blvd and Ramblin St WB Thru	Buzz Blvd and...	8.33	0.38	12.12	116
15	1	900-1800	6: Buzz Blvd and Ramblin St. WB Left	Buzz Blvd and...	59.36	1.37	71.83	27
16	1	900-1800	7: Peach Freeway NB - End-to-End	Peach Freeway...	0.00	0.00	0.24	289

Figure 10: Sample from Delay Results list

You may open the *.att* file in Excel (or any data analysis tool of your choice) for post-hoc analysis. As with the travel time data the file is semicolon delimited. Figure 11 shows a plot of the vehicle delay per interval for each *delay measurement* zone, generated using Excel.

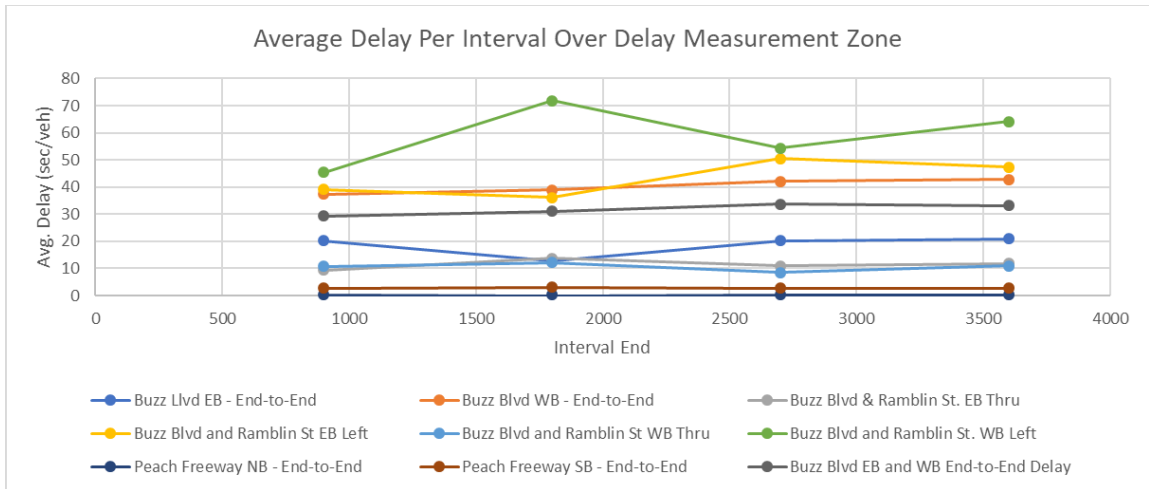


Figure 11: Sample vehicle delay per interval

Next, as with travel time data, it may be desirable to output the individual vehicle delays over each *delay measurement zone*. However, we have already done this! The *Direct Output* file for the travel time raw data also contains the raw delay data. Open the travel time *.rsr* file to see the raw delay data. Only the individual delay measurement segments are included as the combined delay measurements consist of individual segments, thus would have the same raw data. Figure 12 shows the delay for vehicles end-to-end on Buzz Blvd (plotted using excel). In the figure the raw data was used to calculate the 15-minute averages as well, these are also plotted. Again, a comparison of the 15-minute averages calculated using the raw data and that from the *Results List* show the same aggregate values.

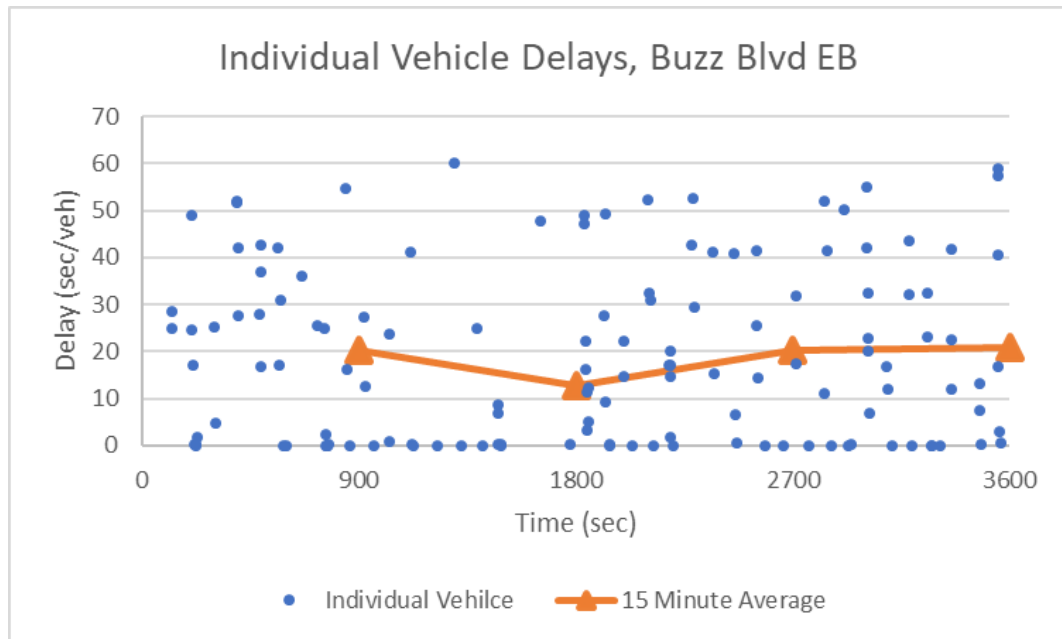


Figure 12: Sample individual vehicle delay data

You may notice when you explore the potential *Results List Attributes* for both travel time and delay that there are a number of attributes that are included in both lists. Once you have set up the delay and travel time measurements it is possible to include most of the performance metrics you are interested in within a single *Results List*. In addition, there is a tremendous wealth of potential performance metrics you may output, allowing for nearly endless analysis variations. Many of the outputs will prove useful in debugging the model or digging deeper to understand how the model is operating. It is highly encouraged to take some time and explore some of the many potential model result attributes.

Volume and Speed – Data Collection Points.

We will next explore two additional critical performance metrics, volume and speed. If desired, using the travel time data you may already calculate an average speed over the *travel time measurement* zones. Using *Data Collection Points*, we will measure speed and volume at a point. *Data collection points* are set up in a very similar manner to *travel time measurements*. First, we must place the desired *Data Collection Points* in the network. *Data collection points* are placed per lane. Next, we will define the *Data Collection Point Measurements*, i.e., utilizing single or groups of data collection points. Then we will set up the data collection interval and select the *Results List* desired *Data Collection Point Attributes*. Finally, we will set up *Direct Output* of raw data.

For our example network we will place *data collect points* at the arterial and freeway locations indicated in Figure 13. For demonstration purposes we will only add a few *data collection points* but you could add points at additional locations, as desired. We will place *data collection points* on Peach Freeway NB approximately 500' south of the NB onramp gore; Buzz Blvd EB, approximately 250' west of the freeway onramp; and on the Peach Freeway SB onramp and offramp, approximately half-way between the arterial intersection and freeway gore area. *Data collection points* are lane specific, thus you need to place a data collection point in each lane at each of these locations.

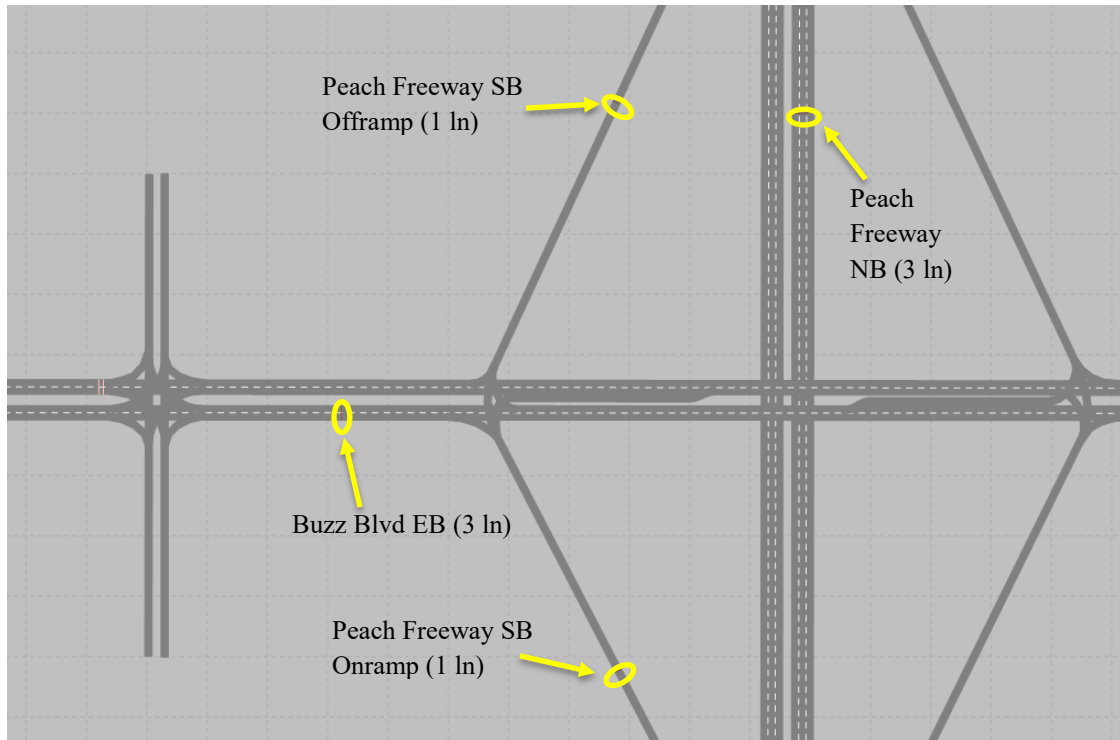


Figure 13: Data Collection point locations

To set up the *Data Collection Points* use the following steps:

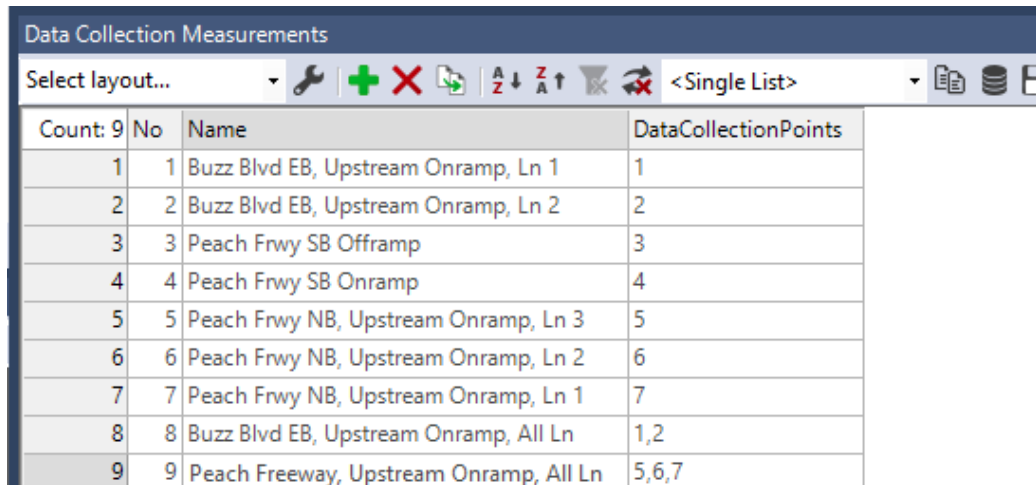
- step i. Select *Data Collection Points* in the *Network Objects*.
- step ii. Right-click on the Buzz Blvd EB link at the desired location for the *data collection point*, Figure 13. Place a *data collection point* for each lane.
- step iii. In the *Data Collection Points* list fill in a *Name* for each point, i.e., Buzz Blvd EB, Upstream Onramp, Ln 1; and Buzz Blvd EB, Upstream Onramp, Ln 2. (Recall, lanes are numbered from the outside curb to the center of the roadway.)
- step iv. Repeat steps i, ii, and iii for the remaining data collection points identified in Figure 13.

Next, we will set up the *Data Collection Measurements*. These will be the *data collection point* or *points* that will be used for grouping data. We will collect data at each individual *data collection point*, as well as for groups of *data collection points*, i.e., one group at the Buzz Blvd location and another group at the Peach Freeway NB location. This will allow for lane-by-lane analysis as well as directional analysis at each location.

- step i. Go to *Evaluation* → *Measurement Definition* → *Data Collection Measurements*.
- step ii. Right-click in the *Data Collection Measurements* window. Select *Generate all (1:1)*.

- step iii. Right-click in the *Data Collection Measurements* window. Select *Add*.
- step iv. In the *DataCollectionPoints* column of the new row select the two Buzz Blvd *Data Collection Points*. Name the measure: Buzz Blvd EB, Upstream Onramp, All Ln.
- step v. Right-click in the *Data Collection Measurements* Window. Select *Add*.
- step vi. In the *DataCollectionPoints* column select the three Peach Freeway *Data Collection Points*. Name the measure: Peach Freeway, Upstream Onramp, All Ln.

The *Data Collection Measurements* list should look similar to Figure 14.





Count: 9	No	Name	DataCollectionPoints
1	1	Buzz Blvd EB, Upstream Onramp, Ln 1	1
2	2	Buzz Blvd EB, Upstream Onramp, Ln 2	2
3	3	Peach Frwy SB Offramp	3
4	4	Peach Frwy SB Onramp	4
5	5	Peach Frwy NB, Upstream Onramp, Ln 3	5
6	6	Peach Frwy NB, Upstream Onramp, Ln 2	6
7	7	Peach Frwy NB, Upstream Onramp, Ln 1	7
8	8	Buzz Blvd EB, Upstream Onramp, All Ln	1,2
9	9	Peach Freeway, Upstream Onramp, All Ln	5,6,7

Figure 14: *Data Collection Measurements*

We could also add additional attributes to this table but instead we will go directly to setting up the *Results List*.

- step vii. Go to *Evaluation* → *Configuration* → *Results Attributes*.
- step viii. Click the *Collect Data* box for *Data Collections*; Set the *Interval* to 900.
- step ix. Go to *Evaluation* → *Results List* → *Data Collection Results*.

By default, the *Results List* will include a number of attributes including: a count of vehicles crossing the data collection point - *Vehs(All)*; as well arithmetic and harmonic average speeds, i.e., *SpeedAvgArith(All)* and *SpeedAvgHarm(All)*. Also included is occupancy rate - *OccupRate(All)* - which is the percent-time-occupied, that is, the percentage of time a vehicle is physically activating the detector. Other attributes include: acceleration, distance, length, and queue delay. Definitions for each may be found in attributes list and in the Vissim manual. You may also use the wrench icon to add addition measurement attributes, as desired. You should take a moment and explore the available attributes.

- step x. Select the disk icon with the red arrow () , this will set the Results List to be saved to a file at the end of a run.
- step xi. Select the summation with circle icon () . At the end of the run Vissim will also include the aggregate statistics for the intervals, such as the min and max interval value, standard deviation across intervals (i.e., standard deviation of the 4, 15-minute interval values), etc.

Save and run the model. As with the previous *Results Lists* an *.att* file is created. You can open this file in Excel (or other analysis software). Take a moment and review the file to see that the *Data Collection* data is now available in the file for further post-hoc analysis.

Finally, we will generate the raw *data collection point* data. This will provide the individual vehicle data for each vehicle that crosses a *data collection point*. The raw data collected at each *data collection point* is: time a vehicle entered the *data collection point*, time a vehicle exits a *data collection point*, vehicle no., vehicle type, vehicle speed, acceleration, occupancy, persons in vehicle, time in queue, and vehicle length.

- step i. Go to *Evaluation* → *Configuration* → *Direct Output*.
- step ii. For *Data Collection* (raw data) select *Write to file*.
- step iii. Select *OK*.

Save and run the file. The *data collection points* data will be saved in the same location as the *.inpx* file, as a *.mer* file. Open the file and confirm the data. For instance, Figure 15 is a plot of the speed data by entry time for the combined Buzz Blvd EB *data collection points* and Figure 16 is the speed data by entry time over the Peach Freeway *data collection points*. Interestingly, you will notice that some vehicles on the Freeway have speeds as high as 90 mph. Is this reasonable? Go back to *desired speed distribution* you selected and check to see if speeds this high were allowed.

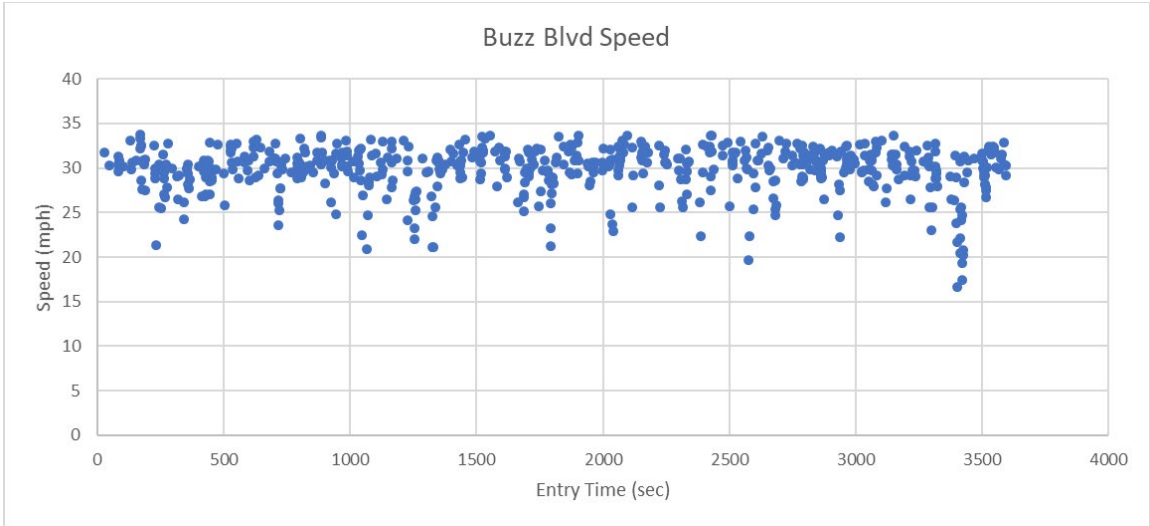


Figure 15: Data Collection Point Speed from Buzz Blvd EB

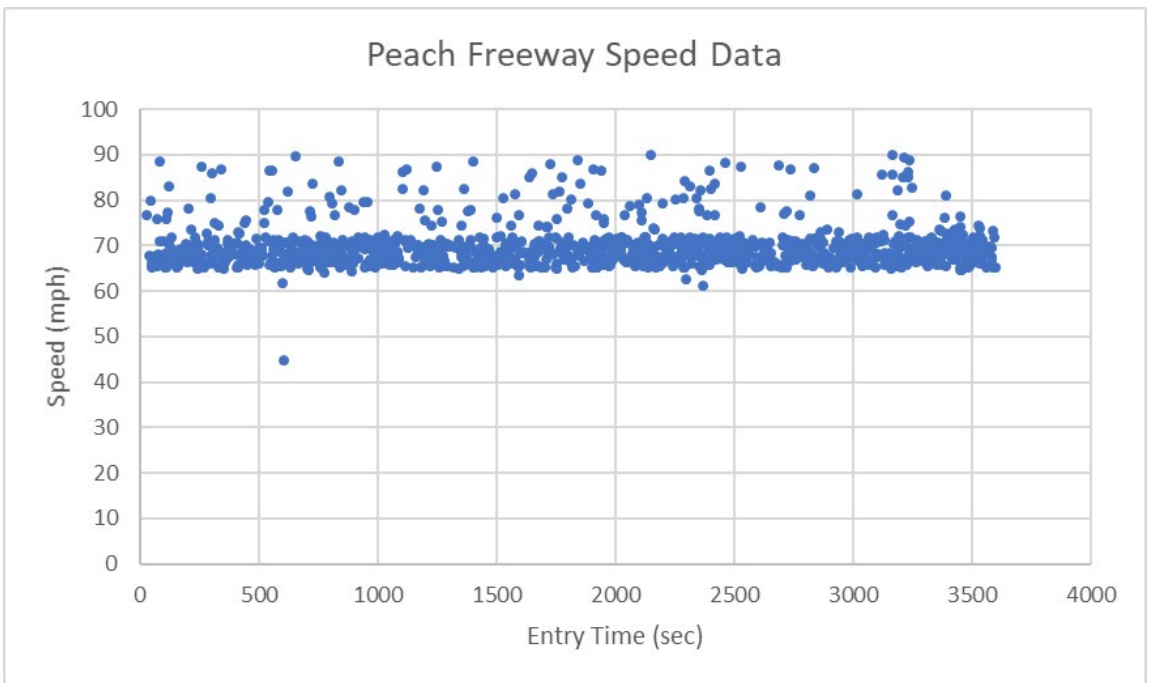


Figure 16: Data Collection Point Speed from Peach Freeway NB

Graphical Display of Speed

In addition to the results list and direct output it may also be helpful to review speeds graphically. To graphically display speed:

- step i. Select *Links* in *Network Objects*.
- step ii. Right-click on the left side of the *Links* menu.
- step iii. Left-click *edit graphics parameters*.
- step iv. Confirm *Object visibility* box is selected, Figure 17.
- step v. Left-Click *Color Scheme Configuration*, Figure 17.
- step vi. For *Attribute* select *Speed (Current, Current, All)*.
- step vii. Select the color palette pull-down menu on the right-side of the *Edit Color Scheme for Links* Window and select *speed*, Figure 18. This will provide a default set of speed bounds and colors. You may adjust these as desired.
- step viii. Select *OK*.
- step ix. Return to the *Links Edit Graphics Parameters* List if it has closed.
- step x. Change the *Drawing Mode* to *Use color Scheme*.

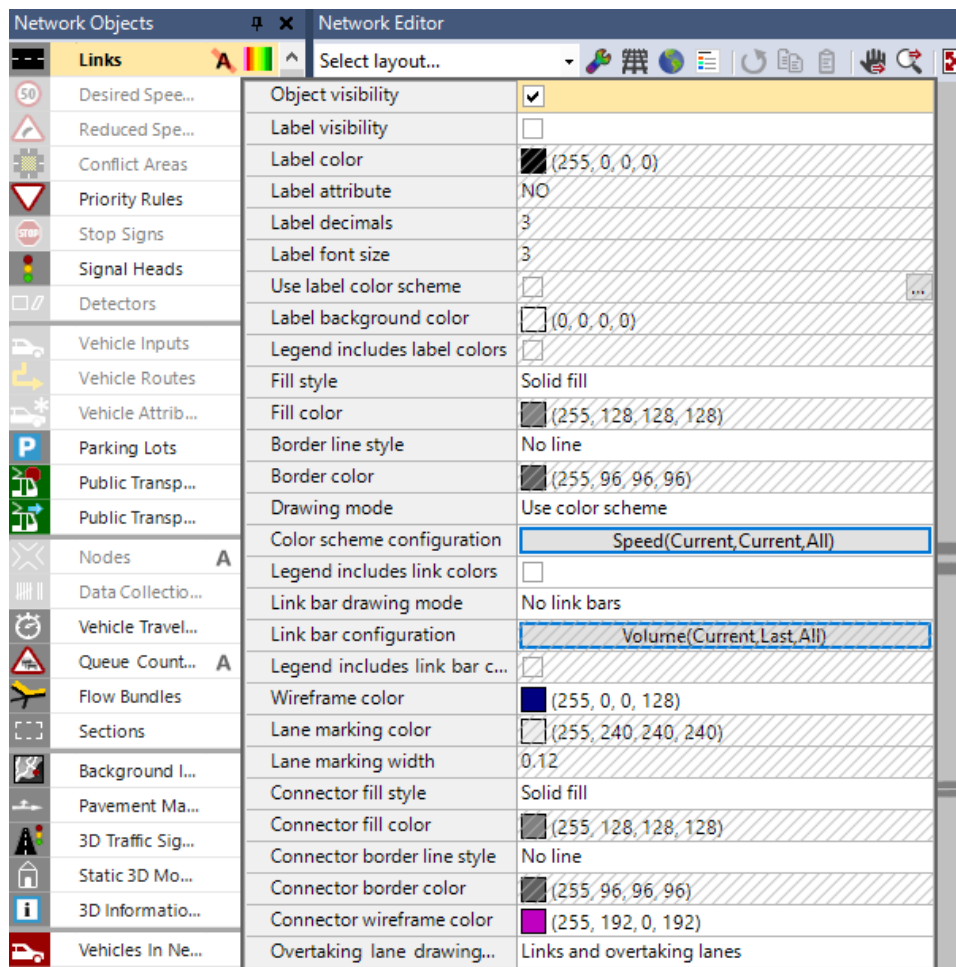


Figure 17: Network Object → Links → Edit Graphics Parameters menu

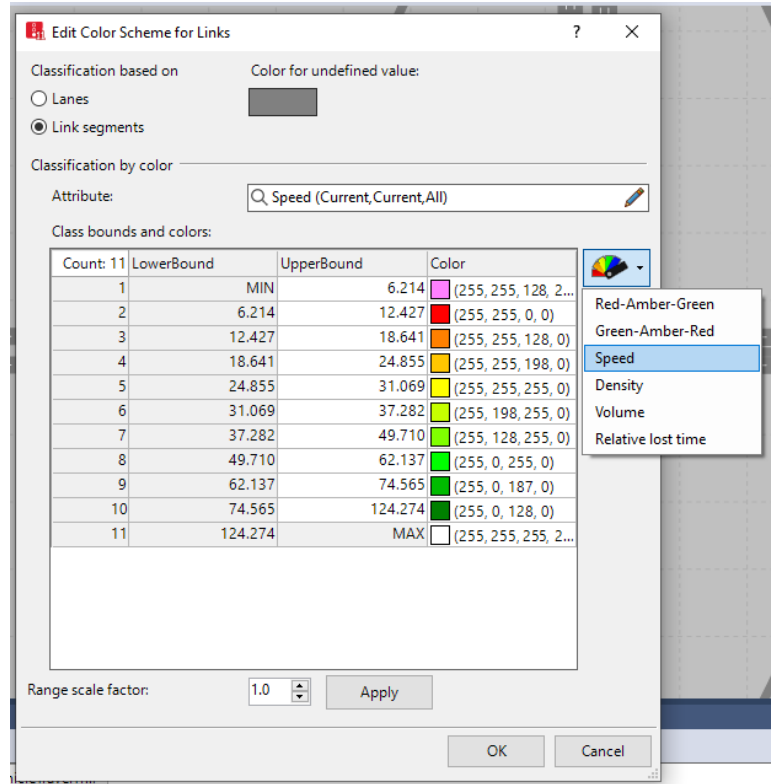


Figure 18: Edit Color Scheme for Links

- step xi. Under the *Evaluation Menu Select Configuration*.
- step xii. Check *Links* in the *Collect Data Column* (if it is not already selected).
- step xiii. Select *OK*.
- step xiv. Select *Links* in *Network Objects* (if it is not already selected).
- step xv. Double right click on any link and open the *Link* dialogue window.
- step xvi. Select *Others*.
- step xvii. By default, *Link evaluation* should be checked. If it is not, check the box. Data will only be collected and visualized if this is checked. If it was not you will likely need to check the other links in the network. (Clicking on each link to check if *Link evaluation* is active could be very tedious. To check this property for all links quickly show the link list, select attribute selection (i.e., click on the wrench icon), in the attribute pop-up window select *Link evaluation active* and use the green arrow to move it over to the displayed attributes. The link list will now show this attribute for all links, allowing for a quick review.)
- step xviii. The link will be divided into segments for collecting, analyzing, and visualizing the data. The *Segment Length* box show the length of the segments. For now, we will use the default, 32.8ft.

Save and run the model. The link colors will now be updated based on the speed. This allows for a quick visual of the model performance. Figure 19 shows a screen capture during a model run.

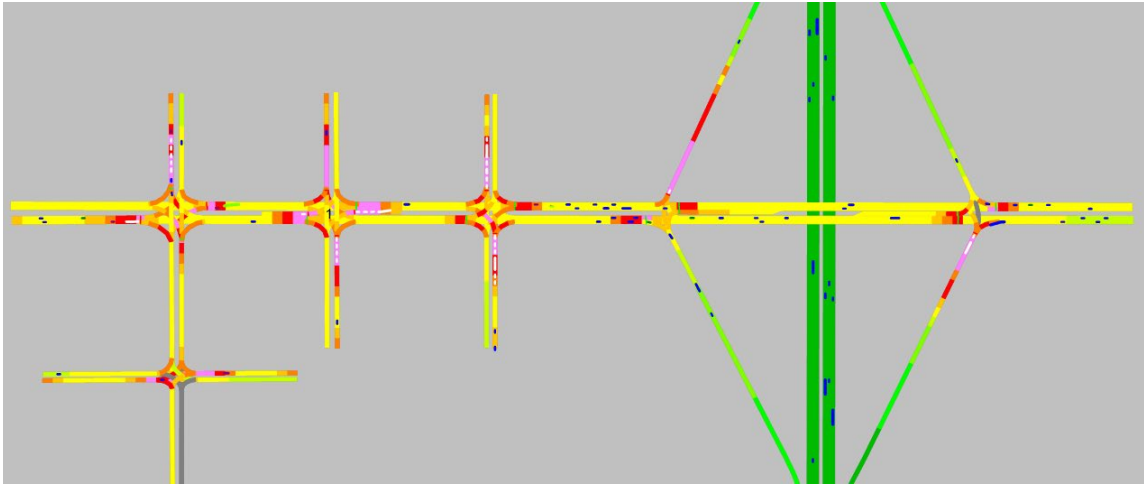


Figure 19: Example speeds within network.

This can be a powerful means to quickly review a model and identify areas with low speeds, high speeds, etc. The colors will update every data collection interval as that is the attribute we selected. You could choose other speed metrics (total, min, max, etc.) or many other attributes (queues, volumes, etc.). In addition, under *Edit Graphics Parameters* you may also edit *Link Bars*, which will change the link thickness according to the performance metric value as well.

Prior to proceeding to the next section, you may wish to go to *Links* → *Edit Graphics Parameters* → *Drawing Mode*. Return the *drawing mode* to *use constant colors*, otherwise in the subsequent runs you will continue to see the speed color scheme.

Queue Data

Next, we will review queue data. To obtain queue data we use *Queue Counters* in *Network Objects*. *Queue counters* are placed at the point you wish to start measuring the queue length. Generally, this will be at *signal heads* or *conflict zones*. (In the next section we will see a way to automate the setting of queue counters using *Nodes*.) Queue length is measured in distance, not number of vehicles.

Let's set up *Queue Counters* for the intersection of Buzz Blvd and Burdell Dr. We will place a *queue counter* on each approach, at the *signal heads*, Figure 20.

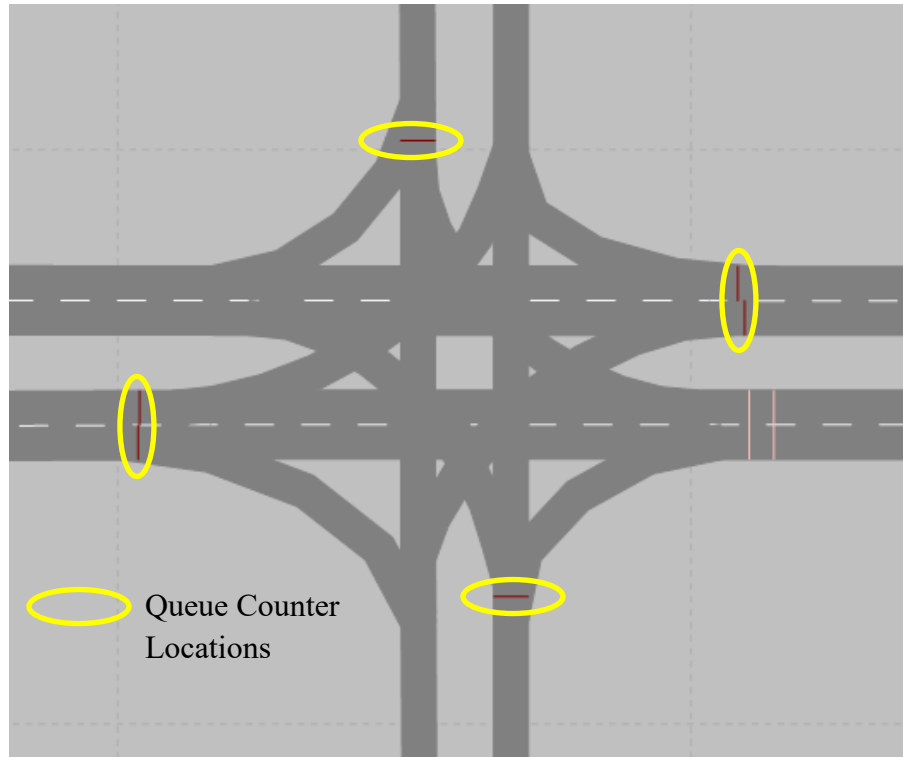


Figure 20: *Queue Counter* Locations for Buzz Blvd and Burdell Dr.

Complete the following steps to set up the *Queue Counters*:

- step i. Select *Queue Counters* in *Network Objects*.
- step ii. Right-click on the Buzz Blvd EB *Link* and place a *Queue Counter* at the *Signal Heads*. Be sure you are on the Buzz Blvd *link* and not the *connector*. You may find it easier to initially place the *queue counter* upstream of the *signal heads* and then drag it to the correct location.
- step iii. In the *Queue Counter* window fill in the *Name*, i.e., “Buzz and Burdell, EB”.
- step iv. Repeat steps ii and iii for the SB, WB, and NB approaches.

The *Queue Counters* list should now be similar to Figure 21.

Queue Counters				
Select layout...				
Count	No	Name	Link	Pos
1	1	Buzz and Burdell, EB	1: Buzz...	40...
2	2	Buzz and Burdell, WB	10: Buz...	31...
3	3	Buzz and Burdell, SB	3: Burd...	29...
4	4	Buzz and Burdell, NB	4: Burd...	83...

Figure 21: *Queue Counters* List

As with the other metrics we could add additional attributes to this list but we will use the *Results List* for the queue data collection.

- step i. Go to *Evaluation* → *Configuration* → *Results Attributes*.
- step ii. Click on the *Collect Data* box in *Queue Counters*.
- step iii. Set the *Interval* to 300, that is, we will collect Queue Data in 5-minute intervals.
- step iv. Click on *More...* You will see the *Queue counters* definition, Figure 22

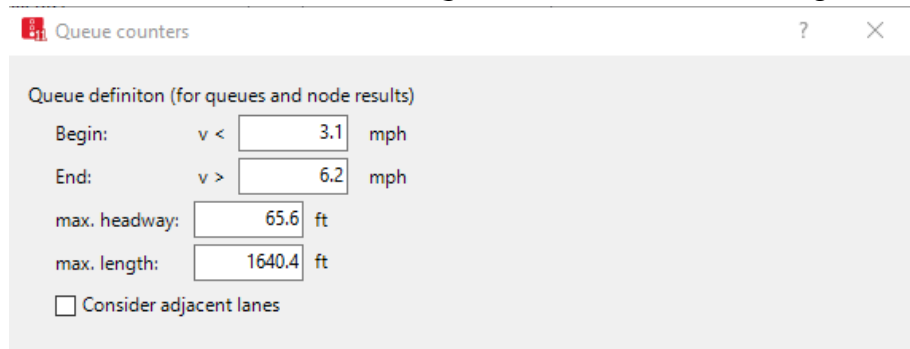


Figure 22: *Queue Counters* Definition

These parameters define a queue. There are a number of finer points in queue measurements and the user is encouraged to review *Queue Counters* in the Vissim manual. However, briefly, for a queue to be initiated a vehicle must have a speed less than 3.1 mph, i.e., *Begin* speed < 3.1 mph. A vehicle is considered to no longer be in a queue when its speed exceeds 6.2 mph, i.e., *End* speed > 6.2 mph. Additionally, to be considered in a queue the headway between vehicles must be 65.6 ft or less, i.e., *max. headway* < 65.6. The *max length* sets the maximum queue length that will be reported. However, in the model the actual queue may be longer, this parameter allows for limiting the reported length, for instance, if as part of the analysis it is desired to consider an upstream section of the queue separately. Additionally, the queue length measured will also be limited by the presence of an upstream *queue counter*. Finally, if selected, *Consider adjacent queues* will include spillback into other lanes in the queue length. These parameters are all user adjustable.

- step v. Go to *Evaluation* → *Results Lists* → *Queue Results*.

By default, the *Queue Counter Result* list includes Queue Length, Queue Length Maximum, and Queue Stops. There are a number of other attributes that you could include using the wrench icon. We will use the default parameters; however, take a moment and explore the other potential attributes.

step vi. In the *Queue Results* window click the disk icon with the red arrow setting the results data to be automatically output to a file.

Save and run the model. The *Queue Results List* should populate, similar to Figure 23.

Count	SimRun	TimeInt	QueueCounter	QLen	QLenMax	QStops
1	1	0-300	1: Buzz and B...	20.42	119.84	23
2	1	0-300	2: Buzz and B...	9.58	94.60	9
3	1	0-300	3: Buzz and B...	88.34	309.56	23
4	1	0-300	4: Buzz and B...	4.62	43.30	3
5	1	300-600	1: Buzz and B...	8.55	112.06	9
6	1	300-600	2: Buzz and B...	19.44	155.93	20
7	1	300-600	3: Buzz and B...	89.59	331.66	23
8	1	300-600	4: Buzz and B...	5.94	44.82	5
9	1	600-900	1: Buzz and B...	5.88	80.95	6
10	1	600-900	2: Buzz and B...	10.14	98.63	12
11	1	600-900	3: Buzz and B...	78.54	315.82	20
12	1	600-900	4: Buzz and B...	8.19	43.44	2
13	1	900-12...	1: Buzz and B...	27.11	171.80	26
14	1	900-12...	2: Buzz and B...	10.80	84.60	11
15	1	900-12...	3: Buzz and B...	82.15	206.32	22
16	1	900-12...	4: Buzz and B...	5.05	44.92	4

Figure 23: Sample Queue Results data

As with the other *Results Lists* there is now an *.att* file for the *queue results*. Open that file in Excel (or other software) to confirm that the data has been recorded. Figure 24 shows the average queue per 5-minute interval, plotted using Excel.

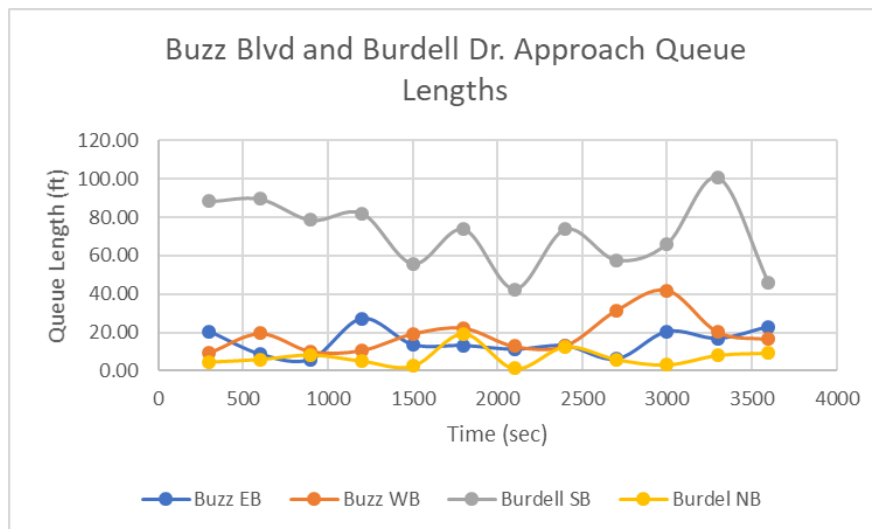


Figure 24: Buzz Blvd and Burdell Drive Queue Lengths

Unlike travel time, delay, and data collection results, queues do not have a *Direct Output* of raw data. This is because queuing data is not vehicle specific. If you need higher resolution data utilize shorter intervals in the *Results List*.

Node and Link based Performance Measures

An additional method to obtain performance metrics is to utilize the *Nodes* and *Links* model features.

Links

Performance metrics based on links are the rather straightforward. To collect *Link* based data, complete the following steps:

- step i. Go to *Evaluation* → *Configurations* → *Results Attributes*.
- step ii. Check the *Collect data* box for *Links*; Set the *Interval* to 900.
- step iii. Select *More...* for *Links*; Check the radio button *per link segment*.
- step iv. Go to *Evaluation* → *Results Lists* → *Link Results*.

By default, the *Results list* will show a number of performance metrics for every link in the network, including density, relative delay, speed, volume, and a multitude of emissions metrics.

Important note: Emissions data will only be available if you have purchased an external emissions API. We will not cover emissions in the [modules](#); however, if you have the emissions API you can find additional information for its use in the Vissim manual.

- step v. Click the disk icon with a red arrow to output the *Results List* to a file.

You can explore additional potential link attributes using the wrench icon. When you are done, save and run the model. Confirm the data is being captured.

The use of *Link* based performance metrics is based on user preference. Some users prefer to construct the underlying network such that link based performance measures will quickly give the performance data needed without requiring the use of additional vehicle travel time measurements, data collection points, etc. I prefer to build the simplest underlying set of *links* and *connectors* possible, that capture the needed complexity, without worrying about the *links* being appropriate for data collection. Then I overlay the desired data collection measurements. However, both approaches have their own benefits and challenges, and both may be acceptable if the developer is careful.

Nodes

Nodes provide a method to quickly collected data over a limited area of interest, such as an intersection or ramp junction. We will create a *node* for the intersection of Buzz Blvd and Ramblin St.

To create a *Node*:

- step i. Select *Nodes* in the *Network Objects*.
- step ii. Draw a *Node* around the intersection. Right-click to start drawing the *node*, left-click to create a turning point in the *node*, double left-click at the last point and Vissim will then close the *node*. Your *node* should be similar to Figure 25.

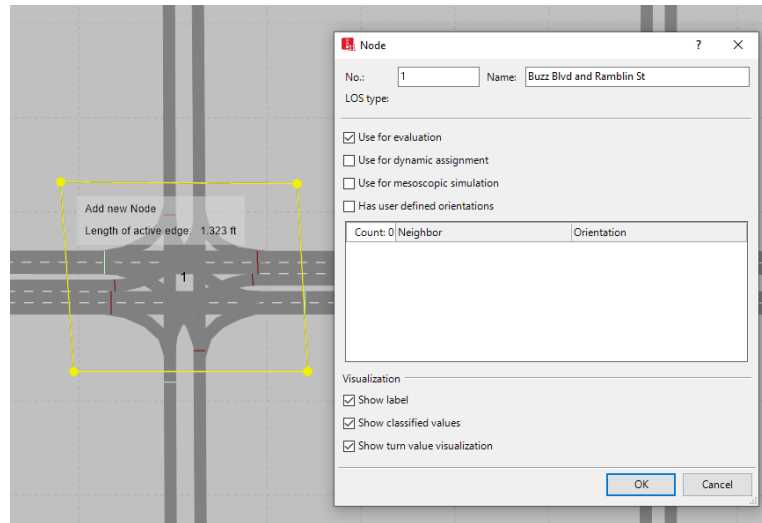


Figure 25: Buzz Blvd. and Ramblin St. Node

- step iii. The *node* pop-up window should be displayed. Fill in the *Name* as Buzz Blvd and Ramblin St., check the *Use for evaluation* box and the three *Visualization* boxes.
- step iv. Go to *Lists* → *Network* → *Edges*, the *Edges* list will show up under network editor.
- step v. The *Edges* list will be empty, right-click, select *Create Evaluation Graph*. This will create an entry for every path through each node (and connecting each node if more than one node is present). These are referred to as edges in VISSIM. (Edges are essentially a simpler abstraction of the Vissim network). Click on each row to highlight the edges.
- step vi. Go to *Evaluations* → *Configuration* → *Results Attributes*.
- step vii. Click the *Collect data for Nodes*; set the *Interval* to 60. (Let's collect some higher resolution data, i.e. one-minute intervals.)
- step viii. Select *More...*

You will see the *Nodes* definition box. The *queue* definitions are the same as seen with the *queue counters*. The *node* will automatically set *queue counters* at all of the *signal heads* and the *conflict markers*. (We will demonstrate how to see queue counter locations below.) We will leave the default parameters.

Nodes will also automatically create *travel time measurements* for the calculation of *delay*, for each potential path through the *node*. The *travel measurement* will start upstream of the *node* entry point, a distance equal to the *Start of delay segment*, which in our case is 328 ft. (There are exceptions to this if you are using parking lots and dynamic assignment, please refer to the manual.) Where you have multiple *nodes* the *travel time measurement* starts immediately downstream of the closest *node*, as long as there are only four or fewer junctions between the *nodes*. The *travel time measurement* ends at the *node* exit boundary. Also, when defining multiple *nodes* be sure they do not overlap.

(Caution: if you have vehicle queuing or other delay related to the *node* further upstream than the *Start of delay segment* value, that delay will NOT be accounted for in the delay measurement. The *Start of delay value* needs to be adjusted to capture the relevant delay; however, do not simply default to large values as you may then include delay that is unrelated to the *node*, i.e., the intersection of Buzz Blvd and Ramblin St. in this case. The modeler must be thoughtful in the setting of this value. Changing the *Start of Delay* under *More...* in either *Results Attributes* or *Direct Output* will change both.)

- step ix. Go to *Evaluation* → *Results Lists* → *Node Results*.
- step x. Select the disk icon with the red arrow.
- step xi. You should see a number of performance metrics already selected by default. You can see the additional potential attributes using the wrench icon. We will use the default attributes for now.

In the *Node Results* list each edge is listed. You can determine the edge in a row by the *Movement* label. The *Movement label* will list as: Node Name - starting link @ position on starting link - ending link @ position on ending link. (If you want to confirm a position on a starting link use the ruler tool in the *Network Editor*.) A good naming scheme on your links makes reading this label much more straight forward!

Save and run the model. The data should populate in the *Results* window. When the run is complete the *.att* file should be generated. Open the file to confirm the data is there. You can perform post analysis on this data. For instance, based on the output, is the intersection processing as many vehicles as you expected based on the vehicle input and routing decisions?

You will notice that the *Node Result List* is reporting *LOS (Level of Service)*. *LOS* is based on delay calculated as discussed previously. *LOS* levels are determined according to Figure 26.

Attribute	Definition
LOS(All)	Level of service (transport quality): The levels of transport quality A to F for movements and edges, a density value (vehicle units/mile/lane). It is based on the result attribute Vehicle delay (average) . The current value range of vehicle delay depends on the Level of service scheme type of the node Signalized or Non-signalized (see "Attributes of nodes" on page 724). The LOS in Vissim is comparable to the LOS defined in the American Highway Capacity Manual of 2010.
LOSVal(All)	Level-of-service value: Level of transport quality as numbers from 1 to 6 according to the LOS scheme assigned. No value = no volume. 1 corresponds to LOS_A < 10 s, up to 6 corresponds to LOS_F . The level-of-service value is more suitable for user-defined formula attributes and color schemes.

Figure 26: Level of Service Table:

Source - PTV Vissim 11 User Manual, page 1082, accessed 4/15/21

Where are the *queue counters*? When using the *nodes*, you might feel as if you are somewhat guessing the *queue counters* locations. Let's set the *node* parameters so we can view the queues during the model run.

- step i. Right-click on *Nodes* in the *Network Objects*.
- step ii. Select *Edit Graphics Parameters*.
- step iii. In the pop-up make the follow edits, Figure 27,
 - a. Select *Object visibility*.
 - b. Select *Label visibility*.
 - c. Select *Show queue length*.
 - d. Set the *Queue length attribute* to *QLEN(CURRENT,CURRENT)*. To do this click to the right of the row (three dots should show), expand *Queue Length*, select *Current run x Current interval*.
 - e. Select a *Queue Length Color* (again, click to the right of the label).
 - f. Select *Show queue length label*.

step iv. Click outside the *Edit Graphics* window to close it.

Save and run the model. You should see the queue lengths visually displayed on the model as well as the label for the length. Figure 28 show a screen shot part way through the run. You will notice that right turn queues are tracked at the merge point with the cross street, at the conflict marker. Also, the queue is an average of all lanes on a link. Thus, the left turn and through lanes report the same queue. If you wish to capture separate length for these movements you would need to use a separate link for the left turn bay, as discussed in [Module 5](#).







Object visibility	<input checked="" type="checkbox"/>
Label visibility	<input checked="" type="checkbox"/>
Label color	 (255, 0, 0, 0)
Label attribute	NO
Label decimals	3
Label font size	3
Use label color scheme	<input type="checkbox"/> ...
Label background color	 (0, 0, 0, 0)
Legend includes label colors	<input type="checkbox"/>
Fill style	No fill
Fill color	 (255, 128, 128, 128)
Border line style	Solid line
Border color	 (255, 0, 0, 0)
Drawing mode	Use constant colors
Color scheme configuration	...
Legend includes node colors	<input type="checkbox"/>
Segment fill style	No fill
Segment fill color	 (153, 0, 0, 128)
Segment border line style	Solid line
Segment border color	 (255, 64, 64, 64)
Show turn value visualization	<input type="checkbox"/> ...
Legend includes turn value c...	<input type="checkbox"/>
Show queue lengths	<input checked="" type="checkbox"/>
Queue length attribute	QLEN(CURRENT,CURRENT)
Queue length color	(255, 255, 233, 127)
Show queue length label	<input checked="" type="checkbox"/>

Figure 27: Nodes Edit Graphics window

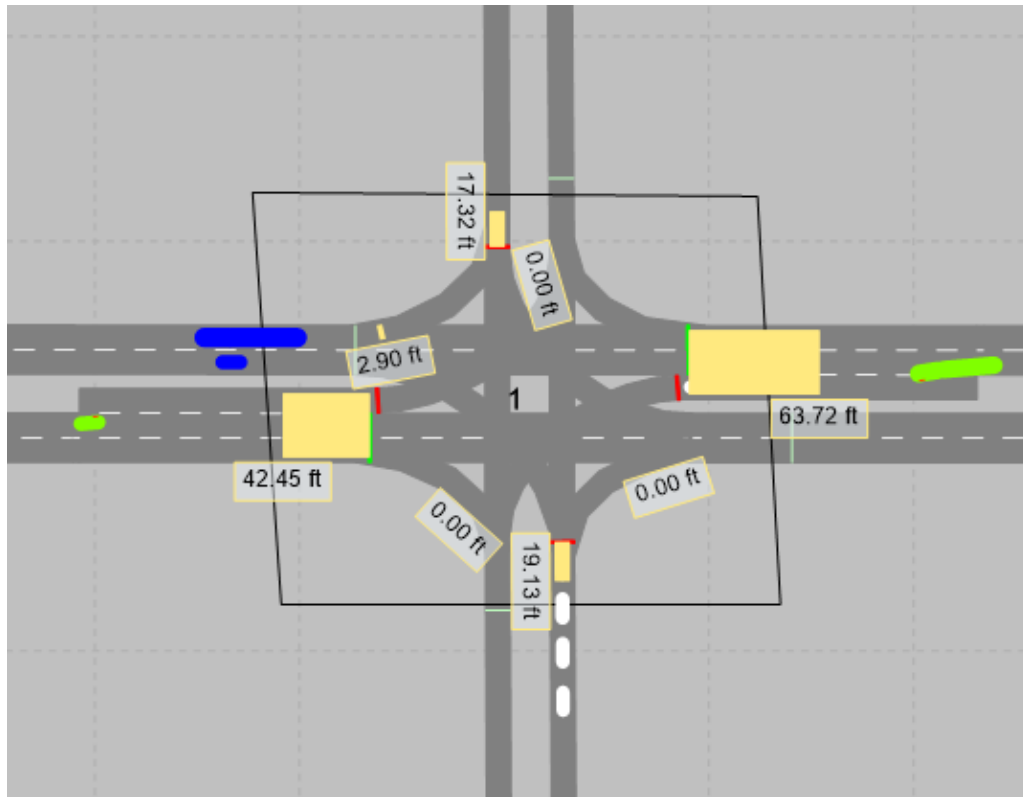


Figure 28: Sample queue length labels and graphics

As with *travel time* and *data collection points* you may also write out the individual vehicle data from *nodes* to a file. Under *Direct Output* select *Write to file* and the *From-time* and *To-time*. (While not discussed within these modules *node* data is one of the *direct outputs* that may also be written to a database file. For working with database files the user is referred to the Vissim manual.)

Signal Controller Data

Vissim has methods for writing signal control data to a file as well as several highly useful visualizations.

For writing data to a file there is not a *Results Attributes list*. There are however two *direct outputs*: *Signal control detector data* and *Signal changes*.

Signal Controller Detector data

This file contains data regarding numerous signal and detector parameters during runtime. To set Vissim to write out the *Signal Controller Detector* data:

- step i. Go to *Evaluation* → *Configuration* → *Direct Output*.
- step ii. Check the *Write to file* boxes for *Signal control detector data*. There are no intervals settings for this *direct output* as the given data will be collected as changes occur, for the entire simulation duration. The file will save to the same folder as the *.inpx* with the extension *.ldp*.
- step iii. Next we will set what data to include in the output file. Go to *Signal Control* → *Signal Controllers*.
- step iv. The *Signal Controllers / Signal Groups* list should be open. Double-click on the Buzz Blvd and Burdell Dr. intersection.
- step v. The *Signal Controller* dialogue box should be open for this intersection. Go to the *SC Detector Record Config* tab.
- step vi. Within this tab select the signal parameters you would like to output. Select:
 - a. Simul.Second,
 - b. Cycle Second,
 - c. Coordination Split – Ring 1,
 - d. Coordination Split – Ring 2,
 - e. Active Phase – Ring 1,
 - f. Active Phase – Ring 2,
 - g. Sig.Display SG – 111-2,
 - h. Sig.Display SG – 111-4,
 - i. Sig.Display SG – 111-6, and
 - j. Sig.Display SG – 111-8.

As you can see, there are a number of other parameters that could be selected. For now we will use these.

The *SC Detector Record Config* tab should look similar to Figure 29.

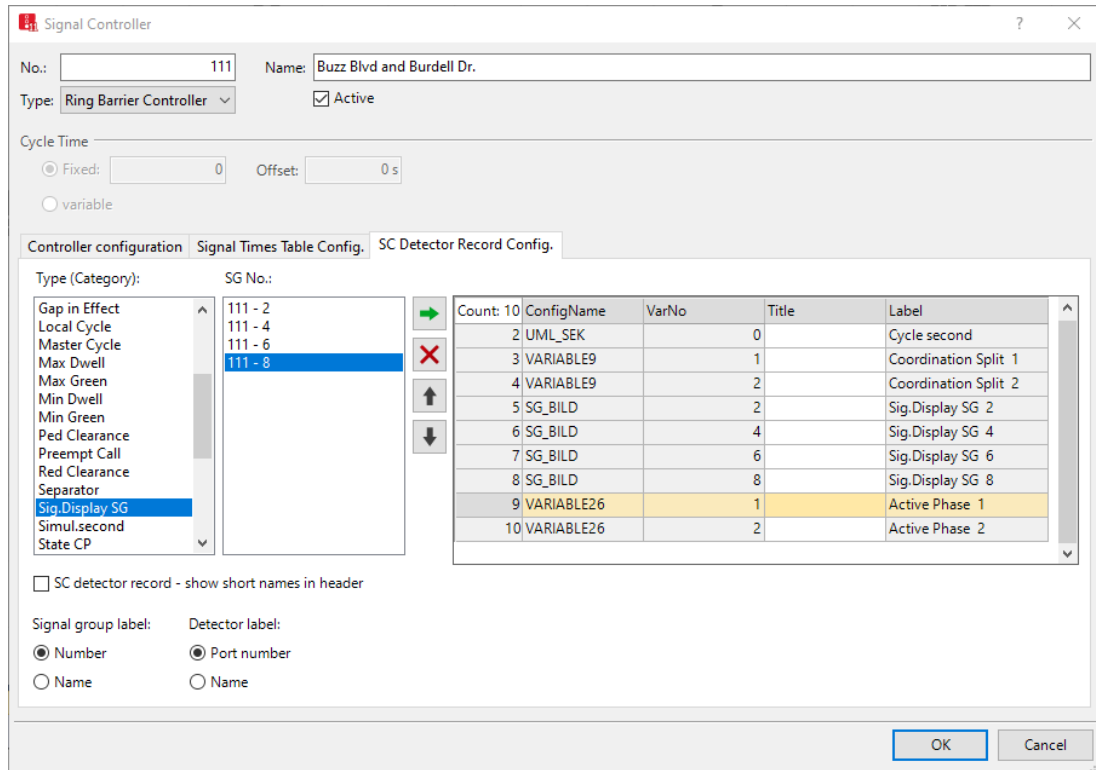


Figure 29: Signal Controller, Buzz Blvd and Burdell Dr., SC Detector Record Config.

step vii. Select *OK*.

Before running the model let's open the *SC Detector Record* window so we can also watch the data populate during runtime. Go to *Evaluation* → *Window* → *SC Detector Record*. Select the Buzz Blvd and Burdell Dr. intersection.

Save and run the model. Pause the model at some point during the run. Within the *SC Detector Record* you can scroll through approximately the last 100 seconds of the model. You should see each of the parameters selected earlier. (Note: For the Signal Display, the phase displays of Green, Yellow, and Red are indicated by “I”, “/”, and “.”, respectively)

At the end of the run open the Buzz Blvd and Burdell Dr. *.ldp* file in Excel. (I find this data is not split well by default in Excel. I use “Fixed Width” and then use the Data Preview to add a few additional columns as desired.) A sample of the Excel output is seen in Figure 30. (Aside, the *.ldp* files will be generated for the other signalized intersections. However, if you open them you will see they contain no data as we have not set their *SC Detector Record Config*.)

7				C	C							
8				o	o							
9				o								
10				r	r							
11				d	d	S	S	S	S			
12				i	i	i	i	i	i			
13				n	n	g	g	g	g	A	A	
14				a	a	c	c	
15				t	t	D	D	D	D	t	t	
16	S	C		i	i	i	i	i	i	i	i	
17	i	y		o	o	s	s	s	s	v	v	
18	m	c		n	n	p	p	p	p	e	e	
19	u	l				l	l	l	l			
20	l	e		S	S	a	a	a	a	P	P	
21	.			p	p	y	y	y	y	h	h	
22	s	s		l	l					a	a	
23	e	e		i	i	S	S	S	S	s	s	
24	c	c		t	t	G	G	G	G	e	e	
25	o	o										
26	n	n										
27	d	d		1	2	2	4	6	8	1	2	
28												
29	1	40		0	0	l	.	l	.	2	6	
30	2	41	18	2	18	2	l	.	l	.	2	6
31	3	42	17	2	17	2	l	.	l	.	2	6
32	4	43	16	2	16	2	l	.	l	.	2	6
33	5	44	15	2	15	2	l	.	l	.	2	6
34	6	45	14	2	14	2	l	.	l	.	2	6
35	7	46	13	2	13	2	l	.	l	.	2	6
36	8	47	12	2	12	2	l	.	l	.	2	6
37	9	48	11	2	11	2	l	.	l	.	2	6
38	10	49	10	2	10	2	l	.	l	.	2	6
39	11	50	9	2	9	2	l	.	l	.	2	6

Figure 30: Sample Excel Data.

Signal Changes

Signal Changes is a single file containing all signal indication changes for the network. To set Vissim to write out the *Signal Changes* data:

- step i. Go to *Evaluation* → *Configuration* → *Direct Output*.
- step ii. Check the *Write to file* boxes for *Signal Changes*. Again, there are no intervals settings for this *direct output* as the given data will be collected for the entire simulation duration. The file will save to the same folder as the *.inpx* as with the extension *.lsa*.

Before running the model let's open the *Signal Changes* window so we can also watch the data populate during runtime. Go to *Evaluation* → *Window* → *Signal Changes*. The *Signal changes* window should now be open.

Save and run the model. You should be able to see the *Signal Changes* window populate with the updated signal indications as the model progresses. The data should look similar to Figure 31. As with the *SC Detector record* you may pause the simulation and scroll through a limited amount of the data. The *Signal Changes* will be found in the *.lsa* file.

Signal changes									
SimSec	CycleSec	SC	SG	Aspect	Prev	Crit	duetoSG		
465.0	0.0	222	8	green	64.0	Ring Barrier Controller	0		
467.0	17.0	111	2	green	19.0	Ring Barrier Controller	0		
467.0	17.0	111	6	green	19.0	Ring Barrier Controller	0		
475.0	85.0	333	2	amber	45.0	Ring Barrier Controller	0		
475.0	85.0	333	6	amber	45.0	Ring Barrier Controller	0		
478.0	88.0	333	2	red	3.0	Ring Barrier Controller	0		
478.0	88.0	333	6	red	3.0	Ring Barrier Controller	0		
479.0	14.0	222	4	amber	14.0	Ring Barrier Controller	0		
479.0	14.0	222	8	amber	14.0	Ring Barrier Controller	0		
480.0	0.0	333	4	green	52.0	Ring Barrier Controller	0		
480.0	0.0	333	8	green	52.0	Ring Barrier Controller	0		
482.0	17.0	222	4	red	3.0	Ring Barrier Controller	0		
482.0	17.0	222	8	red	3.0	Ring Barrier Controller	0		
484.0	19.0	222	1	green	156.0	Ring Barrier Controller	0		
484.0	19.0	222	6	green	21.0	Ring Barrier Controller	0		

Figure 31: Sample *Signal Changes* Window Output.

Signal Times Table

One last highly useful visualization for reviewing the signal control is the *Signal Times Table*. The *Signal Times Table* will visualize the *Signal Group Status* and *Detector* indications for each intersection. For example, Go to *Evaluation* → *Window* → *Signal Times Table*. In the pop-up window select the intersection of Buzz Blvd and Burdell Dr. Save and run the model. The *Signal Times Table* should populate for Buzz Blvd and Burdell Dr., showing the status of each *SG* and *each detector*, by cycle length, Figure 32.

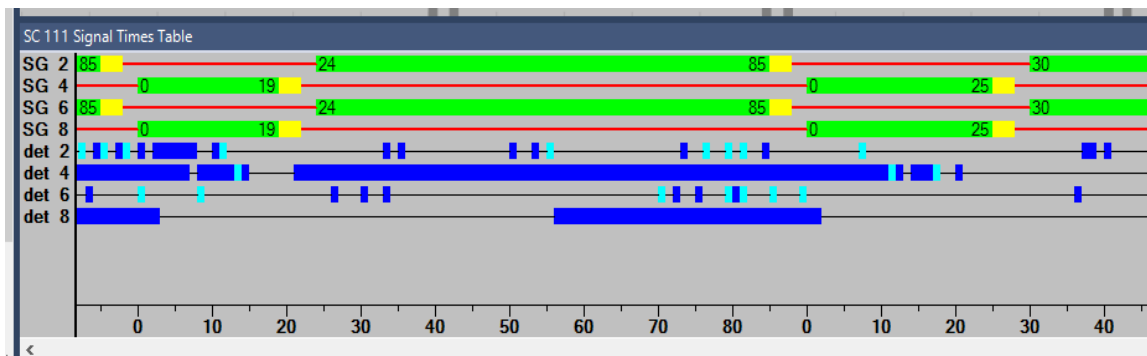


Figure 32: Sample *Signal Times Table* for Buzz Blvd and Burdell Dr. Intersection.

There are a few handy features to the *Signal Times Table*. While the model is running select single step. Shift-left-click on the beginning of an event in the *Signal Times table* (say at the start of a detector actuation) and drag the mouse to the end of the event. In the lower left hand of the *Signal Times table* you will see the time between these two points. Also, you can slide the bar at the bottom of the window to see previous timings (up to a maximum of 5,000 secs.)

For a given intersection you may further refine the contents of the *Signal Times Table* under *Signal Control* → *Signal Controls* → *Signal Times Table Config*. The current data being displayed is the default. Deselect the *Signal times table auto-configuration* and make any desired changes.

CONGRATULATIONS!!!

**You have completed
Data and Performance
Metrics!**

Way to go!!!



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